

Total No. of Questions : 8]

SEAT No. :

P4540

[Total No. of Pages : 3

[4760] - 107

M.E. (Mechanical - Heat Power Engg.)

ADVANCED HEAT TRANSFER

(2008 Pattern)

Time : 3 Hours]

[Maximum Marks : 100

Instructions to the candidates:

- 1) Answer any 3 questions from each section.
- 2) Answer to the two sections should be written in separate books.
- 3) Draw neat diagrams wherever necessary.
- 4) Use of property tables and scientific calculator is allowed.
- 5) Assume suitable data where ever necessary.
- 6) Figures to the right indicate full marks.

**SECTION - I**

**Q1)** a) Explain the following : [8]

- i) Various boundary conditions in heat transfer
- ii) Thermal contact resistance

b) Differentiate between: [8]

- i) Fin efficiency and Fin effectiveness
- ii) Thermal conductivity and Thermal diffusivity

**Q2)** a) Explain lumped capacity method and its validity? [6]

b) A 15 mm diameter mild steel sphere ( $k = 42 \text{ W/m}^\circ\text{C}$ ) is exposed to cooling air flow at  $20^\circ\text{C}$  resulting in the convective coefficient,  $h = 120 \text{ W/m}^2\text{ }^\circ\text{C}$  Determine [10]

- i) Time required to cool the sphere from  $550^\circ\text{C}$  to  $90^\circ\text{C}$ .
- ii) Instantaneous heat transfer from rate 2 minutes after start of cooling
- iii) Energy from sphere during first 2 min. Take : for mild steel  $\rho = 7850 \text{ kg/m}^3$ ,  $c = 475 \text{ J/kg }^\circ\text{C}$ ,  $\alpha = 0.045 \text{ m}^2/\text{hr}$ .

**Q3)** a) Explain Velocity and Thermal boundary layer [6]

b) Write a note on Chilton - Colburn analogy. [4]

c) Define Prandtl number and give its significance. Give its relation with thermal boundary layer and velocity boundary layer. Also give its value for liquid metals, heavy oils, water and air. [8]

**P.T.O.**

**Q4) a)** Air at 27°C blows along one side of a horizontal brick slab along its 15m long length. The slab is at 55°C initially.

The velocity of air is 4.5 m/s. Specific heat of slab = 0.84 kJ/kg K, density of slab = 1600 kg/m<sup>3</sup>, volume of slab = 1.5 m<sup>3</sup>.

Properties of air :

$\rho = 1.128 \text{ kg/m}^3$ ,  $\mu = 19.1 \times 10^{-6} \text{ kg/ms}$ ,  $k = 0.0276 \text{ W/mK}$ ,

$Pr = 0.699$

$$Nu = 0.664 Re^{0.5} Pr^{0.33} \text{ for } Re < 5 \times 10^5$$

$$Nu = 0.037 Re^{0.8} Pr^{0.33} \text{ for } Re > 5 \times 10^5$$

For unit width of the slab, calculate,

- i) The rate of convective heat loss from the slab
  - ii) Initial rate of cooling of the slab per hour. [8]
- b) Write a note on Heat transfer enhancement techniques. [8]

## SECTION - II

**Q5) a)** Identify the characteristic dimension for following cases in Natural convection : [4]

- i) Vertical cylinder
  - ii) Horizontal cylinder
  - iii) Horizontal plate
  - iv) Sphere
- b) Give example of Mixed convection. Which dimensionless number is used for analysis of mixed convection heat transfer? [4]
- c) Consider a human body in vertical position of height 167 cm at an average temperature of 37.3°C exposed to atmospheric air at – 5.7°C at Nainital during winters. Human body can be approximated to a cylinder of diameter 40 cm having surface emissivity of 0.3. Calculate total heat loss rate from the body by convection and radiation. Neglect heat loss from the feet (bottom surface). You may use the following empirical correlation : [8]

$$Nu = 0.56 (GrPr)^{0.25} \text{ for vertical surface}$$

$$Nu = 0.14 (GrPr)^{0.34} \text{ for horizontal upper surface}$$

$$Nu = 0.27 (GrPr)^{0.25} \text{ for horizontal lower surface}$$

Take the following air properties :

$$Pr = 0.715, k = 0.025 \text{ W/mK}, \nu = 13.55 \times 10^{-6} \text{ m}^2/\text{s}$$

Characteristic length for horizontal surface can be taken as  $A/P$ , where  $A$  is the area of the surface and  $P$  is its perimeter.

**Q6) a)** Write a note on Pool boiling [8]

b) Prove that  $L/D = 2.86$  is the relation to decide whether tubes are to be kept horizontal or vertical in a condenser.  $L$  is the length and  $D$  is the diameter of the tubes to be used in condenser. [8]

**Q7) a)** Consider a black body at a temperature of 2000 K. Calculate its total hemispherical emissive power. Also calculate the wavelength at which the maximum emissive power is available from this body.

State and explain the laws of radiation which you have used to calculate the above mentioned quantities. [8]

b) Explain heat transfer analysis for Multimode heat transfer. [4]

c) Consider two concentric spheres 'A' and 'B' of diameters 300 mm and 400 mm respectively. Space between these two spheres is evacuated. Liquid gas at  $-183^\circ\text{C}$  is stored inside the sphere 'A'. The surfaces of the spheres 'A' and 'B' facing each other are coated with aluminum ( $\epsilon = 0.03$ ), Latent heat of vaporization of liquid gas is 210 KJ/kg. If the system is kept in a space vehicle having  $40^\circ\text{C}$ , calculate the rate of evaporation of liquid gas. [6]

**Q8) Write note on any two :** [16]

a) Transpiration and high speed cooling.

b) Cooling load of electronic equipment

c) Immersion cooling



Total No. of Questions : 8]

SEAT No. :

**P4542**

**[4760] - 359**

[Total No. of Pages : 2

**M.E. (Production-Manufacturing & Automation)**

**MATERIAL TECHNOLOGY**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume suitable data if necessary.*
- 6) *Use of calculator is allowed.*

**SECTION - I**

- Q1)** a) Why does an extremely cold worked material recrystallize upon heating? Is there any relationship between recrystallization temperature and extent of cold work? **[8]**
- b) How plastic deformation occurs? Explain in detail. **[8]**
- Q2)** a) Establish the relationship between the stress required to propagate a crack in a brittle material and size of the crack. A relatively large plate of a glass is subjected to a tensile stress of 40 MPa. If the specific surface energy and modulus of elasticity for the glass are 0.3 J/m<sup>2</sup> and 69 GPa respectively. What is the maximum length of a surface flaw that is possible without fracture? **[8]**
- b) What is low angle boundary? Explain the polygonization. How it is produced? **[8]**
- Q3)** a) What are the factors that need to be taken into account for selecting material for high temperature applications? Give any one example. **[8]**
- b) What is transition temperature? Explain its importance with reference to fracture. Explain with relevant example. **[8]**

**P.T.O.**

- Q4)** Write short notes on : **[18]**
- a) Failure analysis.
  - b) Strengthening due to grain boundaries.
  - c) Paris law.

**SECTION - II**

- Q5)** a) Explain strengthening mechanism in dual phase steel and maraging steel. Mention one application of each. **[8]**
- b) A material is to be selected for hip prosthesis. Which factors are most important for such applications? Suggest few materials for the same. **[8]**
- Q6)** a) What are ceramics? Where they find applications? Explain any one method of processing ceramics. **[8]**
- b) What are different types of coatings? Discuss in detail. **[8]**
- Q7)** a) Explain the various recent developments in cemented carbide tool manufacturing in order to enhance their life. **[8]**
- b) What are the issues in machining of glass fiber reinforced plastics? **[8]**
- Q8)** Write short notes on : **[18]**
- a) Production techniques of reinforced fibers.
  - b) Ceramic-matrix composites.
  - c) Applications of engineering polymers.



Total No. of Questions : 8]

SEAT No. :

**P4533**

[Total No. of Pages : 4

[4760] - 1

**M.E. (Civil) (Semester - I)**

**CONSTRUCTION MANAGEMENT**

**Mathematics**

**(2008 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Use of logarithmic table, slide rules, Mollinear charts, electronic pocket calculator and steam table is allowed.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

**Q1)** a) In a bolt factory machines  $M_1$ ,  $M_2$ ,  $M_3$  manufactures 25, 35 and 40 percent of the total respectively of their product outputs 3, 4 and 2% are defective bolts respectively. One bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured by the machine  $M_3$ ? [7]

b) A random variable has the following probability distribution :

x:            4    6    7    10

p(x):        0.2 0.4 0.3 0.1

Find the expectation and standard derivation of the random variable. [7]

c) Define the statistical definition of probability and point out its limitations. [4]

**P.T.O**

- Q2)** a) If 5% of the electric bulbs manufactured by a company are defective, using poisson distribution find the probability that in a sample of 100 bolts
- i) none is defective
  - ii) 5 bulbs will be defective
- (Given that  $e^{-5} = 0.007$ ) **[8]**
- b) Explain with examples applications of normal distribution in civil engineering. **[8]**

**Q3)** A contractor has kept the data as regards the delays and penalties on his previous construction projects, as given below :

| Project | Delays in days | Penalties in Rs. |
|---------|----------------|------------------|
| 1       | 30             | 10,00,000        |
| 2       | 5              | 2,00,000         |
| 3       | 20             | 5,00,000         |
| 4       | 60             | 30,00,000        |
| 5       | 10             | 4,00,000         |
| 6       | 80             | 40,00,000        |
| 7       | 6              | 3,00,000         |
| 8       | 50             | 30,00,000        |
| 9       | 15             | 15,00,000        |
| 10      | 40             | 20,00,000        |

Using monto Carlo simulation simulate the mean delay and mean penalty which contractor should consider for 6 % his future projects. **[16]**

- Q4)** a) Explain gritt's waiting line model applications in equipment management with an example. **[6]**
- b) Explain in detail : **[10]**
- i) Vorster – sears model.
  - ii) Lox Model.

## SECTION - II

**Q5) a)** Explain the role of regression analysis in resource management. [6]

b) Calculate the coefficient of correlation between x and y series from the following data and calculate its possible error and coefficient of determination also : [10]

|    |     |     |     |     |     |    |     |     |    |    |
|----|-----|-----|-----|-----|-----|----|-----|-----|----|----|
| x: | 62  | 72  | 98  | 76  | 81  | 56 | 76  | 92  | 88 | 49 |
| y: | 112 | 124 | 131 | 117 | 132 | 96 | 120 | 136 | 97 | 85 |

**Q6) a)** Explain utility of quality control charts in concreting activity through a graphical representations. [6]

b) In trying to evaluate the effectiveness in its advertising campaign, a firm compiled the following information : [10]

|            |      |      |      |      |      |      |      |      |
|------------|------|------|------|------|------|------|------|------|
| Year :     | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
| Adv. Exp : | 12   | 15   | 15   | 23   | 24   | 38   | 42   | 48   |

(in Rs. 000)

|            |     |     |     |     |     |     |     |     |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Sales in : | 5.0 | 5.6 | 5.8 | 7.0 | 7.2 | 8.8 | 9.2 | 9.3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|

(lakh)

Calculate the regression equation of sales an advertising expenditure. Estimate the probable sales when advertising expenditure is Rs. 60,000

**Q7) a)** Explain the following : [10]

i) Sampling method.

ii) EOQ-Derivation to be performed to determine optimum cost of inventory.

b) In a certain bivariate distribution  $S_1 = 2$ ,  $S_2 = S_3 = 5$ ,  $r_{12} = 0.7$ ,  $r_{23} = r_{31} = 0.5$  [8]

Find : i) Partial correlation coefficient  $r_{13.2}$

ii) multiple correlation coefficient  $R_{2.13}$

iii) Regression coefficient  $b_{13.2}$

- Q8)** a) In a sample of 400 parts manufactured by a factory the number of defective parts was found to be 25. The company however claimed that only 5% of their product is defective. Is the claim tenable. Tabulated value of Z at 5% level is 1.645. **[8]**
- b) A simple random sample of size 40 is drawn from a finite population consisting of 110 units. If the population S.D is 12.4, find the standard error of sample mean when sample is drawn **[8]**
- i) With replacement.
  - ii) With out replacement.

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Total No. of Questions : 8]

SEAT No. :

**P4550**

**[4760] - 10**

[Total No. of Pages :2

**M.E. Civil (Construction & Management)**  
**VALUE ENGINEERING**  
**(2008 Course) (Semester - I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from section I and any 3 questions from section II.*
- 2) *Answers to the 2 sections must be written separately.*
- 3) *Figures to the right indicate full marks.*
- 4) *Make suitable assumptions as necessary and take suitable data wherever required.*
- 5) *Use of calculators is allowed.*

**SECTION - I**

**Q1)** Define value. Discuss 3 essential requirements for any commodity to possess value. Differentiate between cost, price and value with proper examples.

**[2+6+10]**

**Q2)** Discuss with examples from a construction project the primary and the secondary functions of conducting value analysis.

**[16]**

**Q3)** Elaborate on the different factors which affect value of a property made of land and building.

**[16]**

**Q4)** Discuss the different objectives of value engineering. Also highlight various applications of value engineering in civil engineering.

**[16]**

**SECTION - II**

**Q5)** Elaborate the various principles of value analysis. Also discuss the various phases involved in the same.

**[18]**

**Q6)** Perform life cycle costing for a rail over bridge considering a total life of 50 years.

**[16]**

**P.T.O.**

**Q7)** Compare and contrast between the traditional and the discounted cash flow methods which are used in value engineering. **[16]**

**Q8)** Explain in detail the following: **[16]**

- a) Time value of money.
- b) Reversionary value.
- c) Break Even Analysis.
- d) Scenario and Sensitivity analysis.



Total No. of Questions : 8]

SEAT No. :

**P3781**

**[4760]-100**

[Total No. of Pages : 4

**M.E. (Mechanical) (Heat Power)  
REFRIGERATION TECHNOLOGY  
(2008 Course) (Elective-I) (Semester-I) (502104-B)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, mollier charts, electronic pocket calculator is allowed.*
- 6) *Use of different charts and data tables is allowed.*
- 7) *Assume suitable data if necessary.*

**SECTION-I**

**Q1)** Two-stage cascade refrigeration system operating between the pressure limits of 0.8 and 0.14 MPa. Each stage operates on an ideal vapor-compression refrigeration cycle with refrigerant R 134a as working fluid. Heat rejection from the lower cycle to the upper cycle takes place in an adiabatic counter-flow heat exchanger where both streams enter at about 0.32 MPa. If the mass flow rate of the refrigerant through the topping cycle is 0.05 kg/s. Determine: **[16]**

- a) The mass flow rate of refrigerant through the bottoming cycle,
- b) the rate of heat removal from the refrigerated space and power input to the compressor, and
- c) Coefficient of performance of this cascade refrigerator. State assumptions if any. Show the cycle on T-s and p-h diagram. Use data tables or P-h chart for R 134a.

**Q2)** a) What do you understand by “Thermodynamic Irreversibility”? Discuss the effect of irreversibility on the vapour compression cycle of refrigeration with the help of T-s diagram. **[10]**

- b) Explain eutectic point & typical applications for secondary refrigerants. **[6]**

**P.T.O.**

- Q3)** a) Explain in brief, the guidelines for refrigerant piping design. [6]
- b) Explain Selection of Compressors. [6]
- c) Explain design & selection criteria for condensers. [6]

**Q4)** A multi-evaporator, pressure regulating valve and single compressor vapour compression refrigeration system working with ammonia. The refrigeration capacity of high temperature evaporator operating at  $-6.7\text{ }^{\circ}\text{C}$  is 5 TR, while it is 10 TR for the low temperature evaporator operating at  $-34.4\text{ }^{\circ}\text{C}$ . The condenser pressure is 10.8 bar. Assuming saturated conditions at the exit of evaporator and condenser, ammonia vapour to behave as an ideal gas with gas constant of  $0.4882\text{ kJ/kg k}$  and isentropic index of 1.29 and isentropic compression. [16]

- a) Find the required power input to compressor in kW.
- b) Find the required power input in kW if instead of using a single compressor and pressure regulating valve, individual compressors are used for the low and high temperature evaporators.
- c) Draw schematic diagram and P-h chart for (a) and (b).
- d) Comment on results with reference to power input, maximum compressor discharge temperature & volumetric efficiency for (a) & (b).

Use the following data for ammonia:

| T, $^{\circ}\text{C}$ | $P_{\text{sat}}$ , (kPa) | $h_f$ , (kJ/kg) | $h_g$ , (kJ/kg) |
|-----------------------|--------------------------|-----------------|-----------------|
| -34.4                 | 95.98                    | 44.0            | 1417            |
| -6.7                  | 331.8                    | 169.1           | 1455            |
| 27.7                  | 1080.0                   | 330.4           | 1485            |

## SECTION-II

- Q5) a)** List the heat sources available for driving the absorption units. Explain the working of single effect and double effect systems for cooling. [8]
- b) A R-22 compressor with bore of 0.1 m and stroke of 0.08m runs at 750 rpm. The clearance volume ratio is 0.04. It runs between the evaporator and condenser temperatures of  $-10^{\circ}\text{C}$  and  $45^{\circ}\text{C}$  respectively. The isentropic index  $k$  of compression is 1.1163. [8]
- i) Determine the mass flow rate, refrigerating capacity and the work requirement if the mechanical efficiency is 90%.

Compare the results of isentropic work requirement determined using the superheat table.

- ii) If the isentropic efficiency of the compressor is 80%, determine the index of compression and compare the results for work requirement and discharge temperature.

Use following data for R-22.

A) From saturation table

| T( $^{\circ}\text{C}$ ) | P <sub>s</sub> | v <sub>g</sub> | h <sub>f</sub> | h <sub>g</sub> | s <sub>g</sub> |
|-------------------------|----------------|----------------|----------------|----------------|----------------|
| -10                     | 3.55           | 0.0654         | 34.25          | 247.37         | 0.9473         |
| 45                      | 17.209         | 0.0133         | 101.76         | 261.95         | 0.8697         |

B) From superheated table

| Superheat | 20 $^{\circ}\text{C}$ | 30 $^{\circ}\text{C}$ | 40 $^{\circ}\text{C}$ |
|-----------|-----------------------|-----------------------|-----------------------|
| v         | 0.0152                | 0.0161                | 0.0169                |
| h         | 280.95                | 289.87                | 298.66                |
| s         | 0.9270                | 0.9530                | 0.9781                |

**Q6)** In an aqua-ammonia absorption refrigeration system the vapour leaving the dephlegmator may be assumed to be 100% rich saturated ammonia at 40°C. The condenser and evaporator temperatures are 40°C and -20°C respectively. The absorber and generator temperatures are 30°C and 170°C respectively. The weak solution leaving the generator cools down to 50°C in the preheating heat exchanger. Determine the mass flow rates and heat transfer rates on one TR basis and the COP. Draw the schematic diagram of the system. [16]

- Q7)** a) Find the end states of isentropic compression between the saturation pressure at -20°C evaporator temperature, state 1, to saturation pressure at 35°C condenser temperature, state 2 for refrigerant  $\text{CHClF}_2$ . [8]
- b) Describe the working principle of thermostatic expansion valve with the help of neat sketch. [8]

**Q8)** Write short notes on (Any Three) (with the help of neat sketches): [18]

- a) Multistage Thermo electric refrigerator.
- b) Electrolux refrigerator.
- c) Thermoelectric Refrigerator.
- d) Working of Scroll compressor and its applications.



Total No. of Questions : 8]

SEAT No. :

**P4099**

[Total No. of Pages : 2

[4760] - 1002

**M.E. (Civil) (Construction & Management) (Semester - I)  
MANAGEMENT AND PROJECT PLANNING IN  
CONSTRUCTION  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any one from questions 1 & 2, 3 & 4, 5 & 6, 7 & 8.*
- 2) *Neat sketches must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

- Q1)** a) Write a short note on Modern Scientific Management. [5]  
b) Importance of planning in Life Cycle of Project. [5]

OR

- Q2)** Explain the clearance procedure for proposed Chakan International at Pune. [10]

- Q3)** a) What kind of periodic monitoring is done in a network cost system? [5]  
b) Following table gives the data about durations & costs, [10]

| Activity                      | Time (Weeks) |       | Cost   |       |
|-------------------------------|--------------|-------|--------|-------|
|                               | Normal       | Crash | Normal | Crash |
| 1-2                           | 5            | 2     | 6000   | 9000  |
| 2-4                           | 6            | 3     | 7000   | 10000 |
| 1-3                           | 4            | 2     | 1000   | 2000  |
| 3-4                           | 7            | 4     | 4000   | 8000  |
| 4-7                           | 9            | 5     | 6000   | 9200  |
| 3-5                           | 12           | 3     | 16000  | 19600 |
| 4-6                           | 10           | 6     | 15000  | 18000 |
| 6-7                           | 7            | 4     | 4000   | 4900  |
| 7-9                           | 6            | 4     | 3000   | 4200  |
| 5-9                           | 12           | 7     | 4000   | 8500  |
| Indirect Cost : 1000 per week |              |       |        |       |

**P.T.O**

- i) Draw the network and find out Critical Path for project.
- ii) Find out total project costs.
- iii) Carry out stage by stage compression of network.
- iv) Find optimal duration & minimum cost.

OR

- Q4)** a) Focus on Coordination & reporting techniques in construction. [7]  
b) Write a short note on Softwares used in Construction Scheduling. [8]

- Q5)** a) Illustrate the problem of scheduling in view of resource constraints with the help of an example. [10]  
b) Discuss the basic principles of Network Cost System. [5]

OR

- Q6)** a) Explain management roll in safety at construction site. [7]  
b) Focus on workmen compensation Act. [8]

- Q7)** a) What is time lapsed photography techniques? Explain with an example. [5]  
b) Which are the charts & diagram used in construction, explain string diagram. [5]

OR

- Q8)** a) Why incentive schemes are required? Quote an example. [5]  
b) “Maintaining of incentive schemes is based on implementation experience”, Support the statement. [5]

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Total No. of Questions : 8]

SEAT No. :

**P4593**

**[4760]-1003**

[Total No. of Pages : 2

**M.E. (Civil) (Construction & Management)**  
**CONSTRUCTION TECHNOLOGY**  
**(2013 Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams / figures must be drawn wherever necessary.*
- 4) *Assume suitable data / information wherever required.*

- Q1)** a) Explain in detail construction of Micro tunneling in Metropolitan cities. **[5]**
- b) Explain in detail the process of chemical grouting under water. **[5]**
- Q2)** a) Write detail note on “Tunneling in soft strata”. **[5]**
- b) Explain with suitable sketches sequence of lowering reinforcement cage in a diaphragm wall panel and list out precautions taken during placement of reinforcement cage. **[5]**
- Q3)** a) Explain in detail “Concrete mix design by any one of the methods”. **[5]**
- b) A cofferdam is to be constructed prior to construction of bridge pier. The depth of pier below bed level in is 5 m. The depth of water above bed level is 3m. Select suitable shape of the cofferdam and steel sheet piles. Draw neat sketch and explain step by step sequence of construction of coffer dam and removal of sheet piles after completion of bridge pier construction. **[5]**
- Q4)** a) Explain with neat sketch/s underwater concreting using tremie method. Write problems and precautions to be taken during tremie concreting. **[5]**
- b) Explain in detail construction of “Soldier pile coffer dam”. **[5]**

**P.T.O.**

- Q5)** a) Give reasons of failures of bored piles and precautions taken during construction. [5]
- b) Explain in detail construction of “Box caissons for breakwater walls”. [5]
- Q6)** a) Explain with sketches the sequence of construction of Micro piles. [5]
- b) Explain the problems and remedial measures during construction of well foundations. [5]
- Q7)** a) Write notes on: [5]
- i) Construction equipment management.
- ii) Selection of construction equipments for bridge project.
- b) Explain in detail with sketches “Grouting equipments”. [5]
- Q8)** a) Explain the necessity of maintaining “Log books” and “History books” for construction equipments. [5]
- b) Explain “Planning and Transportation of Crawler mounted equipments on highways / expressways for short and long distances”. [5]



Total No. of Questions : 8]

SEAT No. :

**P4100**

**[4760]- 1004**

[Total No. of Pages :2

**M.E. (Construction Management)  
RESEARCH METHODOLOGY TREATMENT  
( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

*1) Solve any 5 full questions*

- Q1)** a) Explain the errors in selecting a research problem. [5]  
b) Explain the difference between Research Methods and Research Methodology. [5]
- Q2)** a) Enlist various Research funding agencies. Discuss about any one in detail. [5]  
b) With suitable example explain Quantitative research. [5]
- Q3)** a) Explain the significance of Literature review in Research. [5]  
b) Discuss the sources of error in measurement. [5]
- Q4)** a) Discuss the advantages of Likert-type Scaling method. [5]  
b) Explain the sources which can and/ or should be used for selecting a research problem [5]
- Q5)** a) Explain the Null hypothesis and Alternative Hypothesis. [5]  
b) Write a note on ‘principal components method of factor analysis’. [5]
- Q6)** a) Write a note on “ Analysis of Variance”. [5]  
b) Explain Important Non-parametric tests for Hypothesis testing. [5]

*P.T.O.*

- Q7)** a) Discuss the steps involved in publishing a research idea in a journal. [5]  
b) Explain the format for writing a research report. [5]

- Q8)** a) Explain the importance of patenting a research idea. [5]  
b) Write a note on “plagiarism in research” [5]



Total No. of Questions : 8]

SEAT No. :

**P4383**

[Total No. of Pages :2

**[4760]-1005**

**M.E. (Civil) (Construction Management)**  
**CONSTRUCTION CONTRACTS ADMINISTRATION**  
**AND MANAGEMENT**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions out of 8.*
- 2) *Each questions carries 10 marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Compare & contrast between Lump Sum, Cost plus & EPC contracts giving suitable examples. **[6]**

b) Define contract as per ICA 1872 and explain the various conditions necessary for the formation of valid contract? **[4]**

**Q2) a)** State the circumstances under which the lowest tender is rejected? **[5]**

b) Enlist the different documents required for preparation of Tender? **[5]**

**Q3) a)** Explain the formation of the DRB & explain how many members gets replaced in case of necessity? **[3]**

b) Draft various pre-qualification necessary to execute a Thermal Power Plant of worth of 2000 crores to be completed in 3 calender year. Assume suitable data as required. **[7]**

**P.T.O.**

**Q4)** Write a brief meaning / Provision for following under FIDIC conditions-  
RED BOOK. **[10]**

- a) Tests on completion & Tests after completion
- b) Employer's personnel & Contractor's personnel
- c) Provisional sum work & Day work schedule
- d) Force Majeure

**Q5)** a) Discuss the advantages of DRB over dispute resolution mechanism.**[5]**

- b) Explain "Breach of Contract" and its subsequent consequences as formulated in the ICA (1872) based on various sections? **[5]**

**Q6)** a) Discuss "Institutionalized Arbitration" and explain its advantages over conventional arbitration? **[6]**

- b) Define-Arbitration in context with Tender. State its purposes. **[4]**

**Q7)** a) Describe the clauses of escalation of cost: **[6]**

- i) Escalation formula for material cost
- ii) Escalation formula for Labour cost

- b) Explain in detail-Subletting of contract? **[4]**

**Q8)** a) Write a short note on-Conciliation related to contract. **[5]**

- b) Explain in detail - Defect Liability Period. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P4594**

[Total No. of Pages : 2

**[4760] - 1006**

**M.E. (Civil) (Construction Management)**

**PROJECT ECONOMICS AND FINANCIAL MANAGEMENT**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Each question carries 10 marks.*
- 2) *Solve any 5 questions out of 8.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, electronic pocket calculator and statistical tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1) a)** What are the functions of cash management? **[5]**

b) Explain the status of present economy in the context of smart city development in India and its importance in Infrastructure sector. **[5]**

**Q2) a)** Explain how working capital requirements are determined by a contractor's organization executing construction work for client. **[7]**

b) Discuss the strategy for effective cash management? **[3]**

**Q3) a)** The details of production costs and revenues of a project are as under

|                    |            |
|--------------------|------------|
| Total Cost         | Rs. 65,000 |
| Fixed cost         | Rs.25,000  |
| Sales (8000 Units) | Rs.80,000  |

Find the break Even point in terms of number of units. What should be the output if the profit desired is Rs. 20,000? **[7]**

b) Explain objectives of financial appraisal. **[3]**

**P.T.O.**

- Q4)** a) Write the importance of recent trend and in the issue of debentures. [4]
- b) A construction company is considering an investment proposal, involving an initial cash outlay of Rs. 45 lakh. The proposal has an expected life of 7 years and zero salvage value. At a required rate of return of 12%, the proposal has a profitability index of 1.182. Calculate the annual cash inflows. [6]
- Q5)** a) What are the objectives or functions of budgeting, budgetary control?[5]
- b) Explain the stages of venture capital planning. [5]
- Q6)** a) Explain stages of venture capital planning [6]
- b) Write a short note on budget manual [4]
- Q7)** Define any 5 ratios useful in financial planning, analysis, control and explain their utility with the examples [10]
- Q8)** With reference to Smart city development project explain [10]
- a) Various means of finance which were used for completion of entire project from its origin.
- b) Financial management at each stage of project



Total No. of Questions : 8]

SEAT No. :

**P4384**

**[4760] - 1007**

[Total No. of Pages :3

**M.E. (Civil) (Construction & Management)**  
**OPERATIONS RESEARCH**  
**(2013 Credit Pattern) (Semester -II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data/information wherever required.*
- 4) *Figures to the right side indicate full marks.*

**Q1) a)** Solve the following LPP by Simplex method. **[6]**

$$\text{Maximize } Z = 3x_1 + 5x_2 + 4x_3$$

Subject to,

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$\text{and } x_1, x_2, x_3 \geq 0.$$

b) Explain in detail “Managerial Decision making process”. **[4]**

**Q2) a)** Write short notes on. **[6]**

- i) Optimization techniques & its applications in civil Engineering.
- ii) Convex and concave functions

b) Write detail note on “Sensitivity Analysis”. **[4]**

**P.T.O.**

- Q3) a)** A company has 3 factories A, B and C which supply materials to 4 warehouses 1,2,3 and 4. The unit cost of supply and demand conditions are as follows: **[6]**

| Source<br>↓ | Destination |    |     |     | Supply |
|-------------|-------------|----|-----|-----|--------|
|             | 1           | 2  | 3   | 4   |        |
| A           | 42          | 48 | 38  | 37  | 160    |
| B           | 40          | 49 | 52  | 51  | 150    |
| C           | 39          | 38 | 52  | 43  | 190    |
| Demand      | 80          | 90 | 110 | 160 |        |

Find initial basic feasible solution by Least cost method & VAM.

- b) Write note on **[4]**
- i) Principle of optimality
  - ii) Recursive Equation

- Q4) a)** A Department has 5 employees with 5 jobs to be performed and the time in hours is given in following table. Allocate jobs to employees to minimize the time. **[5]**

| Jobs | Employee |    |    |    |    |
|------|----------|----|----|----|----|
|      | 1        | 2  | 3  | 4  | 5  |
| A    | 10       | 5  | 13 | 15 | 16 |
| B    | 3        | 9  | 18 | 13 | 6  |
| C    | 10       | 7  | 2  | 2  | 2  |
| D    | 7        | 11 | 9  | 7  | 12 |
| E    | 7        | 9  | 10 | 4  | 12 |

- b) Explain in detail “Decision Under Risk”. **[5]**

- Q5)** a) Use Fibonacci method to maximize  $Z = 8x - 0.1x^2$  within the interval 0 to 100 with an accuracy of 0.1%. Carryout first four iterations. [5]  
 b) Explain in detail “Hessian Matrix”. [5]
- Q6)** a) Explain in detail Multivariate optimization without constraints. [5]  
 b) Explain in detail “Local and Global optima”. [5]
- Q7)** a) Explain characteristics and applications of Queuing theory in Civil Engineering. [5]  
 b) Explain the terms. [5]  
 i) Net present value  
 ii) Payback period  
 iii) Internal rate of return
- Q8)** a) Find an optimal sequence for the following sequencing problem of four jobs and five machines when passing is not allowed. It’s processing time (in hours) is given. [5]

| Job | Machine        |                |                |                |                |
|-----|----------------|----------------|----------------|----------------|----------------|
|     | M <sub>1</sub> | M <sub>2</sub> | M <sub>3</sub> | M <sub>4</sub> | M <sub>5</sub> |
| A   | 7              | 5              | 2              | 3              | 9              |
| B   | 6              | 6              | 4              | 5              | 10             |
| C   | 5              | 4              | 5              | 6              | 8              |
| D   | 8              | 3              | 3              | 2              | 6              |

Also find the total elapsed time.

- b) Write note on “Replacement models”. [5]



Total No. of Questions : 8]

SEAT No. :

P4101

[Total No. of Pages : 2

[4760] - 1008

**M. E. (Civil) (Construction Management)**

**ENERGY AND ENVIRONMENT FOR SUSTAINABLE  
DEVELOPMENT**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

- Q1)** a) Explain in detail the importance of EIA for any one of the mega civil engineering project like Railway or Nuclear power Plant. [5]
- b) Explain what you understand by the term Public Private Partnership in civil engineering projects? Also explain the importance of corporate social responsibility towards environmental conservation. [5]
- Q2)** a) Explain the concept of green procurement and green contracts. How different is a green contract from conventional civil engineering contract? Explain the differences with suitable clauses and examples. [5]
- b) Discuss in detail the roles and responsibilities of various stake holders in a green contract system? [5]
- Q3)** a) Explain the concept of primary energy and embodied energy with example of concrete manufacture. Discuss the impact of additives like flyash and silica fume on energy requirements of concrete production. [5]
- b) Explain what you understand by socio-environmental impact assessment with an example of hill road construction in tribal areas. [5]

**P.T.O.**

- Q4)** a) Explain the terms carbon credits, carbon trading and clean development mechanisms with suitable examples. [5]  
b) Discuss in detail the UNFCCC protocols for carbon trading. [5]
- Q5)** a) Enlist and explain different collection mechanism to harness solar energy. Also discuss relative merits and limitations of each mechanism. [5]  
b) Explain in detail the site selection criteria for wind mill location. Enlist various organizations involved in the wind energy sector in India. [5]
- Q6)** a) What do you mean by the term smart materials? Enlist four different examples of use of smart materials in energy conservation in civil infrastructure. [5]  
b) Discuss the performance factors of hydro power plants with respect to solar plants and wind energy plants with merits and limitations. [5]
- Q7)** a) With the suitable sketch explain in detail the concept of green roof and cavity wall construction as a measure for energy conservation in built environment. [5]  
b) Discuss in detail the components, losses and efficiency factors related to building energy management system. [5]
- Q8)** a) Enlist the various losses incurred in generation, transmission and distribution of electricity. Explain various measures adopted to minimize these losses. [5]  
b) Enlist and explain the concept, production procedure, energy conservation aspects involved in any two low cost construction materials you have studied for possible application in construction industry. [5]



Total No. of Questions : 8]

SEAT No. :

**P4595**

**[4760] - 1009**

[Total No. of Pages :2

**M.E. (Civil) (Construction Management)**  
**TQM IN CONSTRUCTION**  
**(2013 Credit Pattern) (Semester -III) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Make suitable assumptions as necessary and take suitable data as required.*
- 4) *Use of Calculator is allowed.*

**Q1)** Compare the quality definitions as given by different researchers with an example for each definition. Distinguish between quality, QC, QA, TQC and TQM with examples. **[5+5]**

**Q2)** Explain the use of

- a) Control charts in monitoring quality of concrete. **[5]**
- b) Fishbone diagram in analysing causes of defects in plastering work. **[5]**

**Q3)** What is Rework? What are its various causes? How rework can be prevented? Discuss the modules of the PRRT software which enable the quality manager to control the defects. **[1+2+2+5]**

**Q4)** Discuss with examples. **[10]**

- a) PDCA cycle
- b) Quality circles
- c) QIT

**P.T.O.**

**Q5) a)** Compare and contrast between ISO 9001 and ISO 9004 standards. Which standard is more suitable for the TQM? Why? **[4+2]**

b) Discuss with examples the ISO principle of “Process based approach”. What are the advantages of this approach as compared with the traditional approach? Explain. **[3+1]**

**Q6)** Discuss barriers which exist today in the Indian construction sector as regarding the implementation of the TQM policies and suggest measures to overcome them. **[7+3]**

**Q7)** Discuss application of six sigma in improving the quality of **[10]**

- a) Formwork item
- b) Concreting item
- c) Steel Reinforcement item
- d) DLC used on a road

**Q8)** Explain in detail:-

- a) CIDC-CQRA rating. **[4]**
- b) Internal Audits. **[3]**
- c) Customer delight. **[3]**



Total No. of Questions : 8]

SEAT No. :

**P3782**

**[4760]-101**

[Total No. of Pages : 3

**M.E. (Mechanical-Heat Power)  
ENERGY CONSERVATION AND MANAGEMENT  
(2008 Course) (Elective-I) (Semester-I) (502104 (C))**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer of two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator, log tables and electronic calculator is allowed.*

**SECTION-I**

- Q1)** a) State the need of energy conservation in India with reference to the present scenario. [8]
- b) Explain briefly about the various energy conservation schemes. [8]
- Q2)** a) Explain briefly about the simple payback period, return on investment, net present value, Life cycle costing and internal rate of return methods indicating the limitations of each method. [10]
- b) State Indian Electricity rules and regulations followed in energy audit program. [8]
- Q3)** a) Write in short the steps involved in energy audit of air conditioning system. [8]
- b) Explain briefly about the operation of a combined heat and power plant with a schematic diagram. Also, state how energy can be conserved from such plants. [8]

***P.T.O.***

- Q4)** a) In a natural gas fired boiler the air to fuel ratio is maintained at  $10 \text{ Nm}^3/\text{Nm}^3$  of gas. An air preheater is installed to recover the waste heat, which brings down the exit flue gas temperature from  $220^\circ\text{C}$  to  $170^\circ\text{C}$ . If inlet air temperature to air preheater is  $30^\circ\text{C}$ , find out the exit air temperature. Assume that the specific heat of flue gas and ambient air is equal. [8]
- b) Which are the Most Common Problems in steam generators? Explain how to prevent them. [8]

## SECTION-II

**Q5)** Explain Any Three of the following: [18]

- a) Automatic power factor controller.
- b) Technical aspect of energy efficient motors.
- c) Silent features of current Electricity act.
- d) Demand side management.

**Q6)** a) Explain how LEDs are efficient than compact fluorescent lamps. [6]

- b) Write a short note on: [10]
- i) Luminous efficacy.
  - ii) Energy efficient windows.

**Q7)** a) Why variable speed drives can save energy in pumping systems. Explain using head flow curve. [8]

- b) Explain the energy saving opportunities in heat pumps, refrigeration and air conditioning units. [8]

**Q8)** A cogeneration system in a paper plant is operated by a coal fired boiler. The steam from the boiler drives a back pressure turbine. The cogeneration plant parameters are given below.

|                                     |                |
|-------------------------------------|----------------|
| Rated output                        | 3000 kW        |
| Live steam pressure                 | 3.4 MPa        |
| Live steam temperature              | 435°C          |
| Steam pressure at turbine outlet    | 1.45 MPa       |
| Steam temperature at turbine outlet | 335°C          |
| Steam flow rate                     | 79 TPH         |
| Inlet Enthalpy at 3.4 MPa           | 3305.24 kJ/kg  |
| Outlet Enthalpy at 1.45 MPa         | 3116.44 kJ/kg  |
| Boiler feed water temperature       | 80°C           |
| Operation                           | 8000 hrs/annum |
| Cost of coal                        | Rs. 2500/tonne |

- i) Calculate the efficiency of the turbine.
- ii) Calculate the efficiency of the boiler if coal at 18 TPH is fired at a calorific value of 16736 kJ/kg.
- iii) The turbine efficiency can be increased to 73% at cost of Rs. 2 crores and the boiler efficiency can be increased to 83% at a cost of Rs. 1 crore which of these investments will have a shorter payback? **[16]**



Total No. of Questions : 8]

SEAT No. :

P4385

[Total No. of Pages : 2

[4760]-1010

M.E. (Civil) (Geotechnical Engineering)

ADVANCE SOIL MECHANICS

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Use of logarithmic table slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** Explain (a) Stress tensor and (b) Strain tensor by giving suitable matrix form. Also, Explain the meaning of each term included in matrix. **[10]**

**Q2)** Explain Boussinesq's theory for calculating vertical stress in soil bodies at the surface of semi-finite soil mass for (a) Concentrated load and (b) Distributed circular load. **[10]**

**Q3)** What is stress path? Explain Lambe's stress path for following cases : **[10]**  
a) Effective stress path.  
b) Total stress path.  
c) Path of total stress minus static pore pressure.

**Q4)** Explain the Rankine's Analytical method for cohesionless backfill using Mohr's circle to estimate :  
a) Earth pressure at rest  
b) Active Earth pressure  
c) Passive Earth pressure.  
Also, state the assumptions made in Rankine's theory. **[10]**

**P.T.O.**

- Q5)** Explain the lateral earth pressure on Braced sheet pile walls or strutted excavation for (a) Cohesionless soil and (b) Clayey soils as proposed by Terzaghi & Peck. **[10]**
- Q6)** Write the basic equations for (a) One dimensional consolidation & (b) Three dimensional consolidation equation for radial flow. Comment on the solution obtained by Terzaghi and Rendulic for above two cases by giving the relation between time and degree of consolidation. **[10]**
- Q7)** Explain the construction of flow nets for hydraulic structures on nonhomogeneous subsoils. **[10]**
- Q8)** Explain the terms giving suitable equations and their significance. **[10]**
- a) The Seepage force per unit volume of soil mass.
  - b) Seepage force.
  - c) Critical hydraulic gradient.



Total No. of Questions : 8]

SEAT No. :

**P4596**

[Total No. of Pages : 2

[4760] - 1011

**M.E. (Civil) (Semester - I)**  
**GEOTECHNICAL ENGINEERING**  
**Ground Improvement Techniques**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams/figures must be drawn wherever necessary.*
- 3) *Assume suitable data/information wherever required.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Explain the types of atomic bonds in clay mineral. [5]  
b) Explain in detail stabilization of granular soils. [5]
- Q2)** a) Enlist the sheet structures of major clay mineral families. Explain in detail with neat sketch "Illite structure". [5]  
b) Write the effects of chemical stabilization on index and engineering properties of soil. [5]
- Q3)** a) Explain the various factors affecting the effectiveness of cement stabilization". [5]  
b) Explain in detail "Laboratory testing of bitumen stabilized soils". [5]
- Q4)** a) Explain the process of lime stabilization including soil - lime reaction.[5]  
b) It is proposed to use fly ash for stabilizing expansive soil during road construction. The depth of expansive soil is @ 4.0 m. The fly ash stabilization is to done for expansive soil prior to construction of base course. Explain in detail the method of soil stabilization. [5]
- Q5)** a) Explain in detail "Electro kinetic method of stabilization of soils". [5]  
b) Write detail note "Constrution of stone columns and its applications in various Civil Engineering projects". [5]

**P.T.O.**

- Q6)** a) Write note on "Heating and freezing methods of stabilization". [5]  
b) Explain in detail "Deep compaction of soils by Vibro-floatation". [5]
- Q7)** a) Explain in detail "Design of Lime column foundations". [5]  
b) Explain in detail "Jet grouting and its suitability with field conditions". [5]
- Q8)** a) Explain in detail with suitable sketches "Granular trench stabilization". [5]  
b) Write note on "Quality control, testing and effectiveness of grouting". [5]



Total No. of Questions : 8]

SEAT No. :

**P4597**

**[4760]-1012**

[Total No. of Pages : 2

**M.E. (Civil) (Geotechnical Engineering)**

**ROCK MECHANICS**

**(2013 Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data if necessary.*
- 5) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Write a short note on Rock Anchor with respect to design and quality control. **[5]**

b) Enlist the factors affecting the Rock mass Rating (RMR)? Explain RMR by using strength of rock. **[5]**

**Q2) a)** Explain with diagram Hydraulic fracturing method for determination of stresses in rock. **[5]**

b) Write a short note on Rock bolting. **[5]**

**Q3) a)** Write a short note on Rheological properties of rock. **[5]**

b) What are the various types of grouting materials explain any one material in detail. **[5]**

**Q4) a)** Explain in brief about Hook-Brown failure criteria for rock masses. **[5]**

b) Write a short note on Creep in rock masses. **[5]**

**P.T.O.**

- Q5)** a) Enlist the factor affecting rupture behavior of rock. Explain any one in detail. [5]  
b) Write down the short note on theoretical conditions for fracture initiation. [5]
- Q6)** a) Explain the structural discontinuities in rock masses leading to progressive failure. [6]  
b) Write a note on Elastic and non linear behavior of rock. [4]
- Q7)** a) Explain with help of neat sketch the various modes of foundation failure on rock. [6]  
b) Write a note on subsiding and swelling of rocks. [4]
- Q8)** a) What are the various modes of failure of hard rock slopes? Explain it with help of sketch. [4]  
b) Explain the effect of tunnel direction on rock mass support requirement. [6]



Total No. of Questions : 8]

SEAT No. :

**P4102**

**[4760]- 1013**

[Total No. of Pages :2

**M.E. (Geotechnical Engineering)  
RESEARCH METHODOLOGY  
( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) Write a note on Experimental and non-experimental hypothesis-testing research with example. [5]  
b) Enlist at least 4 different research funding agencies.Explain details about any one [5]
- Q2)** a) Explain the general format of a research proposal. [5]  
b) What are the criteria's for a good research. [5]
- Q3)** a) Explain the purpose of a literature review. [5]  
b) Explain the Graphic rating scale and Itemized rating scale techniques.[5]
- Q4)** a) Write the advantages and disadvantages of Internet as a source of a Literature review. [5]  
b) Explain the advantages and Limitations of Likert-type Scale. [5]
- Q5)** a) Write a short note on Chi-Square test as a non-parametric test of testing hypothesis. [8]  
b) Enlist the Important Parametric tests for Hypothesis testing. [2]
- Q6)** a) Explain the centroid method of factor analysis. [5]  
b) Explain the conditions for the application of Chi-Square test. [5]

**P.T.O.**

**Q7)** a) Discuss different types of reports. [5]

b) Explain the factors to be considered for effective presenting a research. [5]

**Q8)** a) Write a note on plagiarism in research. [5]

b) Discuss in brief the important factors needed for a Technical report. [5]



Total No. of Questions : 8]

SEAT No. :

P4534

[Total No. of Pages :2

[4760]-1014

**M.E. (Civil) (Geotechnical Engineering)**  
**ADVANCE FOUNDATION ENGINEERING**  
**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from Eight questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data if necessary.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain the importance of measurement of ground water level during subsoil exploration program and discuss the test procedure to determine GWT on field. [4]  
b) Explain the criteria for spacing and depth of bores used in subsoil exploration program. [6]
- Q2)** a) Write a detailed note on subsoil exploration report covering the aspect of importance, contents and attachments. [4]  
b) Following data is collected in cone penetration test on the field. [6]  
i) Ground water table is located at 3m depth below ground surface  
ii) The unit weight of soil is above and below the ground water is  $17.8\text{kN/m}^3$  and  $19.6\text{kN/m}^3$  respectively.  
iii) The cone penetration resistance at depth of 9m is  $0.82\text{ M/m}^2$   
Determine the undrained cohesion,  $C_u$ .
- Q3)** a) A square footing of size  $1.5\text{m} \times 1.5\text{m}$  is to be constructed in a sandy soil having  $\gamma = 18\text{ KN/m}^3$ ,  $C = 0$  and  $\phi' = 30^\circ$ . The footing is proposed to be located at a depth of 0.9m. Assume that the one - way load eccentricity  $e=0.15\text{m}$ . Determine the ultimate load,  $Q_{ult}$ . [6]  
b) Enlist the various types of bearing capacity of failures and explain any one in detail. [4]

**P.T.O.**

- Q4)** a) Write a note on Approximate flexible method for raft foundation design. [4]
- b) A raft foundation with dimension 12m × 10m is to be constructed over sand deposit. The depth of foundation is 2m and allowable settlement is 25mm. Calculate the allowable bearing capacity of raft foundation considering corrected average penetration number is 10.[6]
- Q5)** a) With help of sketch explain the procedure of construction of cantilever sheet pile in sandy soil. [5]
- b) Enlist the various types of anchors. Explain any one with help of neat sketch. [5]
- Q6)** a) Determine the Ultimate point load for a pile having length 16m and 410mm × 410mm cross section area. The pile is fully embedded in sand for which  $\gamma = 17\text{kN/m}^3$ ,  $\phi' = 30^\circ$ . [6]
- b) Write a detailed note on pile load test. [4]
- Q7)** a) Explain the stability condition of a cellular cofferdam under the partial submergence condition. [5]
- b) A cellular cofferdam is founded over a rock. The cofferdam has a total height of 18.3m. The cell is filled with dry gravel with  $\gamma = 17\text{kN/m}^3$ ,  $\phi' = 30^\circ$ . To the upstream side there is soil berm at bottom for a height of 6m. The upstream berm soil has  $\gamma_{\text{sub}} = 8.8\text{kN/m}^3$ ,  $\phi = 25^\circ$ . On the upstream berm water stands for rest of the height. To the downstream side support berm of soil is up to 1.5m height and having soil properties  $\gamma = 14.4 \text{ kN/m}^3$ ,  $\phi = 28^\circ$  and passive resistance  $F = 2$ . Draw the sketch of cofferdam and calculate total pressure, moment,  $B_{\text{min}}$  for no overturning. [5]
- Q8)** a) Draw the sketch and Explain the various components of well foundation. [5]
- b) Explain the procedure of sinking of well. [5]



Total No. of Questions : 8]

SEAT No. :

**P4598**

[Total No. of Pages : 2

**[4760] - 1015**

**M.E. (Civil) (Geotechnical Engineering) (Semester - II)**  
**CONSTRUCTION METHODS IN GEOTECHNICAL ENGINEERING**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any FIVE questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams /figures must be drawn wherever necessary.*
- 4) *Assume suitable data / information wherever required.*

**Q1) a)** Write the basic purposes of dewatering methods. Explain in detail the method of Electroosmosis. **[5]**

b) Explain with neat sketches tremie method of underwater concreting in large diameter bored cast-in-situ piles. **[5]**

**Q2) a)** List the various types of pile hammers. Explain any two pile hammers. **[5]**

b) Write the problems and remedial measures encountered during pile driving within coffer dams. **[5]**

**Q3) a)** Explain in detail “Construction of diaphragm type cellular coffer dam”. **[5]**

b) Explain the difficulties associated with coffer dams due to improper selection of sheet pile sections and bracings. **[5]**

**Q4) a)** Write detail note on “Rectangular cofferdams” **[5]**

b) Explain the sequence of operations during “Cofferdam destroyed by Surge”. **[5]**

**P.T.O.**

- Q5)** a) Explain in detail “Construction of Box Caissons”. [5]  
b) Write note on:  
i) Tilting and shifting of caissons.  
ii) Excessive skin friction during sinking of caissons. [5]
- Q6)** a) Explain in detail site and foundation preparations associated with caissons. [5]  
b) What do you mean by “Caisson disease”? Write the precautions taken to overcome it. [5]
- Q7)** a) Explain the following [5]  
i) Blast hole design  
ii) Blasting round design  
b) Write note on “Types of Tunnel Boring Machines”. [5]
- Q8)** a) Explain in detail “Over break control”. [5]  
b) Write note on “Sinking caisson method of tunneling”. [5]



Total No. of Questions : 8]

SEAT No. :

**P4386**

**[4760] - 1016**

[Total No. of Pages :2

**M.E. (Civil) (Geotechnical Engg.)**  
**STABILITY OF SLOPES & EARTH DAM**  
**(2013 Credit Pattern) (Semester - II) (501128)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** What are different conditions of stability analysis of earth dam. Explain how the stability of Earth Dam during steady seepage is evaluated? **[10]**

**Q2)** What is short term & long term stabilities of finite slope embankments? Explain Swedish circle method for stability analysis of finite slope embankments. **[10]**

**Q3)** What are the various methods to control the seepage through **[10]**

- a) The Earth dam embankments and
- b) Through foundations.

Explain any one method for each case in detail.

**Q4)** Explain how would you plan the soil investigations for the design of various components of an earth dam with a typical case study. **[10]**

**Q5)** What are the objectives of Instrumentation in an earth dam? Explain how Inclometers are used to study the performance of dams in respect of spreading of slopes with a suitable sketch? **[10]**

**P.T.O.**

**Q6)** Draw a typical layout of Road embankment & Explain the functions of various component parts. **[10]**

**Q7)** Explain the techniques of “Reinforced Earth wall” applied to Fly over approach roads with suitable sketches. **[10]**

**Q8)** Draw a typical layout of “Gabion Walls”. What are the benefits of Gabion wall construction. Also, explain the design guidelines of Gabion wall construction. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4103

[Total No. of Pages : 2

[4760] - 1017

M. E. (Civil) (Geotechnical Engg.) (Semester - III)

GEOTECHNICAL EARTHQUAKE ENGG.

(2013 Pattern)

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 2) *All questions carry equal marks.*
- 4) *Your answers will be valued as a whole.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) Compare 'Continental Drift & Plate Tectonics'. [5]

b) Explain 'DSHA'. [5]

**Q2)** a) Discuss 'Elastic Rebound Theory'. [5]

b) Explain 'Love Waves'. [5]

**Q3)** a) How the 'Dynamic soil propertics' are determined? [5]

b) Discuss the effects of local site conditions on ground motion. [5]

**Q4)** a) Discuss 'Ground Response Analysis'. [5]

b) Explain 'Green's Function Techniques'. [5]

**P.T.O.**

- Q5)** a) Discuss 'Liquefaction'. [5]  
b) Explain 'Dynamic Analysis for Earthdam'. [5]
- Q6)** a) Discuss 'Seismic slope stability'. [5]  
b) Explain 'Jai - Krisna' approach. [5]
- Q7)** a) Explain different soil reinforcement techniques. [5]  
b) How will you improve bearing capacity of foundations, during EQ. [5]
- Q8)** a) Explain 'grouting'. [5]  
b) How will you mitigate EQ effects. [5]



Total No. of Questions : 8]

SEAT No. :

**P4599**

**[4760] - 1018**

[Total No. of Pages :2

**M.E. (Civil) (Geotechnical Engineering)  
GEOENVIRONMENTAL ENGINEERING  
(2013 Credit Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams/figures sketches must be drawn wherever necessary.*
- 4) *Assume suitable information/ data wherever required.*

**Q1) a)** Write in detail about Identification of waste? **[5]**

b) Write note on sources of subsurface contamination? **[5]**

**Q2) a)** Write about characterization and regulatory requirements of hazardous, non-hazardous and domestic waste? **[5]**

b) Write details of characteristics of solid waste? and soil-waste interaction? **[5]**

**Q3) a)** Write processes of cation exchange reaction and effect of pollutants on soil? **[5]**

b) Write in detail “Waste management methods”. **[5]**

**Q4) a)** Write short notes on: Erodability of soil in relation to **[5]**

i) Containment transport

ii) Laboratory and field evaluation of permeability

b) Write notes on Leachet collection and detection system. **[5]**

**P.T.O.**

- Q5)** a) Explain the planning and design aspects relating to waste disposal in landfills. [5]
- b) Explain in detail concept and impacts of Ash ponds and Tailing ponds. [5]
- Q6)** a) Write notes on [5]
- i) Concept of waste containment
- ii) Types of barrier materials
- b) Explain Detection, control and remediation of subsurface containment. [5]
- Q7)** a) Explain engineering properties of waste and comment on use of waste in geotechnical construction. [5]
- b) Explain effectiveness and limitations of single linear and double linear landfills. [5]
- Q8)** a) What are steps involved in Reclamation of old waste dumps? Explain merits and demerits of the process. [5]
- b) Give the applications of Geosynthetics in [5]
- i) Waste disposal
- ii) Landfill Construction.



Total No. of Questions : 8]

SEAT No. :

**P4104**

[Total No. of Pages : 2

**[4760] - 1019**  
**M.E. (Civil) (Hydraulics Engg.)**  
**FLUID MECHANICS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithms tables, slide rule, electronics pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Derive Euler's equation of motion. **[5]**  
b) State Bernoulli's equation. Explain why it is called energy equations though all the terms are in meter units. What are its applications? What are limitations of it? **[5]**
- Q2)** a) Write short note on solution of Laplace's equation by relaxation method. **[5]**  
b) Define rate of rotation. Derive formula for rotation about Z axis. **[5]**
- Q3)** a) Derive equation for stream function and potential function of a sink flow. **[6]**  
b) Write Navier Stokes equations and explain the terms. **[4]**
- Q4)** a) What is conformal mapping? For a complex potential of  $w = AZ$  for a uniform flow find stream function and velocity potential if A is imaginary. **[4]**  
b) Derive equation for velocity distribution of laminar flow through parallel plates with one plate stationary and other moving starting with Navier Stokes equation. **[6]**
- Q5)** a) What is laminar sub-layer? What is hydrodynamically smooth and rough boundary? **[4]**  
b) Derive boundary layer equations. **[6]**

**P.T.O.**

- Q6)** a) Derive Karman-momentum integral equation for boundary layer. [6]  
b) Write a short note on boundary layer separation. [4]
- Q7)** a) Write a short note on factors affecting transition from laminar to turbulent flow. [5]  
b) Derive equation for stagnation temperature in compressible flow. [5]
- Q8)** a) Derive equation for work done during an adiabatic process. [5]  
b) Derive Reynolds equation of motion for turbulent flow. [5]



Total No. of Questions : 8]

SEAT No. :

**P4304**

**[4760]-102**

[Total No. of Pages : 3

**M.E. (Mechanical-Heat Power)**  
**CONVECTIVE HEAT TRANSFER ANALYSIS**  
**(2008 Course) (Elective-I) (502104 D) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables are allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a)** Explain the following: **[8]**

- i) Reynolds No.
- ii) Grashoff No.
- iii) Graetz No.
- iv) Nusselt No.

b) For laminar flow over a flat plate, show that average heat transfer coefficient is twice the local heat transfer coefficient. **[8]**

**Q2) a)** Discuss Reynold & Colburn analogy for flow over a flat plate. **[8]**

b) Show that the average heat transfer coeff. for a configuration is given by,  $\bar{h} = 1.11h_x$ ; where the local heat transfer coefficient is given by,  $h_x = c \cdot x^{-0.1}$ . **[8]**

**P.T.O.**

- Q3) a)** The velocity and temperature profiles for fully developed flow at a particular axial location in a 20cm diameter pipeline may be approximated by the following expressions,

$$u = (96r - 190r^2) \text{ and } T = [100 (1 - 2r)]^\circ\text{C}.$$

Where  $r$  is the distance in metres measured from inside surface. Calculate the average (cup mixing) temperature of the fluid. **[10]**

- b) Distinguish between differential and integral analysis of boundary layer flows. **[6]**

**Q4) Write note on (Any Three):** **[18]**

- Thermal and velocity boundary layer.
- Various models for turbulent flow.
- Eddy viscosity.
- Dittus Boelter equation.

## SECTION-II

- Q5) a)** Sketch temperature and velocity profiles in free convection on a vertical wall. **[4]**

- b) Two vertical flat plates are at  $60^\circ\text{C}$ . They are placed in a tank of water at  $20^\circ\text{C}$ . If the plates are 10cm high, what is the minimum spacing to prevent interference of the free convection boundary layers. Use the relation, for boundary layer thickness,  $\delta$ , given by,

$$\frac{\delta}{x} = 3.93 \left[ \frac{\text{Pr} + 0.9}{(\text{Pr})^2 \cdot Gr_x} \right]^{1/4}$$

Properties of water are:  $\rho = 992 \text{ kg/m}^3$ ,  $C_p = 4.18 \text{ kJ/kgK}$ ,

$$\mu = (631 \times 10^{-6}) \frac{N-s}{m^2}, \text{ K} = 0.64 \text{ W/mK}. \quad \mathbf{[12]}$$

- Q6)** a) Calculate the heat transfer coefficient by free convection between a horizontal wire and air at 25°C. The surface of the wire is at 95°C and its diameter is 2.5mm. Also find the maximum admissible current intensity if the resistance of the wire is 6 ohm/m. Use  $Nu_d = 1.18(Ra)^{1/8}$ . Properties of air:  $\nu = (18.97 \times 10^{-6}) \text{ m}^2/\text{s}$ ;  $Pr = 0.7$ ,  $K = 0.28 \text{ W/mK}$ . [10]
- b) Discuss free convection caused by centrifugal forces. [6]
- Q7)** a) Explain film wise and drop wise condensation. [6]
- b) Write notes on: [10]
- i) Nusselt's theory of film condensation.
- ii) Condensation promoters.
- Q8)** Write short notes on: [18]
- a) Combined convection.
- b) Convective heat transfer through porous media.
- c) Internal and external turbulent flow.



Total No. of Questions : 8]

SEAT No. :

**P4105**

[Total No. of Pages : 2

[4760] - 1020

**M.E. (Civil) (Hydraulics) (Semester - I)**

**IRRIGATION AND DRAINAGE**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions from Eight questions.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Calculate the depth and frequency of irrigation required for a crop pattern having the following data : **[10]**

- a) Root zone depth = 1m
- b) Field Capacity = 22%
- c) Wilting point = 12%
- d) Specific Weight Soil = 1.50gm/cc
- e) Consumptive use = 25 mm per day
- f) irrigation efficiency = 50%

Assume 50% depletion of available moisture before application of irrigation water at field capacity.

**Q2)** What do you mean by soil erosion? Explain the causes of soil erosion and also illustrate the various soil conservation techniques. **[10]**

**Q3)** Explain drip irrigation system considering the following points. **[10]**

- a) General concept
- b) advantages & disadvantages
- c) elements of the system
- d) design concept

**P.T.O**

- Q4)** What do you mean by lift irrigation scheme? State its necessity. Explain the meaning of economics of lift irrigation scheme and state the criteria for the justification of the execution of such scheme. [10]
- Q5)** Explain sprinkler irrigation system considering the following points. [10]
- a) Advantages and disadvantages
  - b) Components of the system
  - c) Types of sprinklers
  - d) Design concept
- Q6)** Write short notes on : [10]
- a) On farm structures
  - b) Rotational water supply (RWS)
- Q7)** Describe canal outlet by considering the following points : [10]
- a) Definition of canal outlet
  - b) Requirement of a good outlet
  - c) Minimum modular head
  - d) Efficiency of an outlet
  - e) Canal automation
- Q8)** Write short notes on : [10]
- a) Water logging causes, its preventive and remedial measures.
  - b) Various layouts of suitable drainage systems for land drainage.



Total No. of Questions : 8]

SEAT No. :

**P4106**

**[4760] - 1021**

[Total No. of Pages :2

**M.E. (Civil) (Hydraulic Engg.)**

**PLANNING AND MANAGEMENT OF WATER RESOURCES**

**(2013 Credit Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) What are objectives of planning and management of water resources?[5]  
b) Comment on challenges in water resources sector. [5]

- Q2)** a) Classify water resources and briefly discuss the status of its development in India. [5]  
b) Explain with suitable example the impact of 'spatial and temporal variation of rainfall' on Indian economy. [5]

- Q3)** a) With the help of cash flow diagram explain the economics of WR project. [5]  
b) Briefly explain the hierarchy of feasibility investigations of WR project. [5]

- Q4)** a) Write a note on elasticity of water demand. [5]  
b) What are the advantages of multipurpose projects. [5]

- Q5)** a) Elaborate the need of integrated planning. [5]  
b) What is meant by flood attenuation? [5]

**P.T.O.**

- Q6)** a) Write a note on conflicts in reservoir operations. [5]  
b) How spillway capacity is designed? [5]
- Q7)** a) What is the role of ground water if there is drastic reduction in rainfall due to climate change? [5]  
b) Write a note on management of international river basin: Brahmaputra. [5]
- Q8)** a) What is the role of unlined canals in conjunctive use of surface and ground water resources? [5]  
b) State different discounting techniques and briefly explain any one of them. [5]



Total No. of Questions : 8]

SEAT No. :

**P4107**

**[4760]- 1022**

[Total No. of Pages :2

**M.E. (Hydraulics)**

**RESEARCH METHODOLOGY**

**( 2013 CreditPattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

*1) Solve any 5 full questions*

- Q1)** a) Explain the techniques involved in defining a research problem. [5]  
b) Discuss the general objectives of research funding agency. [5]
- Q2)** a) Discuss in brief the format of a research proposal. [5]  
b) Identify the ethical issues related to interpretation and reporting a research problem. [5]
- Q3)** a) Write a note on “Sources of literature review”. [5]  
b) Explain in brief various sampling techniques. [5]
- Q4)** a) Why should the data collected for research must be checked for reability,suitability and adequacy. [5]  
b) Explain the importance of a good literature review. [5]
- Q5)** a) Write a note on Factor Analysis. [5]  
b) Write a note on advantage and limitation of Simple Regression Analysis. [5]
- Q6)** a) Discuss the important characteristics of Chi-Square test. [5]  
b) Explain the centroid method of factor Analysis. [5]

**P.T.O.**

- Q7)** a) Discuss the prerequisites for publishing the research in a journal paper. [5]  
b) Explain the significance of a research report. [5]
- Q8)** a) Write a note on Oral presentation as a technique of reporting research results. [5]  
b) Write a note on “Patenting a research idea”. [5]



Total No. of Questions : 8]

SEAT No. :

P4108

[Total No. of Pages : 2

[4760] - 1023

M.E. (Civil) (Hydraulics Engg.)

Open Channel Hydraulics

(2013 Pattern)

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Figures to the right indicate full marks*
- 4) *Use of logarithms tables, slide rule, electronics pocket calculator is allowed*
- 5) *Assume suitable data if necessary*

**Q1)** a) Derive analytical condition of critical flow using specific force concept keeping the discharge constant [4]

b) Derive relation between sequent depths for hydraulic jump occurring on sloping floor [6]

**Q2)** a) Show that maximum velocity in a circular channel occurs when  $y/D = 0.81$  [6]

b) Write a short note on hydraulic jump at an abrupt rise in the channel [4]

**Q3)** a) Draw water surface profiles for gradually varied flow occurring on [4]

i) Milder slope flows a mild slope

ii) steeper slope follows a steep slope

b) A rectangular channel has a bed width of 6 m, slope  $S_0 = 0.0004$ , Manning's  $n = 0.015$  carries a discharge of  $8.4 \text{ m}^3/\text{s}$ . At the end of the channel, the flow emanates from the sluice gate. The depth of flow at vena contracta is 0.15m. If a hydraulic jump is formed at a depth of 0.25m find the distance between the toe of the jump and vena contracta. Use direct step method. Take two steps. [6]

**Q4)** a) Flow in a 5 m wide rectangular channel drops in depth from 1.7 m to 1.3 m in a length of 1000m. If the bed slope is 0.001 find the theoretical rate of flow in the channel. Take  $n = 0.013$  [6]

*P.T.O.*

b) Write a note on Graphical method for determining GVF profile length[4]

**Q5) a)** What is flood routing? Differentiate between hydraulic and hydrologic flood routing, channel and reservoir routing [4]

b) A rectangular channel 1.5 m wide conveys a discharge of  $1.17 \text{ m}^3/\text{s}$  at a depth of 0.6 m. A uniformly discharging side weir with crest at 0.42 m above the bed at the commencement of the side weir is proposed to divert the flow of  $0.3 \text{ m}^3/\text{s}$  laterally. Design the length of the side weir.[6]

**Q6) a)** Route the following flood through a reach of  $K = 8 \text{ h}$  and  $x = 0.25$ . At  $t = 0$  the outflow discharge is  $8 \text{ m}^3/\text{s}$ . [6]

|                              |   |    |    |    |    |    |    |    |
|------------------------------|---|----|----|----|----|----|----|----|
| Time (h)                     | 0 | 4  | 8  | 12 | 16 | 20 | 24 | 28 |
| Inflow $\text{m}^3/\text{s}$ | 8 | 16 | 30 | 30 | 25 | 20 | 15 | 10 |

b) Write a short note on classification spatially varied flow. [4]

**Q7) a)** A rectangular channel 4 m wide carries a discharge of  $12 \text{ m}^3/\text{s}$  at a depth of 2 m. Calculate the height and velocity of surge produced when the flow is suddenly stopped completely by the full closure of a sluice gate at the down stream gate [6]

b) What is dam break problem? Is it a positive surge or negative surge? Write the basic differential equation for solving the dam break problem.[4]

**Q8) a)** Derive dynamic equation for gradually varied unsteady flow [4]

b) What is solitary wave? Derive equation for celerity of a solitary wave.[6]



Total No. of Questions : 8]

SEAT No. :

P4109

[Total No. of Pages : 2

[4760] - 1024

M. E. (Civil) (Hydraulics) (Semester - II)

SEDIMENT TRANSPORT AND RIVER MECHANICS

(2013 Pattern)

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Solve any Five questions from Eight questions.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Briefly explain the various modes of sediment transport. **[10]**

**Q2)** Draw neat sketches indicating the various flow regimes with changing flow conditions and explain each of them briefly. **[10]**

**Q3)** Explain Du-Buoy's bed load equation for prediction of bed load transport rate. **[10]**

**Q4)** Using Meyer-Peter and Muller equation, estimate the bed load transport of sediment in an alluvial channel 100 m wide carrying a discharge of 200 m<sup>3</sup>/sec. with 3.0 m depth of water. The bed slope of the channel is 1 in 4000 and the mean size of sediment particles is 0.3 mm. **[10]**

**Q5)** Design an irrigation channel in alluvial soil according to Lacey's method for following data

- a) Full supply discharge: 40 m<sup>3</sup>/sec
- b) Lacey's silt factor — 0.9
- c) Channel side slope 0.5H: 1V

**[10]**

**P.T.O.**

**Q6)** What is bifurcation ? What is confluences? Explain their practical significance. **[10]**

**Q7)** What are the causes of silting of reservoirs? Explain the controlling measures of silting of reservoirs? **[10]**

**Q8)** Write short notes on **[10]**

- a) River gauging by ultra sonic methods
- b) Elements of river morphology



Total No. of Questions : 8]

SEAT No. :

**P4600**

**[4760]-1025**

[Total No. of Pages :3

**M.E. (Civil) (Hydraulics)**

**HYDROLOGY**

**(2013 Credit Pattern) (Semester - II) (501048)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain the application of hydrological studies in connection with water resources development of a country. What are the chief hydrological parameters which influence the water resources development. **[4]**

b) Explain with hydrograph theory with its basic assumptions. How is unit hydrograph different from distribution graph? Explain Collin's method for deriving unit hydrograph. **[6]**

**Q2) a)** What are the various abstraction from precipitation & explain Horton equation for infiltration capacity measurement. **[4]**

b) A particular soil mass has the following parameter  $f_0 = 30$  mm/hr,  $f_c = 5$  mm/hr &  $K = 2$  hr<sup>-1</sup>. What is the infiltration capacity after 12, 24, 36 minutes & how much water has infiltrated during above time. **[6]**

**Q3) a)** Explain the application of stochastic process to hydrology. What are

i) Discrete time stochastic process &

ii) Continuous time stochastic process

explain each with examples.

**[4]**

**P.T.O.**

- b) Explain [6]
- i) Gumbell & generalised extreme value distribution.
- ii) Pearson type III for analysis of extreme hydrological data.
- Q4)** a) What is hydrologic & hydraulic routing & explain the lumped system routing. [4]
- b) Explain Return Period of flood & what are the different methods to predict flood of desired return period. [3]
- c) State the application of regional flood frequency analysis & explain Index-flood method. [3]
- Q5)** a) Discuss the development of ground water & what are the favorable geological conditions which aid in groundwater movement. [3]
- b) Develop the Darcy equation for movement of ground water. Explain the laboratory method for finding the permeability of soil. [4]
- c) The aquifers are separated by 48 km & are connected by water bearing stratum 28 m thick & runs inclined at a rate of 16m/km. The hydraulic gradient was found to be 0.18 m/km. Find the transmissibility of the water bearing stratum. [3]
- Q6)** a) An unconfined aquifer has a thickness of 24m. When a fully penetrating well of 18 cm diameter is pumped at a rate of 30 LPS, the drawdown measured in observation wells located 8m & 95 m from well are 6 m & 0.4m respectively. Find the average hydraulic conductivity of aquifer. Find at what distance from the well drawdown is insignificant. [6]
- b) Explain Theis method for finding the aquifer parameter storativity & Transmissivity. [4]

- Q7)** a) What are the various aquifer parameters required for studying ground water movement? Derive the equation for discharge for a steady radial flow into well. [6]
- b) What are well loss & how is well loss related to specific capacity of the well. [4]
- Q8)** a) Explain the phenomenon of ground water pollution & human factors influencing ground water pollution. [4]
- b) What is the necessity of artificial recharge & Explain the Basin type recharge. [3]
- c) What is length of Intrusion in connection with sea water intrusion? Explain any one method to control sea water intrusion into coastal aquifer. [3]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4544**

[Total No. of Pages : 2

[4760] - 1026

**M.E.(Civil - Hydraulic Engineering)**

**DAM ENGINEERING**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Briefly explain elementary profile of gravity dam and its extension to practical profile. **[5]**

b) Write a note on Roller Compacted Concrete. **[5]**

**Q2) a)** Explain the zone method of design of gravity dam. **[5]**

b) What is middle third rule? In reservoir full condition, the resultant has crossed the limit of middle third; suggest the design modification to bring it within limit. **[5]**

**Q3) a)** Differentiate between arch dam and gravity dam. **[5]**

b) Write a note on construction aspects of rockfill dam. **[5]**

**Q4) a)** Differentiate between buttress dam and arch dam. **[5]**

b) Briefly explain limitations of buttress dams. **[5]**

**P.T.O.**

- Q5)** a) How various components of earthen dam are designed? [5]  
b) Derive equations required for determination of phreatic line. [5]
- Q6)** a) Explain in detail how sudden drawdown condition is harmful for the safety of earthen dam. [5]  
b) What type of foundation is required for construction of earth dam? [5]
- Q7)** a) Design suitable hydraulic jump type stilling basin with horizontal slope for tail water deficiency condition with following data. [5]  
i) Design discharge =  $1250 \text{ m}^3/\text{s}$   
ii) Width of spillway =  $62.5 \text{ m}$   
iii) Supercritical depth at foot of spillway =  $1 \text{ m}$   
b) Explain the role of plumb bob as indicator of dam safety. [5]
- Q8)** a) Write a note on locations of piezometers in earthen dams. [5]  
b) Explain the theory behind ogee profile of spillway. [5]



Total No. of Questions : 8]

SEAT No. :

**P4601**

[4760] - 1027

[Total No. of Pages :4

**M.E. (Civil - Hydraulics)**

**OPTIMIZATION TECHNIQUES**

**(2013 Credit Pattern) (End Semester) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of calculator is allowed.*

**Q1) a)** Min.  $z = 5x_1 - 4x_2 + 6x_3 - 8x_4$  **[6]**

$$\text{St. } x_1 + 2x_2 + 2x_3 + 4x_4 \leq 40$$

$$2x_1 - x_2 + x_3 + 2x_4 \leq 8$$

$$4x_1 - 2x_2 + x_3 - x_4 \leq 10$$

$$x_1, x_2, x_3, x_4 \geq 0.$$

b) What is dynamic programming? How it is different from linear programming? Also state the Bellman's Principle of optimality. **[4]**

**Q2) a)** Use Lagrange Multiplier Technique to maximize

$$Z = X_1^2 + 3X_2^2 + 2X_1X_2 + 2X_1 + 6X_2 \text{ Subject to } 2X_2 - X_1 = 4, \text{ And } X_1, X_2 \geq 0. \quad \text{[5]}$$

b) Minimize  $z = 3x_1 + 2x_2 + 4x_3$  **[5]**

$$\text{St. } 2x_1 + x_2 + x_3 = 60$$

$$3x_1 + 3x_2 + 5x_3 \geq 120$$

$$x_1, x_2, x_3 \geq 0. \text{ Use two phase method only.}$$

**P.T.O.**

- Q3) a)** Water is to be supplied to three irrigation areas in terms of number of full units of water to maximize benefits. The supply for the three irrigation areas are given in table below. Determine the optimal solution when water available is 6 units. [6]

| Unit of water | Benefit of each irrigation area |        |        |
|---------------|---------------------------------|--------|--------|
|               | Area 1                          | Area 2 | Area 3 |
| 0             | 0                               | 0      | 0      |
| 1             | 40                              | 20     | 45     |
| 2             | 60                              | 40     | 60     |
| 3             | 80                              | 70     | 78     |
| 4             | 100                             | 105    | 95     |
| 5             | 110                             | 130    | 115    |

- b) Explain algorithm of Newton's method. What are its advantages over steepest gradient technique? [4]

- Q4) a)** Use Fibonacci method to maximize  $Z = 24x - 0.2x^2$  in the range (20 to 120) to an accuracy of 0.05%. Carry out computations for the first four stages only. [5]

- b) Minimize  $f(x) = 2(x_1 - 1)^2 + (x_2 - x_1)^2$  with initial value  $(-1, 2)$  using gradient method. [5]

- Q5) a)** A refrigeration company has six plants located in different parts of a city. Every year it is necessary for each plant to be completed overhauled. The overhauling is carried out in two stages A and B, and each stage requires a crew workmen with completely different skills. The work on stage B can start only when A has been completed. The plant has to be closed for entire period of the overhauling. The company, at present is following the schedule of the overhaul of the six plants as given below. [6]

| Plant:  | Time required by the crew (days) |                |                |                |                |                |
|---------|----------------------------------|----------------|----------------|----------------|----------------|----------------|
|         | P <sub>1</sub>                   | P <sub>2</sub> | P <sub>3</sub> | P <sub>4</sub> | P <sub>5</sub> | P <sub>6</sub> |
| Crew A: | 12                               | 9              | 10             | 8              | 10             | 10             |
| Crew B: | 10                               | 7              | 9              | 14             | 6              | 8              |

- i) Determine the optimal sequence
- ii) If down time of any of the six plants costs Rs. 5000 per day, idle time for crew A costs Rs. 1500 per day and idle time for crew B costs Rs. 2500 per day which of the two schedules, the present one or the one determined in part (i), will be more economical? What are their respective costs?

b) Explain the Monte Carlo Simulation with suitable example. [4]

**Q6)** a) Reduce the following game by dominance property and solve it: [6]

|          |     |          |   |   |   |   |
|----------|-----|----------|---|---|---|---|
|          |     | Player B |   |   |   |   |
|          |     | 1        | 2 | 3 | 4 | 5 |
| Player A | I   | 1        | 3 | 2 | 7 | 4 |
|          | II  | 3        | 4 | 1 | 5 | 6 |
|          | III | 6        | 5 | 7 | 6 | 5 |
|          | IV  | 2        | 0 | 6 | 3 | 1 |

b) What is mean by decision making with experimentation? [4]

**Q7)** a) Explain Simple game with prototype example. [4]

b) A bakery keeps stock of a popular brand of cake. Daily demand based on past experience is given below: [6]

|              |      |      |      |      |      |      |
|--------------|------|------|------|------|------|------|
| Daily demand | 0    | 15   | 25   | 35   | 45   | 50   |
| Probability  | 0.01 | 0.15 | 0.20 | 0.50 | 0.12 | 0.02 |

Consider the following sequence of random numbers:

48,78,09,51,56,77,15,14,68 and 09.

- i) Using the sequence, simulate the demand for the next 10 days.
- ii) Find the stock situation if the owner of the bakery decides to make 35 cakes every day. Also estimate the daily average demand for the cakes on the basis of the simulated data.

- Q8)** a) Explain decision tree analysis with a suitable example. **[6]**
- b) Customer arrive at the First Class Ticket Counter of a Theatre at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour. **[4]**
- i) What is the probability that there is no customer in the counter (i.e., that the system is idle)?
  - ii) What is the probability that there are more than 2 customers in the counter?
  - iii) What is the probability that there is no customer waiting to be served?
  - iv) What is the probability that a customer is being served and nobody is waiting?



Total No. of Questions : 8]

SEAT No. :

**P4523**

[Total No. of Pages : 2

**[4760] - 1028**

**M.E. (Civil - structures ) (Semester - I)  
ADVANCED MECHANICS OF SOLID  
(2013 Pattern) (Credit System)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answers any five questions from the following.*
- 2) *Answers should be written in one answer book.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Neat diagrams should be drawn wherever necessary.*
- 5) *If necessary, assume suitable data.*
- 6) *Use of nonprogrammable electronic pocket calculator is allowed.*
- 7) *Use of Cell phone is prohibited in examinaion hall.*

- Q1)** a) Derive compatibility conditions in-terms of strains for 3D elasticity problem. **[5]**
- b) Explain in brief stress tensor and strain tensor. **[5]**
- Q2)** a) Derive the stress equilibrium equation with usual notation. **[5]**
- b) State and explain in brief Generalized Hook's law for Isotropic material. **[5]**
- Q3)** a) Derive the differential equations of equilibrium in terms of polar co-ordnates. **[5]**
- b) Develop the relationship between the Cartesian and polar coordinates for two dimensional problems. **[5]**
- Q4)** a) Obtain stress componets when a concentrated load acting on the vertex of a wedge (Michell's problem). **[5]**
- b) A thick cylinder of internal radius  $r_1 = 150$  mm and external radius  $r_0 = 260$  mm is subjected to an internal pressure  $p_1 = 60$  MPa. Show the variation of radial and circumferential stress across the section of thick cylinder. **[5]**

**P.T.O.**

- Q5) a)** A quarter circle beam of radius 1500 mm curved in plan is fixed at A and free at end B as shown in Fig. 5 a. It carries a vertical load  $P = 30\text{kN}$  at its free end. Determine the shear force ( $V$ ), bending moment ( $M$ ) and twisting moment ( $T$ ). Also determine deflection at point B. [7]

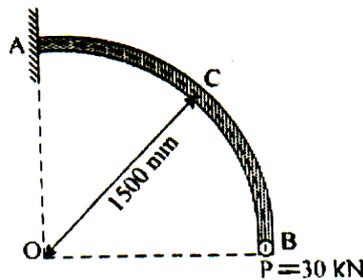


Fig. 5 a

- b) Draw the shear force ( $V$ ), bending moment ( $M$ ) and twisting moment ( $T$ ) diagram for the beam shown in Fig. 5 a. [3]
- Q6) a)** Explain in details St. Venant's theory of torsion for prismatic bars of non-circular cross-sections. [5]
- b) Explain torsion of thin walled structures by membrane analogy. [5]
- Q7) a)** Show that the neutral axis of curve beam in elevation is below the centroidal axis towards the centre of curvature. [5]
- b) Differentiate beams curved in plan and elevation. Plot the bending stress distribution for rectangular section of the crane hook. [5]
- Q8) a)** Explain in details, Winkler type of foundation. [4]
- b) Explain in details of an infinite beam subjected to a single concentrated load related to beams on elastic foundation. [6]



Total No. of Questions : 8]

SEAT No. :

**P4602**

[Total No. of Pages : 3

[4760] - 1029

**M.E. (Civil) (Structures)**  
**STRUCTURAL DYNAMICS**  
**(2013 Pattern)**

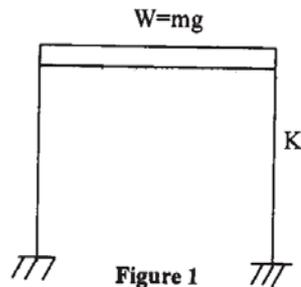
*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures in bold to the right, indicate full marks*
- 3) *If necessary, assume suitable data and indicate clearly*
- 4) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Define the terms **[3]**
- i) Forced Vibrations
  - ii) Resonance
  - iii) Fundamental Mode of Vibration
- b) Set up the equation of motion for the following undamped SDOF systems without external forces and solve for the response under the given condition.  $m=20\text{kN}$ ,  $K = 18 \times 10^3\text{kN/m}$ ,  $x_0 = 0.01\text{m}$ ,  $\dot{x}(0) = -3\text{m/s}$  refer Figure 1. **[7]**



- Q2)** a) Explain the various terms involved in forming a mathematical model for Dynamic system. **[3]**
- b) The displacement of a body performing simple harmonic motion is defined by the following equation  $x = A \sin(\omega t + \Phi)$  where  $A =$  amplitude,  $\omega =$  natural frequency &  $\Phi =$  phase angle. Given  $A = 20 \text{ mm}$ ,  $\omega = 50 \text{ rad/s}$  and  $\Phi = \pi/8$  radian, calculate the following : **[7]**
- i) The frequency.
  - ii) The periodic time
  - iii) The displacement, Velocity and acceleration when  $t = T/4$ .

**P.T.O.**

- Q3) a)** Write a note on Dynamic magnification factor. [3]
- b)** The two-storey building shown figure 2 has very stiff floor slabs relative to the supporting columns. Calculate the natural frequencies and mode shapes. Take  $EI_c = 4.5 \times 10^3 \text{kNm}^2$ . [7]

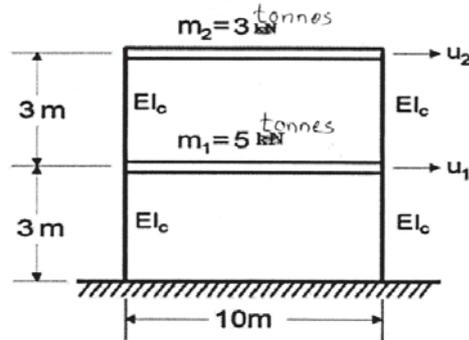


Figure 2

- Q4)** Write a short note on Newmark's method. [10]

- Q5) a)** Write short note on Orthogonality of mode shapes. [3]
- b)** Determine the fundamental frequency for the system shown using Stodola's method. [7]

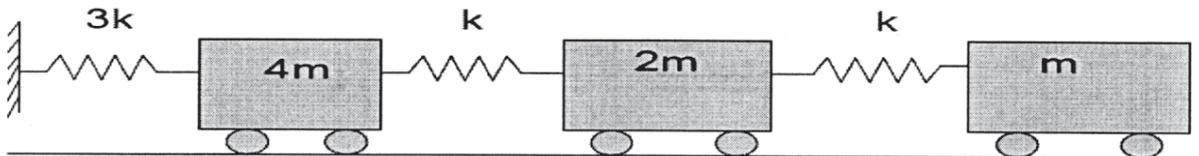


Figure 3

- Q6) a)** What are coupled system? Give suitable example? [3]
- b)** Find the natural frequencies of the system shown in Figure. 4 with  $m_1 = m$ ,  $m_2 = 2m$ ,  $k_1 = k$ , and  $k_2 = 2k$ . Determine the response of the system when  $k = 1000 \text{N/m}$ ,  $m = 20 \text{kg}$ , and the initial values of the displacements of the masses  $m_1$  and  $m_2$  are 1 and -1, respectively. [7]

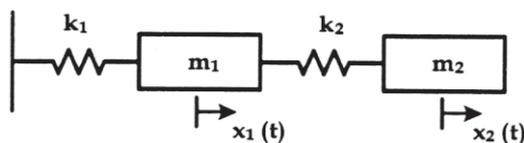


Fig. 4

**Q7) a) Write note on mode superposition method for MDOF system? [5]**

**b) What short note on shear buildings with suitable examples? [5]**

**Q8) Calculate the natural frequency for a clamped free rod subjected to axial vibration? [10]**



Total No. of Questions : 8]

SEAT No. :

P4305

[Total No. of Pages : 2

[4760] - 103

**M.E. (Mechanical) (Heat Power)**  
**INTERNAL COMBUSTION ENGINES**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Design bore and stroke of six cylinder, four stroke SI engine for CR 6, bp 312kW N 2500 rpm , stroke = 1.25 bore, mechanical efficiency = 0.82 ; imep = 10 bar; relative efficiency = 0.5 ; CV = 43962 kJ/kg.

Also calculate the fuel consumption in kg/min & kg/kWh [8]

b) Name various methods to find frictional power & explain morse test. [8]

**Q2) a)** A single cylinder 4S CI engine running at 350 rpm develop 26.5kW BP. The fuel contains 85% carbon and 15% of hydrogen by weight. The mechanical and brake thermal efficiency is 86% and 30% respectively. The atmospheric air temperature is 20°C and pressure is 1 bar. The engine uses 25% of excess air and volumetric efficiency is 82%. Determine the bore diameter and stroke of engine if bore to stroke ratio is 1:2 and CV of fuel is 43960 kJ/kg of fuel. [8]

b) Enlist the various material use for cylinder head, spark plug, gaskets, cylinder block, piston ,piston rings, gudgeon pin ,connecting rod, crankshaft. [8]

**P.T.O.**

- Q3)** a) Explain MPFI and GDI system for SI Engine. [8]  
b) Write short note on electronic control system. [8]

- Q4)** a) Explain the instruments for measuring the following invisible emission. [10]  
i) Oxides of nitrogen.  
ii) Carbon monoxide.  
Write their approximate values for SI engine.  
b) Explain the different methods of improving engine performance. [8]

**SECTION - II**

- Q5)** a) Explain any five reasons for HC emissions in the exhaust of an automobile. [8]  
b) Fuel injection systems are replacing carburetors in automobile spark ignition engines. Explain major advantages and any disadvantages of fuel metering with fuel injection relative to carburetion. [8]

- Q6)** a) Explain application of simulation technique for engine design. [8]  
b) What are the causes of particulates generation? How are they controlled? [8]

- Q7)** Discuss the effect of speed on the following parameters of CI engines. [16]  
a) Mechanical and Brake thermal efficiency.  
b) BMEP and BSFC.  
c) Brake torque of engine.

- Q8)** Write short note on (any three) : [18]  
a) Oxides of nitrogen  
b) Catalytic convertors.  
c) EGR  
d) Principles of combustion chamber designing for petrol engines.



Total No. of Questions : 8]

SEAT No. :

**P4110**

**[4760] - 1030**

[Total No. of Pages :3

**M.E. (Civil-Structures)**

**ADVANCED DESIGN OF STEEL STRUCTURES**

**(2013 Credit Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five from eight questions.*
- 2) *Neat sketches must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable calculator IS:800-2007, 801, 802, 811 and steel tables is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** What are the different forces acting on the hoarding structures and various structural configuration used. **[4]**

b) The design factored forces coming in a member of a hoarding structure are 100KN tensile and 150KN compressive due to reversal of wind forces. Design the member using double unequal angle section back to back on opposite faces of 10mm thick gusset plate using M20 black bolt of 4.6 grade. Assume Fe-415 grade of steel. Draw the design sketch. Take length of member as 2.4m. **[6]**

**Q2) a)** State the advantages and disadvantages of using castellated beams over rolled steel sections. **[3]**

b) Design a castellated beam in grade Fe 410 steel to carry an imposed load of 3.5kN/m and dead load of 3.5kN/m over a simply supported span of 16m. Assume that the compression flange is fully restrained. **[7]**

**Q3) a)** Define tower and state the difference between Microwave tower and transmission tower. **[4]**

b) A 60m high microwave antenna lattice tower is to be built near Agra where the terrain at the site is nearly a level ground with terrain of category 2. The diameter of the hemi-spherical antenna disc, fixed at the top is 3m. The width of the tower at the top has to 3.5m. Select a suitable configuration for the tower and determine maximum compressive force

**P.T.O.**

and tension in the tower legs and also the maximum shear at the base, for the following data. [6]

Weight of antenna disc and fixtures: 9kN

Weight of platform at top: 0.82 kN/m<sup>2</sup>

Weight of railing at top: 0.30 KN/m<sup>2</sup>

Weight of ladder and the cage: 0.65 kN/m

Weight of miscellaneous item: 2.5kN

**Q4) a)** Draw figures and explain XBX-Bracing, K-Bracing, Y-Bracing. [4]

b) Explain structural configuration (Tower geometry) and material. State the factor considered while deciding the configuration. [6]

**Q5) a)** What are tubular structures? Write down its various purpose and its important advantages. State IS provisions for tubular structures used in form works. [5]

b) A tubular column hinged at both ends has the outside diameter of tube 130mm and is of heavy gauge (i.e. @ 16.2 kg/m). The length of the column is 3.5m. Determine the safe load and column can carry if the column is of IS 1161 grade Yst 240 steel. [5]

**Q6) a)** Define stiffened, Unstiffened & multiple stiffened element and What are the advantages of light-gauge sections. [4]

b) Find the allowable load for the rectangular tubular column section show in fig.b. The effective length of column is 3.3m. Take  $f_y = 235 \text{ N/mm}^2$ . [6]

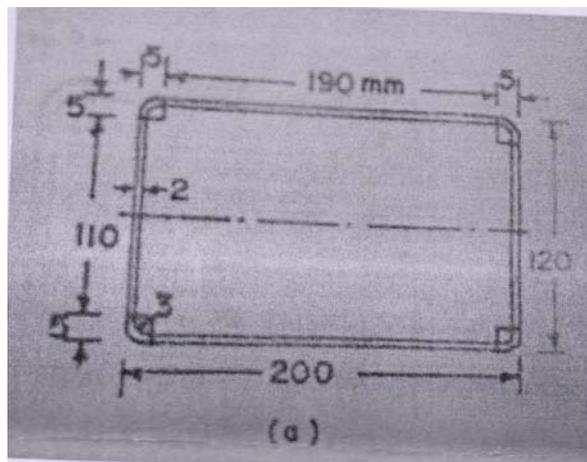


Fig. b.

**Q7)** Design a self- supporting lined chimney to the following particulars. **[10]**

Height of the chimney = 100 metres

Diameter of the chimney = 5 metres

Thickness of the lining = 100mm

Wind pressure =  $1800 \text{ N/metre}^2$  on flat vertical surface

Assume suitable safe stresses.

**Q8)** A column section ISHB 350@ 661.2 N/m carries a factored axial compressive load of 1600kN and factored bending moment of 80kNm. Design the base plate and its connections.

If the factored bending moment is increased to 180kNm redesign the base and connections.

Assume concrete pedestal of M-20 grade. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P4111**

**[4760]-1031**

[Total No. of Pages :2

**M.E.(Structure)**

**RESEARCH METHODOLOGY  
(2013Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions.*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) Enlist various types of research and discuss fundamental research in detail. [5]  
b) Write a note on “Format of a research proposal.” [5]
- Q2)** a) Explain why research is important to decide a economic system of a country. [5]  
b) Explain the precautions to be taken while writing a research report. [5]
- Q3)** a) Write a note on advantages and limitations of sources of Literature survey. [5]  
b) Explain the characteristics of a good sample design. [5]
- Q4)** a) Explain the various sources of error in measurement. [5]  
b) Explain why a good literature survey is important to narrow the research problem and the technique that might be used. [5]
- Q5)** a) Explain Type I and Type II error in testing hypothesis. [5]  
b) Write a note on “Important characteristics of Chi-Square test”. [5]

**P.T.O.**

- Q6)** a) Enlist non- parametric tests for hypothesis testing and explain any one. [5]
- b) Enlist Important parametric tests for hypothesis testing and explain any one. [5]
- Q7)** a) Discuss the important factors to be considered during presenting a research idea. [5]
- b) Write a note on “Patenting a research idea”. [5]
- Q8)** a) Write down the characteristics of a good Abstract. [5]
- b) Write a note on “steps involved in publishing a research paper”. [5]



Total No. of Questions : 8]

SEAT No. :

**P4112**

[Total No. of Pages : 2

**[4760] - 1032**

**M.E. (Civil) (Structures) (Semester - II)**

**FINITE ELEMENT METHOD**

**(2013 Pattern) (Credit System)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five from Eight questions.*
- 2) *Neat sketches must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable calculator.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain approximate methods of solution. [4]  
b) Explain physical significance of variational approach when applied to cantilever beam loaded with UDL along its span. [6]
- Q2)** a) Explain the displacement model for 2D triangular element using polynomial function. [4]  
b) Derive the linear model for triangular element in terms of interpolation function. [6]
- Q3)** a) Derive shape function for first order rectangular element. [4]  
b) Derive stiffness vector for constant strain triangle using variational principle. [6]
- Q4)** a) Derive shape function using natural coordinates for one dimensional bar element. [4]  
b) Derive shape function using natural coordinates for beam element. [6]

*P.T.O.*

- Q5) a)** Explain axisymmetric problem with suitable example. [3]
- b)** A prismatic stepped bar is made of steel and Brass. Each portion being 200 mm long. Both, steel and brass ends of the bar are welded to machine part. The junction of steel and brass portion is subjected to axial force of 2000N, compressing brass. as shown in Fig 1. Find the reactions at welded ends. Also find nodal displacement for the stepped bar.  $E_{st} = 200 \text{ Gpa}$ ,  $E_{Br} = 100 \text{ Gpa}$ ,  $\mu_{st} = 0.29$ ,  $\mu_{br} = 0.25$ . [7]

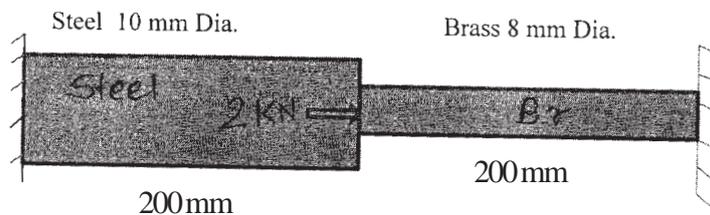


Fig. - 1

- Q6) a)** Explain rectangular plate element with 12 DOF. [5]
- b)** Explain compatibility conditions for 12 DOF plate element. [5]
- Q7) a)** Sketch various 2D and 3D isoparametric elements, state its application with suitable engineering example. [6]
- b)** Explain Bogner fox element. [4]
- Q8) a)** Explain shape function for geometry for a typical curved shell element. [5]
- b)** Write the strain Displacement Matrix for the curved shell element. [5]



Total No. of Questions : 8]

SEAT No. :

**P4603**

[Total No. of Pages : 2

**[4760]-1033**

**M.E. (Civil - Structures)**

**THEORY OF PLATES AND SHELLS**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions from the following.*
- 2) *Answers should be written in one answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams should be drawn wherever necessary.*
- 5) *If necessary, assume suitable data.*
- 6) *Use of nonprogrammable electronic pocket calculator is allowed.*
- 7) *Use of Cell phone is prohibited in examination hall.*

- Q1)** a) Differentiate clearly difference between thin and thick plate. [4]  
b) A rectangular plate of size  $a \times b$  with four edges simply supported carries a central concentrated load P. Derive the expression for the deflection of the plate using Navier's method. [6]
- Q2)** a) Derive an expression for the flexural rigidity of plate. [3]  
b) Derive 4<sup>th</sup> order differential equation for a thin plate in Cartesian coordinate with usual notation. [7]
- Q3)** a) Explain in brief shear deformation theories for analysis of plates. [5]  
b) Derive an expression for maximum deflection of the rectangular plate subjected to two equal and opposite couple applied at the ends by Lavy's method. [5]
- Q4)** a) Find transverse deflection  $w$  for the simply supported circular plate of radius  $a$  subjected to central point load P. [5]  
b) Derive governing differential equation for circular plate under axisymmetric loading from first principle. [5]

**P.T.O.**

- Q5)** a) State the advantage and disadvantage of shell structures compared to plates. [4]
- b) Derive expression for the strains  $\epsilon_x$  and  $\epsilon_y$  at a point due to the bending and membrane action in a shell. Hence obtain expression for the stress resultants in terms of strains. [6]
- Q6)** A horizontal cylindrical shell with closed ends is filled with liquid of density  $\gamma$  and is simply supported at ends. Derive expression for stress resultants  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$  for meridional angle  $\phi$  in the shell. [10]
- Q7)** a) Explain in brief beam and arch analysis of cylindrical shell with suitable example. [6]
- b) State the assumption made in Finsterwalder bending theory of cylindrical shell and hence states the equation of equilibrium. [4]
- Q8)** a) State and explain the assumption and advantage of Lundgren's beam theory in brief. [4]
- b) Explain in brief application of membrane theory to cylindrical roof shells and hence derive expression for  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$ . [6]



Total No. of Questions : 8]

SEAT No. :

**P4113**

**[4760] - 1034**

[Total No. of Pages :2

**M.E. (Civil) (Structures)**

**ADVANCED DESIGN OF CONCRETE STRUCTURES**

**(2013 Credit Course) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Answers should be written in same book.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of IS 456, IS 1343, IS 1893, IS 3370 & non programmable calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Assume suitable data if necessary.*

**Q1) a)** Draw yield line patterns for the following: **[6]**

- i) Rectangular slab with fixed at supports on three sides with the remaining longer side unsupported.
- ii) Right angled triangular slab, fixed at two sides making right angle, unsupported at third side.

b) Write short note with sketches on Characteristics of yield lines. **[4]**

**Q2)** Design a RCC slab for a square hall of clear dimensions  $4.5 \times 4.5$  m using Yield Line Theory. Assume the support thickness 230 mm, the slab is fixed on all sides Use M20 Fe 500 take Live load =  $5 \text{ kN/m}^2$  & floor finish load =  $1.2 \text{ kN/m}^2$ . Draw details of reinforcement. **[10]**

**Q3)** Design a grid slab for a floor of hall  $12 \times 15$  m c/c having square grid of 1.5 m using M25 Fe 500. Take the live load =  $4.5 \text{ kN/m}^2$  & floor finish load =  $1.2 \text{ kN/m}^2$ . Apply the required checks & draw details of reinforcement. **[10]**

**Q4)** Design a interior panel of RCC flat slab for a hall with column spacing  $6.2 \text{ m} \times 6.2 \text{ m}$  c/c. The diameter of the column is 550 mm each. Use M20 Fe 500 take Live load =  $5 \text{ kN/m}^2$  & floor finish load =  $0.9 \text{ kN/m}^2$ . Draw details of reinforcement. **[10]**

**P.T.O.**

**Q5)** Design a staging for square type ESR for 3 lakh liters with staging height 12 m using M25, Fe500 in earthquake zone III. Safe bearing capacity is  $180 \text{ kN/m}^2$ . Design of container is not required. Calculate the inner dimension of container considering the depth of the as 3.3m including free board of 0.3 m, Take approximate dimensions for, wall, top, bottom slab thickness, beams sizes & nine equispaced columns. Design must include calculations of vertical loads and earthquake force. Design the bracings and columns. Draw the reinforcement details. **[10]**

**Q6)** Design a side wall and hopper bottom of circular bunker to store 40 tonnes of cement. Take the unit weight of cement =  $16 \text{ kN/m}^3$ , Angle of repose =  $29^\circ$ . Use M20 & TMT steel. Draw the details of reinforcement. **[10]**

**Q7)** Design Raft foundation for the following: **[10]**

Centre to centre distance of column in both directions = 2.5 m, Column size =  $350 \times 350 \text{ mm}$ , working axial load on each column = 620 kN. The depth of the strata = 1.5m Use M20 & Fe 500.

The safe bearing capacity of the strata =  $85 \text{ kN/m}^2$ . Show all Analysis and Design calculations & draw the reinforcement details.

**Q8)** a) Write detailed note on design of formwork for flat slab. **[5]**

b) Write detailed note on Bar bell shear wall. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4114

[Total No. of Pages : 2

[4760] - 1035

M. E. (Civil) Structures

**EARTHQUAKE ENGINEERING AND DISASTER  
MANAGEMENT**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

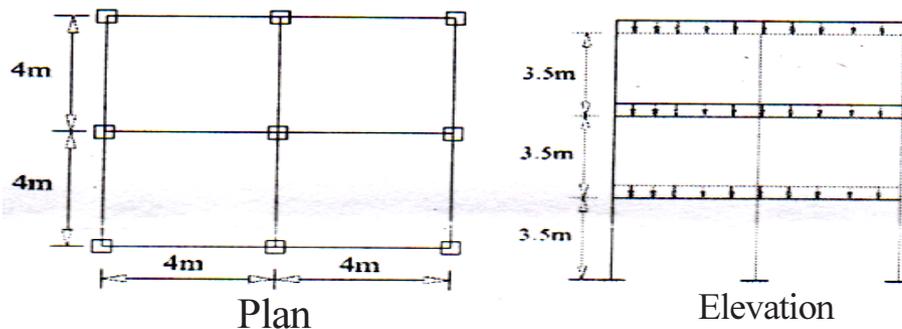
*Instructions to candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Use of non programmable electronic calculator is allowed.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of IS 1893 2002 (part - I) and IS 13920 - 1993 is permitted*

- Q1)** a) Define disaster. What are the Natural and Man Made Disasters. [5]  
b) Write a note on Seismic waves . [5]

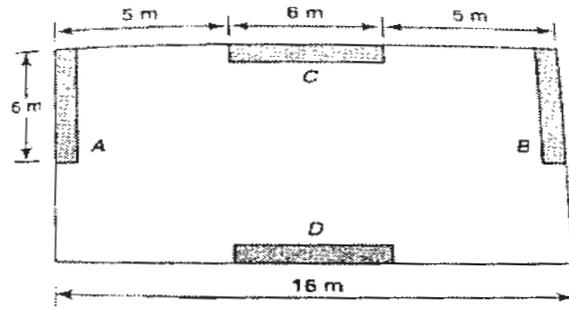
- Q2)** Write a note on [10]  
a) Post disaster resource management.  
b) Direct and Indirect effects of earthquake.

- Q3)** The plan and elevation of three storied RCC school building is shown in Figure. The building is located in seismic zone V. The type of soil encounter is medium stiff. It is proposed to design the building with special moment resistant frame. The intensity of dead load is  $10 \text{ kN/m}^2$  and the floor is to cater to an imposed load of  $3 \text{ kN/m}^2$ . Determine the design seismic load on the structure by static analysis. [10]



**P.T.O.**

**Q4)** A plan of single storey building having two shear wall in each direction is shown in fig. All the four wall are of M-20 grade concrete, 200 mm in thickness and 6m long. Height of the building is 3.6m. Design shear force on the building is 120kN in either direction. Determine the design lateral force for different shear walls.



**Q5) a)** Write a note on blast loading on non structural elements. [5]

b) Define: [5]

- i) Decay Parameter
- ii) Ductility Ratio
- iii) Dynamic Pressure
- iv) Equivalent Bare Charge
- v) Shock Wave Front

**Q6)** Explain in detail codal provision for design of structure for blast loading. [10]

**Q7)** Write a note on design consideration of structural steel members as per IS-800: 2007. [10]

**Q8) a)** What are the sources of weakness in framed buildings explain in detail. [5]

b) What are the failure modes of masonry structures and repairing techniques. [5]



Total No. of Questions : 8]

SEAT No. :

**P4115**

**[4760] - 1036**

[Total No. of Pages :3

**M.E. (Civil) (Structures)**  
**DESIGN OF R.C.C. AND Pr.C.C. BRIDGES**  
**(2013 Credit Pattern) (Semester -III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *All answers should be written in same answer book.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of IRC-5, 6,18, 27, 45,78 & 83 Codes, I.S. 1343, IS-456-2000 is allowed.*
- 5) *Mere reproduction of IS Code & IRC Codes as answer will not considered as answer.*
- 6) *Assume suitable data, if required.*

**Q1) a)** Classify the bridges according to materials of construction and forms of Superstructure. **[5]**

b) Explain various types of loads and forces considered in the design of bridges. **[5]**

**Q2) a)** Explain the role of Impact factor in the design of highway bridges. **[5]**

b) Explain with neat sketches various types of highway bridges. **[5]**

**Q3)** Design a R.C.Box culvert having clear waterway  $3.5\text{m} \times 3.5\text{m}$ , the superimposed D.L. on culvert is  $13.5\text{KN/m}^2$  and L.L. on culvert is  $65\text{KN/m}^2$ , density of soil at site is  $18\text{KN/m}^3$  and angle of repose is  $30^\circ$ . Use M20 and Fe 500, Sketch details of Reinforcement in box culvert. **[10]**

**Q4)** Design the deck slab and calculate the maximum Bending moment and Shear force for the intermediate post tensioned pre stressed concrete bridge girder for the following data **[10]**

a) Effective span = 18m,

**P.T.O.**

- b) width of carriage way = 7.5m
- c) No. of beams = 3 equally spaced along the carriage way width
- d) Spacing of girders = 3m c/c
- e) Width of footpath = 1.2m
- f) Loading -IRC class AA tracked vehicle
- g) Kerb size – 200 mm ×600mm
- h) Material -M25 & Fe 500 for deck slab & Multi strand cables for girder

- Q5)** a) Explain design criteria of rigid frame bridges with suitable sketches. **[5]**
- b) Differentiate between rigid frame bridges and simply supported bridges. **[5]**

**Q6)** Design the elastomeric pad bearing to support the Tee beam girder of bridge using following data. **[10]**

- a) Maximum D.L. reaction per bearing - 300KN
- b) Maximum L.L. reaction per bearing - 700 KN
- c) Longitudinal force due to friction per bearing - 45 KN
- d) Estimated rotation at bearing of girder due to DL & LL = 0.002 radians
- e) Estimated strain due to creep, shrinkage & temperature =  $6 \times 10^{-4}$
- f) Concrete for Tee beam & bed block = M 25

- Q7)** a) Explain various factors to be considered while designing Wing Wall. **[5]**
- b) Differentiate between Pre cast wing wall & R.C.C Wing wall. **[5]**

**Q8)** The Pier of a major fly over bridge transmits a load of 9000KN at the foundation level. Design the number of precast R.C.C piles and suitable pile cap using following data, **[10]**

- a) Width of pier = 1.5m
- b) Length of pier = 9m
- c) Size of pile = 300m × 300mm
- d) Spacing of piles = 1.5m
- e) Material -M20 & Fe 415
- f) Hard strata is available at 6m depth below G.L.



Total No. of Questions : 8]

SEAT No. :

P4387

[Total No. of Pages : 2

[4760]-1037

M.E. (Civil) (Environmental Engineering) (Semester - I)

**ENVIRONMENTAL LEGISLATION AND  
MANAGEMENT SYSTEMS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic table, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**Q1)** a) Discuss the concept of absolute liability. **[5]**

b) State the functions and constitution of CPCB. **[5]**

**Q2)** a) Explain the legal Sampling procedures. **[5]**

b) Discuss the consent to establish and consent to operate as per water (P & CP) Act 1974. **[5]**

**Q3)** a) Discuss the consent to establish and consent to operate as per Air (P & CP) Act 1981. **[5]**

b) Discuss the provisions relating to Prevention and Control in Air Act of 1981. **[5]**

**Q4)** a) Discuss the salient features of latest EIA Notifications of 2006. **[5]**

b) Discuss CRZ criteria for sitting of Industries. **[5]**

**P.T.O.**

- Q5)** Discuss the background and development of ISO 14,000 series. Also explain its principle and elements. [10]
- Q6)** a) Discuss the role of Judiciary in environmental protection. [5]  
b) Discuss the salient features of Indian Forest Act. [5]
- Q7)** a) Write a short note on Biomedical Waste [M & H] Rule 1998. [5]  
b) Discuss the important powers and functions of Maharashtra Pollution Control Board. [5]
- Q8)** a) Discuss the role of NGO in Nature conservation. [5]  
b) Write a Note on Procedure for conducting Public hearing. [5]



Total No. of Questions : 8]

SEAT No. :

**P4604**

**[4760] - 1038**

[Total No. of Pages : 2

**M.E. (Civil) (Env. Engg.)**

**ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Use of Scientific Calculators is allowed.*
- 5) *Assume suitable data if necessary clearly mentioning the same.*

- Q1)** a) Find the pH and buffer index for the following : **[4]**  
i) 0.2 M acetic acid plus 0.2 M sodium acetate.  
ii) 0.15 M acetic acid plus 0.05M sodium acetate.  
b) Explain the importance of Environmental Chemistry in Environmental studies. **[6]**
- Q2)** a) Explain the effect of temperature, solar radiation and wind current on pollutants. **[6]**  
b) What are carcinogenic compounds? What are the engineering and administrative controls adopted to reduce exposure to carcinogens? **[4]**
- Q3)** a) Why are oxidation reactions of organic compounds important to environmental engineers? **[6]**  
b) What is radio toxicology? What are the factors involved in radioactive pollution of the atmosphere. Discuss the fate of radioactive contaminants present in the atmosphere. **[4]**
- Q4)** a) Describe the instrumentation in HPLC? What are the limitations of HPLC. How this limitation is overcome by Gas Chromatography? **[5]**  
b) Write a short note on selectivity of mobile phase in chromatography. **[5]**
- Q5)** a) Give the four basic principles of ecology as recognized by Misra in 1991. **[5]**  
b) Define the terms: Metabolism, responsiveness, growth, ecology, evolution. **[5]**

**P.T.O.**

- Q6)** a) Distinguish between the Gram positive and Gram negative cell wall. [5]  
b) Give the functions of : objective lens, coarse and fine focus, eyepiece, turret, condenser. [5]
- Q7)** a) What are Universal phylogenetic tree/Universal tree of Life? [5]  
b) Explain : Certain physical conditions affect the type and amount of microbial growth. [5]
- Q8)** a) Explain various industrial products in which microbes are used. [5]  
b) Write a short note on Fermentations and Biotechnology. [5]



Total No. of Questions : 8]

SEAT No. :

P4116

[4760] - 1039

[Total No. of Pages :3

**M.E. (Civil) (Environmental Engineering)**  
**PHYSICO CHEMICAL PROCESS FOR WATER AND WASTE**  
**WATER TREATMENT**  
**(2013 Credit Pattern) (Semester -I) (501063)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat figures wherever necessary.*
- 3) *Use of Scientific Calculators is allowed.*
- 4) *Attempt any five questions.*
- 5) *Assume suitable data if necessary clearly mentioning the same.*

- Q1) a)** Explain with suitable example, the importance of stream standards and effluent standards in environmental engineering. **[5]**
- b) Enlist various types of reactors used in water or wastewater treatment. Explain with a suitable example ideal plug flow reactor. **[5]**

- Q2) a)** A settling column analysis is run on a type-I suspension. The settling column is 2.1m tall and the initial concentration of the well-mixed sample is 600 mg/l. Results of the analysis are shown below: **[7]**

| Time, min      | 0   | 60  | 75  | 90  | 120 | 150 | 240 |
|----------------|-----|-----|-----|-----|-----|-----|-----|
| Conc.          |     |     |     |     |     |     |     |
| Remaining mg/l | 600 | 575 | 425 | 300 | 200 | 125 | 65  |

What is the theoretical efficiency of the settling basins that receive this suspension if the loading rate is  $2.5 \times 10^{-2}$  m/min.

- b) Explain in detail: zeta potential. **[3]**
- Q3) a)** Determine the basin dimensions, power requirement, paddle configuration and rotational speed for a flocculator that treats 25 MLD of raw water. Take optimum value of  $G \cdot t$  as 48,000. **[6]**

**P.T.O.**

- b) Explain with suitable example, various zones of settling in water and wastewater treatment reactors. [4]

**Q4) a)** Draw flow sheets for: [6]

- i) A conventional WTP in urban area
- ii) A conventional wastewater treatment plant based on aerobic process in urban area.

Explain role played by various units as above in the respective treatment.

- b) Explain in detail: recycle and reuse of treated sewage for agricultural purpose. [4]

**Q5) a)** Design an RSGF to treat a net filter flow of 150 cu m/hr. Use following additional data: [5]

- i) Quantity of backwash water used = 3%
- ii) Time lost in backwashing = 30 mins
- iii) Design rate of filtration = 5 cu m/hr/sq. m.
- iv) L:W ration 1:1.25
- v) U/D System: Central manifold with laterals
- vi) Size of perforations = 10mm

Design:

- 1) Filter bed
- 2) Sand depth
- 3) U/D System
- 4) Washwater troughs

- b) A bed of filter is 0.7m deep and is composed of uniform particles with diameter 0.6mm and sp.gravity of 2.65. The shape factor is 0.85 and porosity of packed bed is 0.5. determine: [5]

- i) The backwash velocity at which the filter bed will just begin to fluidize and
- ii) The resulting expanded depth if the filter medium is to be expanded to a porosity of 0.75 by hydraulic backwash.

- Q6)** a) Enlist 04 disinfectants. Explain with suitable equations combined chlorine when ammonia is present in water. [5]
- b) Enlist various types of chlorination practices. Explain each in brief. [5]
- Q7)** a) Explain the importance of chemical treatment processes with reference to oxidation and reduction reactions. [5]
- b) What are the limitations of chemical treatment? Discuss in detail: importance of biological treatment in wastewater treatment. [5]
- Q8)** a) Explain in detail: adsorption kinetics. Explain use of activated carbon as adsorbent in wastewater treatment. [5]
- b) Enlist various water softening methods. Explain significance of ion exchange in water and wastewater treatment. [5]



Total No. of Questions : 8]

SEAT No. :

**P4306**

[Total No. of Pages : 4

**[4760] - 104**

**M.E. (Mechanical) (Heat Power Engineering)**  
**ADVANCED AIR CONDITIONING, HEATING AND**  
**VENTILATION**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any THREE questions from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Assume suitable data, if necessary and mention it clearly.*

**SECTION - I**

- Q1)** a) In an air conditioning system, it is required to maintain air at 31°C DBT and 70% RH by heating and humidifying air prevailing at 18°C DBT and 40 % RH. Explain the various processes which can be used for attaining above conditions. Recommend the most suitable one. [8]
- b) What is effective temperature? Explain the significance in the design of the air conditioning system. [8]
- Q2)** a) With neat diagram explain indirect and direct evaporative cooling. [8]
- b) Explain all water systems with its merits and demerits over other types of systems. [8]
- Q3)** a) In a cooling application moist air enters a refrigeration coil at a rate of 100 kg of dry air per minute at 35°C and 50% RH. The ADP of the coil is 5°C and bypass factor is 0.15. Determine the outlet state of the moist air and cooling capacity of coil in TR. [6]

***P.T.O.***

- b) A minitheater having audience capacity of 50 has the data related to air conditioning system as follows.

Inside conditions: 24°C, 50% RH

Outside conditions: 38°C, 60% RH

Sensible and latent heat gain from passengers = 110W & 130W respectively.

Sensible load from other sources = 2500 W

Assume 20% fresh air is used. The bypass factor of cooling coil is 0.2. With appropriate assumptions of other cooling loads, determine ADP, Cooling coil capacity, Supply air conditions, and quantity of dehumidified air. [10]

- Q4)** A computer laboratory is to be air conditioned. Related data collected is as follows: [18]

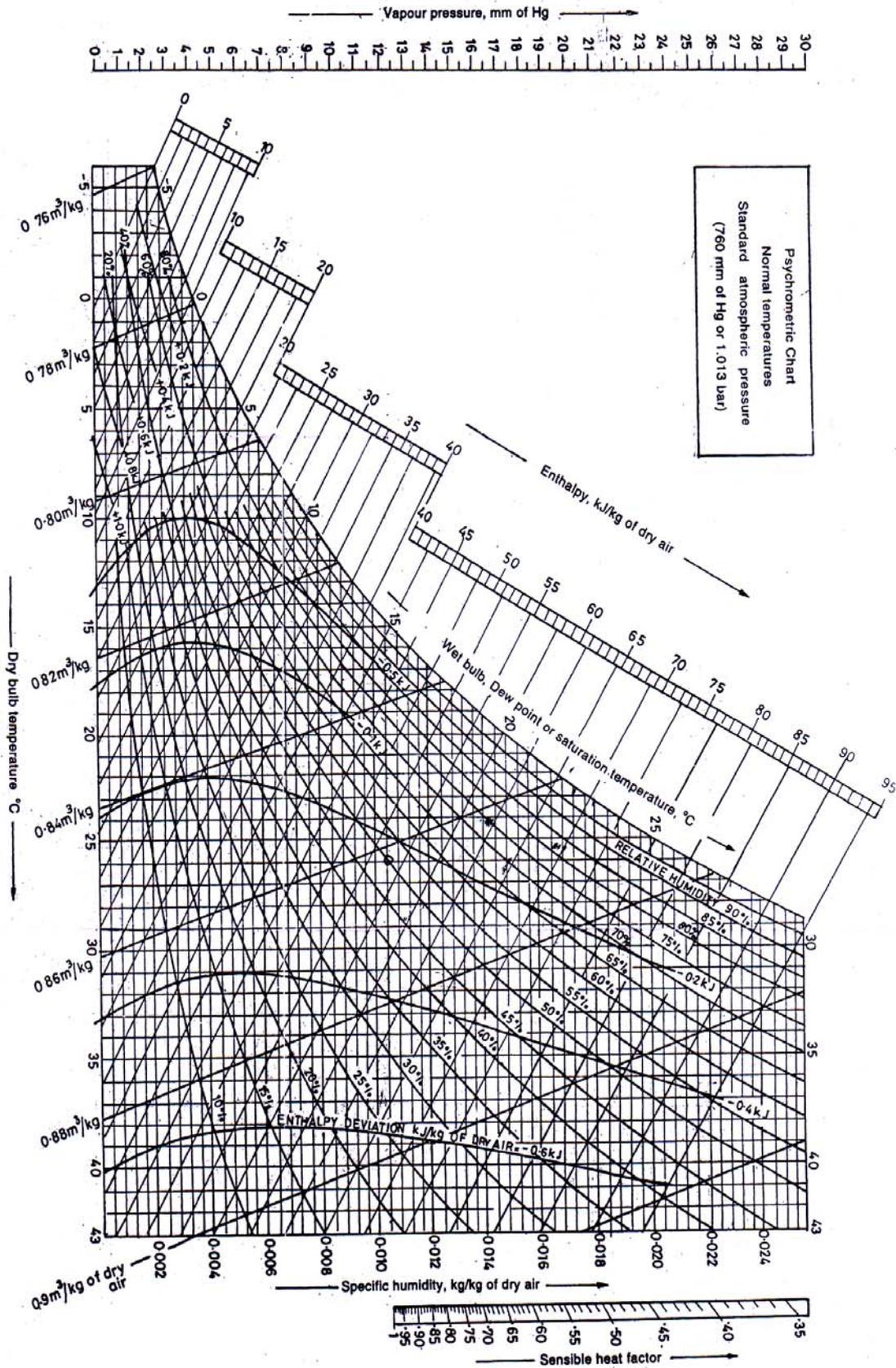
|                                |                                |
|--------------------------------|--------------------------------|
| Outdoor design conditions      | = 42°C DBT & 24°C WBT          |
| Indoor design conditions       | = 22 °C DBT & 50 % RH          |
| Occupancy                      | = 35 nos.                      |
| Ventilation requirement        | = 0.25 cmm/person              |
| Infiltration                   | = 5 cmm                        |
| Sensible heat from occupants   | = 70 W/person                  |
| Latent heat from occupants     | = 100 W/person                 |
| Heat gain through wall         | = 8 kW                         |
| Heat gain through roof         | = 6 kW                         |
| Heat gain through glass panel  | = 2 kW                         |
| No. of fluorescent tube lights | = 30 of 40W each               |
| No. of PCs                     | = 25 of 300W                   |
| No. of printers                | = 3 of 500W                    |
| Miscellaneous load             | = 2 kW sensible, 0.8 kW latent |

Determine: RSHF, ESHF, Capacity of plant in TR, quantity of water required & the condition of water supplied to the air washer.

Assume that the equal quantities of ventilation and recirculated air are mixed. The mixture is then adiabatically cooled in an air washer having 85% efficiency. The air is further cooled & dehumidified by passing over a cooling coil having bypass factor 0.14.

### **SECTION - II**

- Q5)** a) With suitable example explain equal friction method of duct design. How circular duct is converted in equivalent rectangular duct? [12]  
b) Write short note on: Duct materials and insulations. [6]
- Q6)** a) What are various types of filters used in air conditioning systems? Explain HEPA filter in detail. [8]  
b) Explain the variable air volume (VAV) all air system with neat sketch. [8]
- Q7)** a) Explain the working of year round air conditioning system with neat schematic. [8]  
b) With neat diagram explain the working of thermostat and humidistat. [8]
- Q8)** Write short notes on : [18]  
a) Laminar flow clean rooms  
b) Sound control in air conditioning systems  
c) Comfort chart



Total No. of Questions : 8]

SEAT No. :

**P4117**

**[4760]-1040**

[Total No. of Pages :2

**M.E. (Environmental Engineering )  
RESEARCH METHODOLOGY  
(2013 Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 full questions.*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) Write a note on sources of research problem. [5]  
b) Write a note on plagiarism in research. [5]
- Q2)** a) What are the components of a research problem? [5]  
b) Explain the significance oral presentation of research and precautions to be taken for same. [5]
- Q3)** a) Enlist few renowned journals in civil Engineering which can be used as sources of literature review. [2]  
b) Define sampling and discuss the different types of sampling. [8]
- Q4)** a) Explain the necessity of surveying the available literature for a research. [5]  
b) Explain in merits of collection of data done through questionnaires. [5]
- Q5)** a) Write a note on “Parametric tests for Hypothesis testing”. [5]  
b) Explain in brief the procedure for hypothesis testing. [5]

**P.T.O.**

- Q6)** a) Explain the z- test and t- test used for hypothesis testing. [5]  
b) Explain Type I and Type II errors in context of “Testing of hypothesis” [5]
- Q7)** a) Discuss the precautions to be taken for writing research reports. [5]  
b) What are the principles of report writing. [5]
- Q8)** a) Write differences between: [5]  
i) A journal paper  
ii) A research report.  
iii) A research thesis  
b) Discuss in brief the steps in writing report. [5]



Total No. of Questions : 8]

SEAT No. :

P4388

[Total No. of Pages :2

[4760]-1041

M.E. (Civil) (Env.Engg.)

**INDUSTRIAL WASTE WATER TREATMENT &  
MANAGEMENT  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic tables side rule, mollier charts, electronic pocket Calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**Q1)** Explain with suitable examples how prevention helps to control the Industrial pollution. **[10]**

**Q2)** Discuss the criteria for selection of aerobic and anaerobic treatment methods. **[10]**

**Q3)** Draw the flowsheet and explain nitrification and denitrification process of waste water treatment. **[10]**

**Q4)** Write a note on:  
membrane technologies for waste water treatment. **[10]**

**Q5)** Explain pulp and paper Industry with reference to following. **[10]**  
a) Manufacturing process & sources of w/w generation  
b) Treatment options

**P.T.O.**

**Q6)** Explain the tannery Industry with reference to following. **[10]**

- a) Characteristics and composition of w/w.
- b) Treatment and disposal of w/w.

**Q7)** Discuss the operation and maintenance problems of CETP. **[10]**

**Q8)** Draw the flow sheet of petroleum refinery waste water treatment plant.  
Explain the design criteria of each treatment unit. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4605

[Total No. of Pages : 2

[4760]-1042

M.E. (Civil) (Environmental)

AIR POLLUTION AND CONTROL

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Solve any five questions.
- 2) Figures to the right indicate full marks.
- 3) Draw neat figures wherever necessary.
- 4) Assume necessary data.
- 5) Use of scientific calculators is allowed.

- Q1)** a) List some of the main air pollutants and its probable sources in a city like Pune. [5]
- b) Coal containing 5% sulphur leaves 10% ash after combustion. Ash itself contain 2% sulphur. If a power plant burns 5 tons of coal per hour, what will be amount of SO<sub>2</sub> emitted in kg/hr? [5]
- Q2)** a) How do inversions, mixing heights and lapse rate influence the ambient air quality? Illustrate with diagrams. [5]
- b) On a clear summer day CO<sub>2</sub> is being emitted to the atmosphere (1 bar pressure) from an 80 m high industrial chimney with 0.25 m internal diameter. Wind speed at 10 m height from the ground is 4 m/s. Calculate the effective stack height. Assume p (wind power exponent) = 0.15 and stability category B. The stack gas velocity is 8 m/s and the temperature of stack gas and ambient air at 80 m height are 50°C and 25°C, respectively. [5]
- Q3)** a) Explain Gaussian equation to determine pollutant concentration. [5]
- b) A power plant is emitting SO<sub>2</sub> with exhaust rate of 127 g/s through a stack that has effective height of 75 m. The atmospheric conditions are moderately to slightly stable. The wind velocity at the top of the stack is 6 m/s. Determine the ground level concentration at a distance of 3 km downwind at the centreline of the plume  $\sigma_y = 280$  m and  $\sigma_z = 170$  m. [5]

P.T.O.

- Q4)** a) Describe the principle and working of baghouse filter. [5]  
b) An ESP is to be constructed to remove fly ash particles from stack gases flowing at a flow rate of 10 m<sup>3</sup>/s. Analysis of a similar system shows that drift velocity can be taken as  $w = 3.0 \times 10^5 \times d_p$ , where  $d_p$  is particle diameter in  $\mu\text{m}$  and  $w$  is in m/s. Determine the plate area required to collect particulate matter of 0.5  $\mu\text{m}$  size with 99% efficiency. [5]
- Q5)** a) Write a short note on NO<sub>x</sub> control technology. [5]  
b) Write a short note on desulfurization of flue gas. [5]
- Q6)** a) Briefly describe high volume sampler. [5]  
b) Write a short note on ambient air quality standards. [5]
- Q7)** a) Explain the methods of control of air pollution from automobile. [5]  
b) Explain sources and measurement of odour. [5]
- Q8)** a) Explain briefly the sources of indoor air pollution. [5]  
b) Write a note on control of indoor air pollution. [5]



Total No. of Questions : 8]

SEAT No. :

**P4118**

**[4760] - 1043**

[Total No. of Pages :2

**M.E. Civil (Environmental Engineering)**

**SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT**

**(2013 Credit Pattern) (Semester - II) (501068)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of logarithms tables, slide rule, electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Discuss public health aspects of solid waste management. **[10]**

**Q2)** Explain sources, classification and physical composition of solid waste. **[10]**

**Q3)** What is Leachate in Landfills? Explain water balance in Landfills. **[10]**

**Q4) a)** Determine the area required for a new landfill site with a projected life of 20 years for a population of 150000 generating 25 kg per house hold per week. Assume the density of the waste is 500 kg/m<sup>3</sup>. The height of the landfill should not be more than 10m. **[4]**

b) Explain waste heat recovery and co-generation from the solid waste Treatment. **[6]**

**Q5)** Define hazardous waste. What are the categories of hazardous waste. Discuss location and types of hazardous waste generated from household. **[10]**

**Q6)** What are various commercial treatment facilities for hazardous waste. Also explain rotary Kiln incineration. **[10]**

**P.T.O.**

**Q7)** What is vermicomposting? Compare its advantages and disadvantages with other methods. **[10]**

**Q8)** Write short notes: **[10]**

- a) Management of Nuclear waste.
- b) Plasma arc destruction incineration.



Total No. of Questions : 8]

SEAT No. :

**P4389**

[Total No. of Pages : 2

**[4760] - 1044**

**M. E. (Civil) (Environmental Engg.) (Semester - III)**

**ENVIRONMENTAL SANITATION**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five full questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Which methods of communications are responsible for communicable diseases? [4]  
b) Why does categorization of diseases by the route of transmission make sense as a means of systemization of infectious disease? Provide an example of a disease that is transmitted by food or water route. [6]
- Q2)** a) Why should mosquitoes be controlled? How is mosquito control accomplished? [4]  
b) What is an Insecticide? Explain the commonly available insecticides in market. [6]
- Q3)** a) Write a short note on: Bio-control method of fly breeding. [4]  
b) Which disinfectants are generally used? Explain the specific use with an importance. [6]
- Q4)** a) How will you achieve sanitation in case of Cinema Theaters? Explain. [4]  
b) Explain any one case study on sanitation. [6]
- Q5)** a) What do you understand by Low cost excreta disposal system? [4]  
b) How will you achieve sanitation in case of [6]  
i) Hospitals  
ii) Swimming pools.

**P.T.O.**

- Q6)** a) Write a short note on Rural sanitation improvement schemes. [4]  
b) Draw a water supply network for domestic building and explain. [6]
- Q7)** a) Write a short note on principles governing design of building drainage.[4]  
b) Comment on choice of plumbing System of Drainage. [6]
- Q8)** a) Explain Gully Trap with a neat sketch. [4]  
b) What are the principles for Governing Design of Water supply in buildings? [6]



Total No. of Questions : 8]

SEAT No. :

**P4390**

**[4760] - 1045**

[Total No. of Pages :1

**M.E. (Civil) (Environmental Engg.)**  
**ENVIRONMENTAL IMPACT ASSESSMENT**  
**(2013 Credit Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data if necessary.*

**Q1)** Discuss the screening and scoping of projects for EIA studies. **[10]**

**Q2)** Discuss the Environmental Impact Assessment Methodology. **[10]**

**Q3)** Explain how the Impact prediction is done for Air environment in EIA studies. **[10]**

**Q4)** Explain how the Impact prediction is done for Water Environment in EIA studies. **[10]**

**Q5)** Discuss how the Impact prediction is done for socioeconomic environment in EIA studies. **[10]**

**Q6)** Discuss the role of public participation in Environmental decision making. **[10]**

**Q7)** Write a note on “Post Environmental monitoring”. **[10]**

**Q8)** Explain the procedure for obtaining Environmental clearance for construction project. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P4119**

[Total No. of Pages : 3

[4760] - 1047

**M.E. (Civil) (Water Resources and Environment Engineering)**  
**ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY**  
**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *Use data sheet.*

- Q1)** a) State the stability of atmosphere for the following data Temp. of air at ground = 30°C. Temp. of air at 200m height = 20°C. If a balloon is release from a ground after 1 hour reach to height of 100m at that time temperature of 22°C. **[4]**
- b) Explain radiation and types of radiation. **[3]**
- c) A high volume sampler is run for 30 min @ 20m<sup>3</sup>/min air. Initial weight of filter paper is 5 gm after 30 min weight of filter paper is 10 gm what is concentration of dust particle in microgram/m<sup>3</sup>. **[3]**
- Q2)** a) Design multi cyclone chamber for flue gas of 10m<sup>3</sup>/sec. Assume all the necessary data. **[4]**
- b) A fabric filter must process 3m<sup>3</sup>/s of flue gas. Design the bag house filter with air to cloth ratio of 4m<sup>3</sup>/min/m<sup>2</sup> Determine no. of bags and physical arrangement. Take dia. of each base as 200mm. **[3]**
- c) Explain working of adsorption process in details. **[3]**

**P.T.O**

**Q3)** a) A gas has density of  $1.89 \text{ kg/m}^3$  at a pressure of 1 bar with temperature of  $30^\circ\text{C}$ . A mass of 0.9 kg of the gas requires a heat transfer of 300 kJ to raise the temperature. Determine. [3]

i) Characteristic gas constant.

ii)  $C_p$  of the Gas

iii)  $C_v$  of the Gas

Change in internal energy of gas

b) Explain steam curve. [3]

c) Explain vapor absorption system with diagram. [4]

**Q4)** a) Determine reaction order of reactant removal for the data given in table : [4]

|               |     |     |     |    |    |    |
|---------------|-----|-----|-----|----|----|----|
| concentration | 230 | 180 | 110 | 60 | 40 | 22 |
| Time (minute) | 0   | 9   | 20  | 30 | 42 | 33 |

b) Explain working & principle of ion exchange process. [3]

c) A cold fluid flow through heat exchanger at rate of  $20 \text{ m}^3/\text{hr}$ . The temperature at entry of fluid and exit is  $38^\circ\text{C}$  and  $62^\circ\text{C}$ . The another fluid enters at rate of  $30 \text{ m}^3/\text{hr}$  and temperature is  $112^\circ\text{C}$ . Find the area required for heat exchanger in parallel and counter current flow conditions. [3]

**Q5)** a) Write short note on toxicity test. [3]

b) Explain the concept of anaerobic sludge digestion with three phases such as hydrolysis, acidogenesis, methanogenesis and also explain conventional sludge digester with diagram. [4]

c) A one cubic meter of air was found to contain  $100 \text{ microgram/m}^3$  of  $\text{CO}_2$ . The temperature & pressure are  $20^\circ\text{C}$  and  $103.12 \text{ kPa}$  when the air sample was taken what was the concentration of  $\text{CO}_2$  in PPM. [3]

**Q6)** Explain working mechanism of : [10]

a) pH meter

b) Flame photometer

c) Atomic Absorption Spectrophotometer

- Q7)** a) What are different type of reactor used in water treatment process. [6]  
b) Design ASP for Industrial waste water of 10,000 m<sup>3</sup>/d, BOD of I/F = 200 mg/L, E/F BOD = 10 mg/L, Y = 0.5, K<sub>d</sub> = 0.05/ day, MLSS = 4000 mg/L, Return sludge concentration = 10,000 mg/L, MCRT = 10 days [4]

Determine 1. Volume of reactor

- i) F/M ration.
- ii) OLR
- iii) Oxygen requirement
- iv) Recycle ratio

- Q8)** Explain uses of algae and problems caused by algae in water along with their controlling measures. [10]



Total No. of Questions : 8]

SEAT No. :

**P4120**

**[4760] - 1048**

[Total No. of Pages :2

**M.E. (Civil)**

**Water Resources and Environmental Engg.**

**FLUID MECHANICS**

**(2013 Credit Pattern) (Semester - I) (501083)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithms tables, slide rule, electronics pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Define stream line, streak line, pathline and stream tube. **[4]**

b) Define nominal thickness, displacement thickness and momentum thickness with reference to boundary layer. **[6]**

**Q2) a)** State assumptions made in Bernoulli's theorem. What are limitations of Bernoulli's theorem. **[4]**

b) The velocity distribution in the turbulent boundary layer over a flat plate

is given as  $\frac{u}{U_\infty} = 2 \frac{y}{\delta} - \frac{1}{2} \left( \frac{y}{\delta} \right)^2$ . Obtain an expression for the displacement thickness, momentum thickness and energy thickness. **[6]**

**Q3) a)** Write a short note on conformal mapping? **[4]**

b) An oil with density 900 kg/m<sup>3</sup> and viscosity 0.16 N-s/m<sup>2</sup> flows through a 20cm diameter pipe. What is the maximum flow that will ensure laminar flow? If the length of the pipe is 200m, find the pressure drop between the two ends of the pipe. **[6]**

**Q4) a)** Derive equation for stream function and velocity potential for a source. **[5]**

**P.T.O.**

- b) Derive equation for velocity distribution for flow between parallel plates with both plate are at rest starting with Navier-Stokes equations. [5]
- Q5)** a) What is boundary layer separation? What are its effects and how to control it? [5]  
b) Derive Reynolds equation. [5]
- Q6)** a) Derive Karman momentum equation. [6]  
b) Write a short note on Reynolds rules of averages. [4]
- Q7)** a) Derive equation for stagnation temperature. [5]  
b) Discuss the analogy between the normal shock wave and the hydraulic jump. [5]
- Q8)** a) Derive equation for work done in adiabatic process. [5]  
b) What is the effect of compressibility on drag. [5]



Total No. of Questions : 8]

SEAT No. :

**P4121**

**[4760]-1049**

[Total No. of Pages : 2

**M.E.WREE**

**RESEARCH METHODOLOGY TREATMENT**

**(2013CreditPattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 full questions.*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) With suitable example explain Quantitative research. [5]  
b) “Selecting an appropriate research problem is the key to successful research”Discuss. [5]
- Q2)** a) Discuss the characteristics of a good Research Problem. [5]  
b) Explain the requirements of Research in the modern times with an example. [5]
- Q3)** a) Write a note on “Internet as a source of literature review in Research”. [5]  
b) Enlist different types of sample designs and explain probability sampling. [5]
- Q4)** a) Explain the merits and demerits of collection of data through observations. [5]  
b) Write the advantages and disadvantages of raking scale. [5]
- Q5)** a) Differentiate between Null hypothesis and Alternative hypothesis. [5]  
b) Explain the steps involved in procedure for hypothesis testing. [5]

**P.T.O.**

- Q6)** a) What is a t-test? When it is used and for what purpose? Explain with examples. [5]  
b) Discuss in brief the important factors needed for a technical report. [5]
- Q7)** a) Discuss the precautions to be taken for writing Research reports. [5]  
b) Explain Multiple Regression Analysis method. [5]
- Q8)** a) Write a note on requirements of a research thesis. [6]  
b) When can an invention be eligible for filing of its patent?. [4]



Total No. of Questions : 8]

SEAT No. :

**P3783**

[Total No. of Pages : 3

**[4760] - 105**

**M.E. (Mechanical - Heat Power)**

**CONVENTIONAL POWER PLANTS**

**(2008 Pattern) (Semester - I) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer for the two sections should be written in separate answer book.*
- 3) *Neat Diagrams should be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of pocket calculator & different gas charts as applicable is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1) a)** Draw the general layout of thermal power plant and explain the working of different circuits. **[10]**
- b) Steam at 10 bar and 0.95 dry is available. Find the final dryness fraction of steam for each of the following operations using steam table: **[8]**
- i) 160 kJ of heat is removed per kg of steam at constant pressure.
  - ii) It is cooled at constant volume till its temperature falls to 1400C
  - iii) Steam expands isentropically in the steam turbine developing 200KJ of work per kg of steam flow and pressure becomes 0.5bar.
- Q2) a)** What are the factors to be considered while selecting a site for hydroelectric power plant? **[8]**
- b) Nozzle of impulse stage turbine receives steam at 15 bar and 300 deg. C and discharges it at 10 bar. The nozzle efficiency is 90 % and the nozzle angle is 30 degrees. The blade speed is that required for maximum work and entry of the steam is without shock. The blade exit angle is 5 degrees less than the inlet blade angle. Blade friction factor is 0.9. Calculate the power and efficiency. **[8]**

**P.T.O.**

**Q3)** a) Explain the Gas turbine power plant with neat sketch. Discuss the advantages of gas turbine power plant. [8]

b) Draw the layout of Diesel power plant. [8]

**Q4)** a) What are the advantages of reheat cycle over simple ranking cycle? [8]

b) Explain significance of Co-generation and what are the different industries which can benefit from Co-generation? [8]

### SECTION - II

**Q5)** a) Explain use of Load curves in Power plants. [8]

b) Explain working of combined cycle gas power plant and derive expression for overall efficiency of plant. [8]

**Q6)** A steam boiler generates steam at 30bar, 3000 deg C at the rate of 2kg/s. This steam is expanded isentropically in a turbine to a consider pressure of 0.05bar, condensed at constant pressure and pumped back to boiler. [16]

a) Draw the schematic arrangement of the above plant and T-s diagram of Rankine Cycle.

b) Find heat supplied in the boiler per hour

c) Determine the quality of steam after expansion.

d) What is the power generated by the turbine?

e) Estimate the Ranking efficiency considering pump work.

**Q7)** a) Explain the energy Scenario in India and possible road map for meeting the increasing energy demand for future. Explain how the projection or estimation of Power demand done for future energy needs. How the increasing energy demand of India should be met for future. [10]

b) What are the different instruments system used for normal operation and safety of a power plant? [8]

**Q8)** Write a short note on (any three)

**[16]**

- a) Ash handling in thermal power plant.
- b) Nuclear waste disposal.
- c) Cooling towers used in Power plants.
- d) Fluidized bed combustion.
- e) Pollution Control techniques.



Total No. of Questions : 8]

SEAT No. :

**P4526**

**[4760] - 1050**

[Total No. of Pages : 3

**M. E. (Civil) (Water Resources and Environmental Engineering)**  
**ENVIRONMENTAL HYDRAULICS AND ENVIRONMENTAL**  
**STRUCTURES**  
**(2012 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *Use data sheet.*
- 7) *Use of IS code 46 and IS code-1983 (Part - I) - 2002.*

**Q1)** a) Find minimum span length for support and thickness of pipe required for the following data Diameter of pipe = 120mm, weight of pipe 14 Kg/meter, Weight of water 10 Kg/meter, Stress of material 900 kg/cm<sup>2</sup>, pressure of liquid in pipe is 20 kg/cm<sup>2</sup>. Take  $E = 2 \times 10^6$  Kg/cm<sup>2</sup>. **[5]**

b) A single acting reciprocating pump running at a speed of 50 rpm delivering water 0.005 cum meter/sec. The diameter of piston is 190 mm and its stroke length 300mm suction and delivery head are 4 meter and 11 meter. Determine theoretical discharge, coefficient of discharge, % of slip, Power required and efficiency of pump. **[5]**

**Q2)** a) Design hydraulic circuit for the following data. **[5]**

Load during forward stroke = 10 KN, In return stroke 8 KN, Forward and backward speed is 4 m/min and 6 m/min. Total length of stroke is 300mm. Make a provision to hold the cylinder anywhere in between two positions. Select different components as per suitability and also specify rating of pump.

b) Explain any two types of pressure control valve. **[5]**

**P.T.O**

- Q3)** a) Explain working of LVDT [5]  
 b) What are different types of level measurement used and explain any two in detailed. [5]

- Q4)** a) The vapor pressure of n-heptane and n-octane are given the following table at 101.1 KPa. Assume that the Raoult's and Dalton's Law apply. Plot the graph of x-y and Temp -x, Temp-y [5]

|             |       |        |        |        |        |        |
|-------------|-------|--------|--------|--------|--------|--------|
| Temp. in °C | 98    | 105    | 110    | 116    | 120    | 125    |
| p°A KPa     | 101.1 | 125.23 | 139.98 | 159.89 | 179.98 | 205.1  |
| p°B KPa     | 44.4  | 55.5   | 64.5   | 74.7   | 86.6   | 101.32 |

Boiling point of n-heptane and n-octane is 98°C and 120°C.

- b) Determine EBCT, Mass of GAC, Volume of water to treated for the following data. [5]  
 Volume of GAC used = 16 cum. Meter, Volumetric flow rate = 1500 lit/min, Initial and final concentration of pollutant is 6mg/lit and 0.05 mg/lit. Freundlich Capacity Factor = 25 (mg/gm) (Lit/mg)<sup>1/n</sup>, and intensity parameter n = 0.8

- Q5)** a) A vibration system define by the parameter m = 100 kg. [5]  
 K = 150 N/m, C = 4 N s/m

Determine Damping factor, natural frequency, logarithmic discernment.

- b) A four storey Steel Frame structure is use for carrying pipe line in plant situated in zone IV. The height of each floor is 4 meter and total height of RCC structure is 16 meter. The dead load and live load on each floor are as follows. [5]

On First Floor = 4000 KN, On Second Floor = 5000KN, On Third Floor = 6000KN, On Fourth Floor = 2400KN respectively. The soil below foundation is assumed to be hard rock. Find out total base shear as per IS Code – 1893 – (Part – I) - 2002.

- Q6)** a) An air receiver of a cylindrical portion of 8 meter length and 1.0 meter in diameter. It is closed by hemispherical ends. The pressure is not exceeding 9 N/mm<sup>2</sup>. If the material is stress having yield point 250 N/mm<sup>2</sup> and if factor of safety is 3 used. Find the required thickness of the cylinder and thickness of hemispherical shape cylinder assumes joint efficiency for both cylinders is 0.8. [5]

- b) A closed vessel is to be design to withstand internal pressure of 200 MPa having inside diameter of 400mm Following properties may be assumed Yield Strength = 400 MPa, Ultimate Tensile strength = 600 MPa, Poission ratio = 0.4, Estimate wall thickness on the basis of [5]
- Maximum Principle Stress Theory.
  - Maximum Shear Stress Theory.
- Q7)** a) A pressure vessel consist of a cylindrical shell of inside diameter 2000mm. which is closed by cylindrical head with a crown radius of 1400 mm. The operating pressure inside the cylinder is 4.5 MPa. The yield strength of the material is 500 MPa. The corrosion allowance is 2mm and weld efficiency is 80%. Determine the thickness of cylindrical shell and the cylindrical head. [5]
- b) What are different types of head used in pressure vessel. [5]
- Q8)** a) Determine area and depth of foundation of square column carrying load of 1000 KN vertical. The SBC of soil is 100 KN/M<sup>2</sup>, density of soil is 20 KN/m<sup>3</sup>, angle of repose = 30°. [5]
- b) A beam of section 25 cm × 40 cm if, shearforce of 18 KN and torsion moment is 2 KNM at factorized load. Assume M15 mix concrete and 0.22% torsion steel at a given section. State whether torsion reinforcement is required or not. [5]



Total No. of Questions : 8]

SEAT No. :

**P4606**

[Total No. of Pages : 2

**[4760]-1051**

**M.E. (Civil) (Water Resource and Environmental Engineering)**

**HYDROLOGY**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from all the questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Define rainguage density. Discuss the ISI norms for the rainguage density. Explain measurement of rainfall using satellites. **[6]**
- b) What are the design applications of depth-area-duration relations? Explain the procedure for developing these relations. **[4]**
- Q2)** a) Explain Pearson type & its use in hydrology. **[6]**
- b) Write a short note on chi squared test. **[4]**
- Q3)** a) Explain extreme value probability paper with neat graph. **[6]**
- b) State various methods to estimate flood and explain the rational method in detail. **[4]**
- Q4)** a) Describe the modified Puls method of reservoir routing **[6]**
- b) Define flood routing. What are the uses of flood routing. **[4]**

**P.T.O.**

- Q5)** a) A pumping test was carried out on a new irrigation bore well penetrating fully into a confined aquifer at a rate of 22 lit/sec. The drawdown measured in an observation well located at 45.7 m from the pumping well during the test is given below. determine T and S of the aquifer using Cooper-Jacob method. **[5]**

|                      |       |       |       |      |       |       |       |      |      |
|----------------------|-------|-------|-------|------|-------|-------|-------|------|------|
| Time t in hours      | 0.5   | 1.8   | 2.7   | 5.4  | 9.0   | 12.0  | 18    | 30   | 54   |
| Drawdown s in meters | 0.091 | 0.294 | 0.382 | 0.55 | 0.701 | 0.785 | 0.911 | 1.06 | 1.24 |

- b) Explain how the yield of an open well can be determined using recuperation test. **[5]**
- Q6)** a) Explain any one method of exploring ground water and explain any one method of tube well construction. **[6]**
- b) What is ground water pollution? How the industrial use of water affects on it. **[4]**
- Q7)** a) Enlist the various methods of artificial recharge of ground water and explain any one in detail. **[5]**
- b) What are different equipment used to drill tube well? Explain one in detail with neat diagram. **[5]**
- Q8)** a) How porous media models are useful in ground water modelling. **[5]**
- b) Write a note on digital computer modeling technique for groundwater analysis. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P4122**

**[4760] - 1052**

[Total No. of Pages :2

**M.E. (Civil - Water Resources and Environmental Engg.)**

**OPEN CHANNEL HYDRAULICS**

**(2013 Credit Pattern) (501088) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithms tables, slide rule, electronics pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Define depth of flow, depth of flow section, Hydraulic radius, Hydraulic mean depth. **[4]**
- b) A rectangular channel with bed width of 10 m, bed slope of 1 in 2500 and Manning's  $n = 0.002$  carries a discharge of  $10 \text{ m}^3/\text{s}$ . Find the slope of water surface with respect to horizontal at the section where the depth of flow is 0.72m. **[6]**
- Q2)** a) Design an economical channel with side slopes 2 H : 1 V, bed slope 1 : 3600 to carry discharge of  $5 \text{ m}^3/\text{s}$ . Take Manning's  $n = 0.02$ . **[6]**
- b) Draw the water surface profiles when **[4]**
- i) a steep slope follows a steeper slope
  - ii) mild slope follows a steep slope
- Q3)** a) Write in detail about hydraulic jump at an abrupt drop. **[5]**
- b) Write a detail about standard step method to determine length of a water surface profile created by gradually varied flow. **[5]**
- Q4)** a) How to determine energy loss in hydraulic jump graphically. **[4]**
- b) A Wide rectangular channel carries a discharge of  $5 \text{ m}^3/\text{s}/\text{m}$ . The bed slope of the channel is 1 in 3600 and Manning's  $n = 0.02$ . If the channel ends in a drop determine how far upstream the depth of flow would be 10% of the normal depth. Use step method. Take 2 steps. **[6]**

**P.T.O.**

- Q5)** a) Derive equation for increasing discharge of spatially varied flow. [4]  
 b) A wide tidal river has a low water velocity of 1.5 m/s and depth of flow of 2.5 m. A tide in the sea causes a 'bore' which travels upstream. If height of bore is 0.9 m estimate speed of the bore and velocity of flow after its passage. [6]
- Q6)** a) Derive relation for change in the area at a uniformly discharging side weir. How these weirs can be constructed? [6]  
 b) Derive continuity of gradually varied unsteady flow? [4]
- Q7)** a) Define condition of incipient motion? Write in brief of Shield's analysis. [6]  
 b) Write a short note on flood routing. [4]
- Q8)** a) Define bed load, saltation load, suspended load, total load. [4]  
 b) Route the following flood through a reach of  $K = 22$  h and  $x = 0.25$ . At  $t = 0$  the outflow discharge is  $40 \text{ m}^3/\text{s}$ . [6]

|                              |    |    |     |     |     |     |     |     |     |     |     |     |     |
|------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Time (h)                     | 0  | 12 | 24  | 36  | 48  | 60  | 72  | 84  | 96  | 108 | 120 | 132 | 144 |
| Inflow $\text{m}^3/\text{s}$ | 40 | 65 | 165 | 250 | 240 | 205 | 170 | 130 | 115 | 85  | 70  | 60  | 54  |



Total No. of Questions : 8]

SEAT No. :

**P4607**

[4760] - 1053

[Total No. of Pages : 2

**M.E. (Civil) (Water Resource and Environmental Engg.)  
ADVANCED WATER & WASTE WATER TREATMENT  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Explain the principle & working of reverse osmosis & U.F. for water & waste water treatment. **[10]**

**Q2)** Design a tube settler module of square cross section with following data:**[10]**

- i) av. output from tube settler =  $250\text{m}^3/\text{hr.}$ ,
- ii) loss of water in desludging = 2% of output required,
- iii) av. design flow =  $(250 \times 100)/(100-2) 255.1\text{m}^3/\text{hr.}$ ,
- iv) cross section of square tube =  $50\text{mm} \times 50\text{mm}$ ,
- v) length of tubes = 1m,
- vi) angle of inclination of tubes =  $60^\circ$

**Q3)** What is theory of filtration? Explain in detail components, under drainage system, cleaning & operational trouble in RSGF. **[10]**

**Q4)** Design an aerated grit chamber for the treatment of municipal waste water. The average flow rate is  $0.5\text{ m}^3/\text{s}$ . Take peak factor as 2.75. **[10]**

**Q5)** Explain unit operation & unit operation. State the microorganisms in waste water discuss their importance in waste water treatment system. **[10]**

**P.T.O.**

- Q6)** a) Explain theory & working of RBC. [5]  
b) With a neat sketch explain bacteria-algae symbiosis in oxidation pond.[5]
- Q7)** Explain the methods of sludge treatment & disposal with their advantages & disadvantages. [10]
- Q8)** State the sources of waste water from manufacturing process & characteristics of effluent for distillery & textile industry. Draw the treatment flow charts.[10]



Total No. of Questions : 8]

SEAT No. :

**P4719**

[Total No. of Pages : 2

[4760] - 1054

**M.E. (Civil Engineering) Examination, May - 2015**

**WATER RESOURCE AND ENVIRONMENTAL ENGINEERING**

**Dam Engineering**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of calculators allowed.*
- 4) *Draw sketches wherever necessary.*
- 5) *Assume suitable data, if required.*

**Q1) a)** State various treatments necessary for foundation of gravity dam and explain with neat sketch any two. **[6]**

b) Give the load combinations as per Indian standard (IS. 6512) for the design of dam. **[4]**

**Q2) a)** A homogeneous dam is 43 m high. The free board provided is 3 m. a 30 m long horizontal filter is also provided on the downstream end. A flow net was drawn for the dam section. The flow net comprised of 5 flow channels and 15 potential drops. If the permeability of the material in the dam is  $3 \times 10^{-5}$  m/sec. Calculate the seepage flow per meter length of earth dam. If the dam is 500 m long calculate the total discharge through the body of dam. **[4]**

b) Draw typical section of earth dam and explain the functions performed by component briefly. **[6]**

**Q3) a)** Explain the thick cylinder theory for design of arch dam. **[6]**

b) Explain various forces acting on arch dam. **[4]**

**P.T.O.**

- Q4)** a) What is buttress dam? State the classification of buttress dam and explain any one. [4]
- b) Explain various types of rock fill dams and draw the sketches of each of them. [6]
- Q5)** a) State various types of spillways and explain Ogee and siphon spillways.[6]
- b) At an energy dissipater structure below a low spillway, the discharge is  $19 \text{ m}^3/\text{s}$  and the energy loss 1 m at hydraulic jump forming therein. Determine the depths of flow at both ends of the jumps. [4]
- Q6)** a) State the objectives of DSO. What is the purpose of this organization?[6]
- b) State various instruments installed to monitor safety of dam. Explain any one in detail. [4]
- Q7)** a) Write short note on CWC. [5]
- b) How Global Water Partnership play important role in management of water resources. [5]
- Q8)** a) For construction of a dam (multipurpose project) how will account for displacement and rehabilitation. Justify in brief. [5]
- b) Explain social impact assessment and environmental impact. [5]



Total No. of Questions : 8]

SEAT No. :

P4123

[Total No. of Pages : 4

[4760]- 1055

**M.E. (Mechanical) (Heat Power Engg. / Energy Engg.)**  
**ADVANCED MATHEMATICS AND NUMERICAL METHODS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables are allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** A car covers 210km with some speed. If the speed is increased by 10km/hr, it will cover the same distance in one hour less. Find out the algebraic equ<sup>n</sup> governing the speed of the car & find the speed of the car by Newton Raphson Method. Assume initial guess as 80km/hr. Carry out five iterations. **[5]**

b) The value of Nusselt number (Nu) & Reynolds number (Re) found experimentally are given below. If the relation between Re & Nu is of the type  $Nu = a R^b$  **[5]**

Fit the curve using least square method & find a & b.

|              |         |         |         |         |         |
|--------------|---------|---------|---------|---------|---------|
| Reynolds no. | 3000    | 4000    | 5000    | 6000    | 7000    |
| Nusselt no.  | 14.3575 | 15.6517 | 16.7353 | 17.6762 | 18.5128 |

**Q2) a)** Solve the following Linear Simultaneous Equations using LU decomposition method. **[5]**

$$3x_1 + 2x_2 + 4x_3 = 7$$

$$1x_1 + 3x_2 + 5x_3 = 2$$

$$2x_1 + 1x_2 + 1x_3 = 4$$

**P.T.O.**

- b) Following table shows enthalpy at different pressures.

|                       |       |       |       |       |
|-----------------------|-------|-------|-------|-------|
| Pressure<br>(Bar)     | 1.9   | 2.2   | 2.4   | 2.6   |
| Enthalpy<br>(kJ/kg.K) | 497.9 | 517.6 | 529.6 | 540.9 |

Find out the enthalpy at pressure 2.3 bar by Langrange's interpolation method. [5]

- Q3) a)** The following table describes various parameters associated with a thermo dynamic problem. [5]

|    |     |    |    |
|----|-----|----|----|
| x  | -1  | 0  | 1  |
| y  | -10 | -4 | -2 |
| y' | 10  | 3  | 2  |

Determine Hermite polynomial for the above data.

- b) Employ power method to determine largest eigen value for the given system of equations. [5]

$$x_1 - 3x_2 + 2x_3 = \lambda x_1$$

$$4x_1 + 4x_2 - x_3 = \lambda x_2$$

$$6x_1 + 3x_2 + 5x_3 = \lambda x_3$$

- Q4) a)** A fluid is confined in a cylinder by a spring loaded with frictionless piston so that pressure in the fluid is a linear function of volume  $P = l+mV$  where  $l = -60 \text{ kN/m}^3$ ,  $m = 7667 \text{ kN/m}^2$ . If the fluid changes from initial condition of  $0.03 \text{ m}^3$  to final volume of  $0.06 \text{ m}^3$ . Find magnitude of work transfer during the process using Gauss- Lagurre 3' point formula. [5]

- b) The velocity distribution of a fluid near a flat surface is given below.

$$t: 0 \quad 1 \quad 2 \quad 5$$

$$v: 2 \quad 3 \quad 12 \quad 147$$

Express velocity as a function of time and calculate velocity at the end of 3<sup>rd</sup> minute. [5]

- Q5) a)** Using House-Holder's method reduce the following matrix A to the tridiagonal form. **[5]**

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$$

- b)** Mechanical system is represented by differential equation **[5]**

$$\frac{dy}{dx} = \frac{1}{x+y}, x_0 = 0, y_0 = 1$$

Apply Runge - Kutta method of fourth order to find  $y$  at  $x = 0.4$ , taking  $h = 0.2$

- Q6) a)** Use Adams - Bashforth mehtod to find  $y(1.4)$ , given that **[5]**

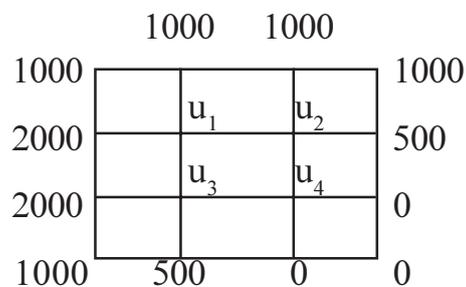
$$\frac{dy}{dx} = x^2(1+y) \text{ and}$$

$$\begin{array}{l} x : \quad 1 \quad 1.1 \quad 1.2 \quad 1.3 \\ y : \quad 1 \quad 1.233 \quad 1.548 \quad 1.979 \end{array}$$

- b)** Solve two dimensional steady stale heat flow equation **[5]**

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$$

Carry out 5 iterations using Jacobi's method to find  $u_1, u_2, u_3, u_4$ . Given that



**Q7) a)** Solve by Gauss-Seidel method, the following system of equations.

$$10x_1 - 2x_2 - x_3 - x_4 = 3$$

$$-2x_1 + 10x_2 - x_3 - x_4 = 15$$

$$-x_1 - x_2 + 10x_3 - 2x_4 = 27$$

$$-x_1 - x_2 - 2x_3 + 10x_4 = -9$$

(upto four iteration) [5]

b) Develop the Crank - Nicolson's implicit finite difference scheme for one

dimensional Heat equation  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$  [5]

**Q8) a)** Solve the Poisson equation  $u_{xx} + u_{yy} = -81xy$ ,  $0 < x < 1$ ,  $0 < y < 1$  given

that  $u(0,y) = 0$ ,  $u(x,0) = 0$ ,  $u(1,y) = 100$ ,  $u(x,1) = 100$  and  $h = \frac{1}{3}$ . [5]

b) Explain the standard 5- point formula to solve the Laplace equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0, \text{ in a steady state condition.} \quad [5]$$



Total No. of Questions : 8]

SEAT No. :

**P4391**

[4760] - 1056

[Total No. of Pages : 3

**M.E. (Mechanical) (Heat Power Engg.) (Semester - I)**  
**ADVANCED THERMODYNAMICS & COMBUSTION**  
**TECHNOLOGY**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculators and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** State and explain law of corresponding states. Explain compressibility chart with suitable sketch. **[6]**

b) Show that for an ideal gas, the slope of the constant volume line on T-s diagram is more than that of the constant pressure line. **[4]**

**Q2) a)** Explain the process of steam generation (change of phase) at constant pressure. Show the various stages on P-V, T-V and T-S diagrams. **[5]**

b) Two kg of steam at 10 bar pressure and 0.95 dry is throttled to 3 bar. Determine : **[5]**

- i) Final quality of steam
- ii) Change in internal energy and
- iii) Change in entropy

**Q3) a)** Derive an equation for exergy balance of a closed system. **[5]**

**P.T.O.**

b) Air expands through a turbine from 500 kPa, 520°C to 100 kPa, 300°C. During expansion 10 kJ/kg of heat is lost to the surroundings which is at 98 kPa, 20°C. Neglecting the KE and PE changes, determine per kg of air : [5]

i) the decrease in availability

ii) the maximum work and

iii) the irreversibility

Take for air,  $C_p = 1.005$  kJ/kg-K &  $R = 0.287$  kJ/kg-K

**Q4)** a) Explain second law of thermodynamics with Kelvin plank and Clausius statements. [5]

b) A system has a heat capacity at constant volume [5]

$$C_v = AT^2$$

Where  $A = 0.042$  J/K<sup>3</sup>.

The system is originally at 200 K, and a thermal reservoir at 100 K is available. What is maximum amount of work that can be recovered as the system is cooled down to the temperature of the reservoir?

**Q5)** a) Write a short note on Joule Thomson coefficient. [4]

b) Using Maxwell's Equation derive first and second Tds Equations. [6]

**Q6)** a) What is adiabatic flame temperature? [4]

b) The products of combustion of an unknown hydrocarbon  $C_x H_y$  have the following composition as measured by an Orsat apparatus : [6]

CO<sub>2</sub> 8.0%, CO 0.9%, O<sub>2</sub> 8.8% and N<sub>2</sub> 82.3%

Determine :

- i) The composition of the fuel
- ii) The air-fuel ratio, and
- iii) The percentage excess air used.

**Q7) a) Explain :** **[4]**

- i) Amagat's law
  - ii) Kay's rule
- b) A gas mixture contains 3kg of  $N_2$  and 5kg of  $CO_2$  at a pressure of 3 bars and a temperature of  $20^\circ C$ . Find : **[6]**
- i) the fraction of each constituent
  - ii) the molecular weight of the mixture and
  - iii) gas constant of the mixture.

**Q8) a) Write a short note on fugacity and activity.** **[4]**

- b) Write short note on : **[6]**
- i) thermodynamics of biological cells
  - ii) thermodynamics of ageing and death.



Total No. of Questions : 7]

SEAT No. :

**P4124**

**[4760] - 1057**

[Total No. of Pages : 2

**M.E. (Mechanical -Heat Power)  
ADVANCED FLUID MECHANICS  
(2013 Credit Pattern) (502103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer five questions from following.*
- 2) *Draw Diagrams wherever necessary.*
- 3) *Use of Scientific calculator is allowed.*
- 4) *Assume suitable data wherever necessary.*

**Q1) a)** Define & derive an expression of Streamlines, Streaklines, and Pathlines. **[5]**

b) A small pressure probe inserted in water in which the velocity and pressure field are given by **[5]**

$$V = 2x, y + 3t^2y, 2 \text{ and } P = 2x^2 + yz + t$$

Find the rate of change of pressure recorded by the probe when it is at a position  $x = (3,1,3)$  and time  $t = 2$ . Also determine total acceleration.

**Q2) a)** Deduce Bernoulli's equation of motion from Navier Stokes equation. **[5]**

b) Steel sphere of 4mm dia. falls in glycerine at a terminal velocity of 0.04m/s. Assuming Stokes law is applicable, determine **[5]**

- i) Dynamic viscosity of glycerine
- ii) Drag force, and
- iii) Drag coefficient for the sphere

Take sp.wt. of steel and glycerine as  $75\text{kN/m}^3$  and  $12.5 \text{ kN/m}^3$ .

**Q3)** Obtain exact solution of flow between two concentric rotating cylinders. **[10]**

**Q4) a)** Explain the four simple Potential flows with graphical representations. **[5]**

**P.T.O.**

- b) Derive an expression for lift coefficient for rotating cylinder. Also discuss variations of lift and drag coefficients with velocity. [5]

**Q5) a)** Obtain expression for ordinary differential equation for laminar boundary layer for wedge flows. [5]

- b) Using Karman momentum integral equation calculate the local skin friction coefficient  $C_f$  for the following velocity profiles on a flat plate 1.5m long and 1m wide when placed in water flowing with a velocity of 0.2m/s. Take viscosity of water = 0.001 Ns/m<sup>2</sup>. [5]

$$\frac{u}{U_\infty} = \frac{3}{2}\eta - \frac{1}{2}\eta^3. \text{ Where } \eta = y / \delta.$$

**Q6) a)** Discuss various types of free turbulent flow. [5]

- b) Water is flowing through a rough pipe, 400mm in dia. and 600m length at the rate of 0.65 m<sup>3</sup>/s. Calculate the power loss in overcoming friction per km length of pipe, if the roughness element height ( $\epsilon$ ) = 0.15mm. Take viscosity of water = 0.001 Ns/m<sup>2</sup>. [5]

$$\text{for laminar flow } f = \frac{64}{R_e}$$

$$\text{for turbulent flow } \frac{1}{\sqrt{f}} = 2 \log_{10} \left( \frac{R}{s} \right) + 1.74.$$

**Q7) a)** Derive an expression for speed of sound. What is the Mach number of flow of air of velocity 200 m/s at 400K? State the types of flow. [5]

- b) Derive an expression for Fanno line & Rayleigh line for normal shock. [5]



Total No. of Questions : 8]

SEAT No. :

**P4125**

**[4760]- 1058**

[Total No. of Pages :2

**M.E.(Mechanical) (Heat Power / Design / Mechatronics /CAD /  
CAM/Energy Engineering)  
RESEARCH METHODOLOGY  
( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat Diagrams should be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of pocket calculator & different gas charts as applicable is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) What are the important Characteristics of any study to qualify as a research problem. [5]  
b) What care should be taken by the researcher while defining the scope and objective of a research problem. [5]
- Q2)** a) What do you mean by Citation and Impact Factor? Write the names of any two International Journals of your domain and its Impact Factor. [5]  
b) How noisy environment effects data collection? Explain the role of DSP in noisy environment. [5]
- Q3)** a) Write a note on Types of Errors involved in the Measurement. [5]  
b) Write a note on “ANOVA”. [5]
- Q4)** a) What are the different types of mathematical models commonly used with examples. Also state the important steps in mathematical modeling. [5]  
b) Explain regression analysis with examples. [5]

***P.T.O.***

- Q5)** a) Explain research design and how it reduces time required to carry out the research process. [5]
- b) What are the different types of mathematical models used in Engineering research? [5]
- Q6)** a) Discuss Uncertainty Analysis with a suitable example. [5]
- b) Write a note on Types of Errors involved in the Measurement and significance of periodic calibration of instruments. [5]
- Q7)** a) Write a short note on principal component analysis. [5]
- b) Explain the structure for writing a research report. [5]
- Q8)** A company wanted to constant manufacture 10,000 ball bearings. The mean diameter of the bearing was 8 mm and the variance of the same was 4 mm. The measurement of diameter follows the normal distribution. Design the acceptance test taking only samples of 100 sheets with mean diameter of 9 mm.  $Z$  from normal table=2.57. Use the two tailed test and plot the results on a Two-tailed probability curve marking clearly the acceptance and rejection zone. [10]



[4760] - 1059

M.E. (Mechanical - Heat Power) (Semester - II)

Advanced Heat Transfer

(2013 Pattern)

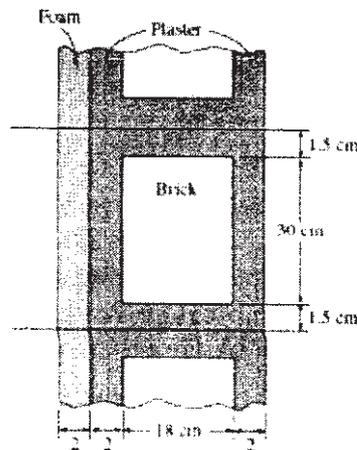
Time : 3 Hours]

[Maximum Marks : 50

*Instructions to the candidates:*

- 1) Answer five questions from following.
- 2) Draw diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data where ever necessary.

- Q1) a)** A 4-m-high and 6-m-wide wall consists of a long 18-cm 30-cm cross section of horizontal bricks ( $k = 0.72 \text{ W/m} \cdot ^\circ\text{C}$ ) separated by 3-cm-thick plaster layers ( $k = 0.22 \text{ W/m} \cdot ^\circ\text{C}$ ). There are also 2-cm-thick plaster layers on each side of the wall, and a 2-cm-thick rigid foam ( $k = 0.026 \text{ W/m} \cdot ^\circ\text{C}$ ) on the inner side of the wall. The indoor and the outdoor temperatures are  $22^\circ\text{C}$  and  $-4^\circ\text{C}$ , and the convection heat transfer coefficients on the inner and the outer sides are  $h_1 = 10 \text{ W/m}^2 \cdot ^\circ\text{C}$  and  $h_2 = 20 \text{ W/m}^2 \cdot ^\circ\text{C}$ , respectively. Assuming one-dimensional heat transfer and disregarding radiation, determine the rate of heat transfer through the wall. [5]



- b)** One- dimensional steady state conduction with uniform internal energy generation occurs in a plane wall with a thickness of 50 mm and a constant thermal conductivity of  $5 \text{ W/m} \cdot \text{K}$ . For these conditions, the temperature distribution has the form,  $T(x) = a + bx + cx^2$ . The surface at  $x = 0$  has a temperature of  $T(0) = T_0 = 120^\circ\text{C}$  and experiences convection with a fluid for which  $T_\infty = 20^\circ\text{C}$  and  $h = 500 \text{ W/m}^2 \cdot \text{K}$ . The surface at  $x = L$  is well insulated. [5]

P.T.O.

- i) Applying an overall energy balance to the wall, calculate the internal energy generation rate  $q_g$ .
- ii) Determine the coefficients a, b, and c by applying the boundary conditions to the prescribed temperature distribution.

**Q2) a)** Long aluminium wires of diameter 3 mm ( $\rho = 2702 \text{ kg/m}^3$ ,  $C_p = 0.896 \text{ kJ/kg } ^\circ\text{C}$ ,  $k = 236 \text{ W/m } ^\circ\text{C}$ , and  $\alpha = 9.75 \times 10^{-5} \text{ m}^2/\text{s}$ ) are extruded at a temperature of  $350^\circ\text{C}$  and exposed to atmospheric air at  $30^\circ\text{C}$  with a heat transfer coefficient of  $35 \text{ W/m}^2 \text{ } ^\circ\text{C}$ . **[5]**

- i) Determine how long it will take for the wire temperature to drop to  $50^\circ\text{C}$ .
  - ii) If the wire is extruded at a velocity of  $10 \text{ m/min}$ , determine how far the wire travels extrusion by the time its temperature drops to  $50^\circ\text{C}$ . What change in the cooling process would you propose to shorten this distance?
  - iii) Assuming the aluminium wire leaves the extrusion room at  $50^\circ\text{C}$ , determine the rate of heat transfer from the wire to the extrusion room.
- b) An ordinary egg can be approximated as a 5.5-cm diameter sphere whose properties are roughly  $k = 0.6 \text{ W/m } ^\circ\text{C}$  and  $\alpha = 0.14 \times 10^{-6} \text{ m}^2/\text{s}$ . The egg is initially at a uniform temperature of  $8^\circ\text{C}$  and is dropped into boiling water at  $97^\circ\text{C}$ . Taking the convection heat transfer coefficient to be  $h = 1400 \text{ W/m}^2 \text{ } ^\circ\text{C}$ , determine how long it will take for the center of the egg to reach  $70^\circ\text{C}$  **[5]**

**Q3) a)** Air ( $k = 0.0284 \text{ W/mK}$ ) at a free stream temperature of  $T_\infty = 20^\circ\text{C}$  is in parallel flow over a flat plate of length  $L = 5 \text{ m}$  and temperature  $T_s = 90^\circ\text{C}$ . However, obstacles placed in the flow intensify mixing with increasing distance  $x$  from the leading edge, and the spatial variation of temperatures measured in the boundary layer is correlated by an expression of the form  $T(C) = 20 + 70 \exp(-600xy)$ , where  $x$  and  $y$  are in meters. Determine and plot the manner in which the local convection coefficient  $h$  varies with  $x$ . Evaluate the average convection coefficient for the plate. **[5]**

- b) The electrically heated 0.6-m-high and 1.8-m-long windshield of a car is subjected to parallel winds at 1 atm,  $0^\circ\text{C}$ , and  $80 \text{ km/h}$ . The electric power consumption is observed to be  $50 \text{ W}$  when the exposed surface temperature of the windshield is  $4^\circ\text{C}$ . Disregarding radiation and heat transfer from the inner surface and using the momentum-heat transfer analogy, determine drag force the wind exerts on the windshield. **[5]**

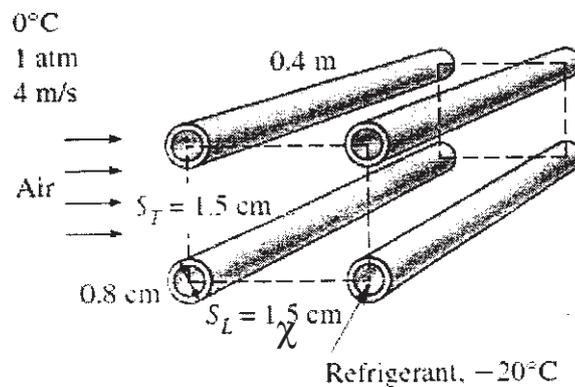
**Q4) a)** Prove that for laminar flow through pipe under constant surface heat flux condition,  $Nu=4.36$ . [5]

b) Air is to be cooled in the evaporator section of a refrigerator by passing it over a bank of 0.8-cm-outer-diameter and 0.4-m-long tubes inside which the refrigerant is evaporating at  $-20^{\circ}\text{C}$ . Air approaches the tube bank in the normal direction at  $0^{\circ}\text{C}$  and 1 atm with a mean velocity of 4 m/s. The tubes are arranged in-line with longitudinal and transverse pitches of  $S_L = S_T = 1.5$  cm. There are 30 rows in the flow direction with 15 tubes in each row. Determine

i) the refrigeration capacity of this system and

ii) and pressure drop across the tube bank. (Take  $f = 0.27$ ,  $\lambda = 1$ )

$k = 0.02326$  W/m - K  $\rho = 1.316$  kg/m<sup>3</sup>  $C_p = 1.006$  kJ/kg-K  $Pr = 0.7375$ ,  
 $\mu = 1.705 \times 10^{-5}$  kg/m-s  $Pr_s = Pr_{@T_s} = 0.7408$  [5]



**Q5) a)** Consider a  $0.6$  m  $\times$   $0.6$  m thin square plate in a room at  $30^{\circ}\text{C}$ . One side of the plate is maintained at a temperature of  $90^{\circ}\text{C}$ , while the other side is insulated, Determine the rate of heat transfer from the plate by natural convection if the plate is

i) vertical,

ii) horizontal with hot surface facing up, and

iii) horizontal surface facing down.  $k = 0.028$  W/m-K  $\rho = 1.316$  kg/m<sup>3</sup>  
 $C_p = 1.006$  kJ/kg - K  $Pr = 0.72$ ,  $\mu = 1.705 \times 10^{-5}$  kg/m-s [5]

b) The vertical 0.8-m-high, 2-m-wide double-pane window consists of two sheets of glass separated by a 2-cm air gap at atmospheric pressure. If the glass surface temperatures across the air gap are measured to be  $12^{\circ}\text{C}$  and  $2^{\circ}\text{C}$ , determine the rate of heat transfer through the window.  
 $k = 0.024$  W/m-K  $\rho = 1.316$  kg/m<sup>3</sup>  $C_p = 1.006$  kJ/kg-K  $Pr = 0.7344$ ,  
 $V = 1.399 \times 10^{-5}$  m<sup>2</sup>/s [5]

- Q6) a)** Derive an expression for heat transfer coefficient for laminar film condensation over vertical flat plate. [5]
- b)** To understand the burnout phenomenon, boiling experiments are conducted in water at atmospheric pressure using an electrically heated 30-cm-long, 3-mm- diameter nickel plated horizontal wire. Determine
- the critical heat flux and
  - the temperature at the critical heat flux. Take  $C_{cr} = 0.136$ ,  $C_{sf} = 0.0060$ ,  $n = 1$ ,  $k = 0.1362$  W/m-K  $\rho_v = 0.1725$  kg/m<sup>3</sup>  $C_p = 2471$  J/kg - k  $Pr = 0.7344$ ,  $\mu = 0.282 \times 10^{-3}$  kg/m-s,  $\rho_1 = 957.9$  kg/m<sup>3</sup>.  $\sigma = 0.0060$ .  $Pr = 9.72$  [5]
- Q7) a)** Discuss various “View Factor Relations”. [5]
- b)** A thin aluminium sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures  $T_1 = 800$  K and  $T_2 = 500$  K and have emissivities  $\epsilon_1 = 0.2$  and  $\epsilon_2 = 0.7$ , respectively. Determine the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without the shield [5]

Table :- Coefficients used in the one-term approximate solution of transient one-dimensional heat conduction in plane walls, cylinders and spheres ( $Bi = hL/k$  for plane wall of thickness  $2L$ , and  $Bi = hr_o/k$  for a cylinder or sphere of radius  $r_o$ )

| $Bi$ | Plane wall  |        | Cylinder    |        | Sphere      |        |
|------|-------------|--------|-------------|--------|-------------|--------|
|      | $\lambda_1$ | $A_1$  | $\lambda_1$ | $A_1$  | $\lambda_1$ | $A_1$  |
| 0.01 | 0.0998      | 1.0017 | 0.1412      | 1.0025 | 0.173       | 1.003  |
| 0.02 | 0.141       | 1.0033 | 0.1995      | 1.005  | 0.2445      | 1.006  |
| 0.04 | 0.1987      | 1.0066 | 0.2814      | 1.0099 | 0.345       | 1.012  |
| 0.06 | 0.2425      | 1.0098 | 0.3438      | 1.0148 | 0.4217      | 1.0179 |
| 0.08 | 0.2791      | 1.013  | 0.396       | 1.0197 | 0.486       | 1.0239 |
| 0.1  | 0.3111      | 1.0161 | 0.4417      | 1.0246 | 0.5423      | 1.0298 |
| 0.2  | 0.4328      | 1.0311 | 0.617       | 1.0483 | 0.7593      | 1.0592 |
| 0.3  | 0.5218      | 1.045  | 0.7465      | 1.0712 | 0.9208      | 1.088  |
| 0.4  | 0.5932      | 1.058  | 0.8516      | 1.0931 | 1.0528      | 1.1164 |
| 0.5  | 0.6533      | 1.0701 | 0.9408      | 1.1143 | 1.1656      | 1.1441 |
| 0.6  | 0.7051      | 1.0814 | 1.0184      | 1.1345 | 1.2644      | 1.1713 |

|     |        |        |        |        |        |        |
|-----|--------|--------|--------|--------|--------|--------|
| 0.7 | 0.7506 | 1.0918 | 1.0873 | 1.1539 | 1.3525 | 1.1978 |
| 0.8 | 0.791  | 1.1016 | 1.149  | 1.1724 | 1.432  | 1.2236 |
| 0.9 | 0.8274 | 1.1107 | 1.2048 | 1.1902 | 1.5044 | 1.2488 |
| 1   | 0.8603 | 1.1191 | 1.2558 | 1.2071 | 1.5708 | 1.2732 |
| 2   | 1.0769 | 1.1785 | 1.5995 | 1.3384 | 2.0288 | 1.4793 |
| 3   | 1.1925 | 1.2102 | 1.7887 | 1.4191 | 2.2889 | 1.6227 |
| 4   | 1.2646 | 1.2287 | 1.9081 | 1.4698 | 2.4556 | 1.7202 |
| 5   | 1.3138 | 1.2403 | 1.9898 | 1.5029 | 2.5704 | 1.787  |
| 6   | 1.3496 | 1.2479 | 2.049  | 1.5253 | 2.6537 | 1.8338 |
| 7   | 1.3766 | 1.2532 | 2.0937 | 1.5411 | 2.7165 | 1.8673 |
| 8   | 1.3978 | 1.257  | 2.1286 | 1.5526 | 2.7654 | 1.892  |
| 9   | 1.4149 | 1.2598 | 2.1566 | 1.5611 | 2.8044 | 1.9106 |
| 10  | 1.4289 | 1.262  | 2.1795 | 1.5677 | 2.8363 | 1.9249 |
| 20  | 1.4961 | 1.2699 | 2.288  | 1.5919 | 2.9857 | 1.9781 |
| 30  | 1.5202 | 1.2717 | 2.3261 | 1.5973 | 3.0372 | 1.9898 |
| 40  | 1.5325 | 1.2723 | 2.3455 | 1.5993 | 3.0632 | 1.9942 |
| 50  | 1.54   | 1.2727 | 2.3572 | 1.6002 | 3.0788 | 1.9962 |
| 100 | 1.552  | 1.2731 | 2.3809 | 1.6015 | 3.1102 | 1.999  |
|     | 1.5708 | 1.2732 | 2.4048 | 1.6021 | 3.1416 | 2      |

Nusselt number correlations for cross flow over tube banks for  $N > 16$  and  $0.7 < Pr < 500$  (from Zukauskas, Ref. 15, 1987)\*

| Arrangement | Range of $Re_D$                   | Correlation  |
|-------------|-----------------------------------|--|
| In-line     | 0-100                             | $Nu_D = 0.9 Re_D^{0.4} Pr^{0.36} (Pr/Pr_s)^{0.25}$                   |
|             | 100-1000                          | $Nu_D = 0.52 Re_D^{0.5} Pr^{0.36} (Pr/Pr_s)^{0.25}$                  |
|             | 1000- $2 \times 10^5$             | $Nu_D = 0.27 Re_D^{0.63} Pr^{0.36} (Pr/Pr_s)^{0.25}$                 |
|             | $2 \times 10^5$ - $2 \times 10^6$ | $Nu_D = 0.033 Re_D^{0.8} Pr^{0.4} (Pr/Pr_s)^{0.25}$                  |
| Staggered   | 0-500                             | $Nu_D = 1.04 Re_D^{0.4} Pr^{0.36} (Pr/Pr_s)^{0.25}$                  |
|             | 500-1000                          | $Nu_D = 0.71 Re_D^{0.5} Pr^{0.36} (Pr/Pr_s)^{0.25}$                  |
|             | 1000- $2 \times 10^5$             | $Nu_D = 0.35 (S_T/S_L)^{0.2} Re_D^{0.6} Pr^{0.36} (Pr/Pr_s)^{0.25}$  |
|             | $2 \times 10^5$ - $2 \times 10^6$ | $Nu_D = 0.031 (S_T/S_L)^{0.2} Re_D^{0.8} Pr^{0.36} (Pr/Pr_s)^{0.25}$ |

\*All properties except  $Pr_s$  are to be evaluated at the arithmetic mean of the inlet and outlet temperatures of the fluid ( $Pr_s$  is to be evaluated at  $T_s$ ).

Correction factor  $F$  to be used in  $Nu_{D, N_L} = F Nu_D$  for  $N_L < 16$  and  $Re_D > 1000$  (from Zukauskas, Ref 15, 1987).

| $N_L$     | 1    | 2    | 3    | 4    | 5    | 7    | 10   | 13   |
|-----------|------|------|------|------|------|------|------|------|
| In-line   | 0.70 | 0.80 | 0.86 | 0.90 | 0.93 | 0.96 | 0.98 | 0.99 |
| Staggered | 0.64 | 0.76 | 0.84 | 0.89 | 0.93 | 0.96 | 0.98 | 0.99 |



Total No. of Questions : 8]

SEAT No. :

P4307

[Total No. of Pages : 4

[4760] - 106

M.E. (Mechanical) (Heat Power Engineering)

ADVANCED GAS DYNAMICS

(2008 Pattern) (Elective - II(D))

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of gas table is allowed.*
- 6) *Assume suitable data, if necessary and mention it clearly.*

**SECTION - I**

**Q1) a) Derive an expression :**

**[8]**

$$a = \sqrt{\frac{dp}{d\rho}};$$

where a = speed of sound, p = operating pressure and  $\rho$  = density of working fluid.

b) Find the Mach number for an aircraft flying at speed of 1000 Kmph at **[6]**

i) sea level (take ambient temperature 15 °C)

ii) 11000 meters altitude with outside temperature of - 56.5°C.

Assume for air R = 287 J/kg-K and  $\gamma = 1.4$

c) Explain Mach cone and Mach angle

**[4]**

**P.T.O.**

- Q2) a)** For quasi one dimensional flow, derive the relation between velocity and area changes. [8]

$$\frac{dV}{V} = -\frac{dA}{A} \left( \frac{1}{1-M^2} \right)$$

Also show that for  $M = 1$ , the area of the passage is either minimum or maximum.

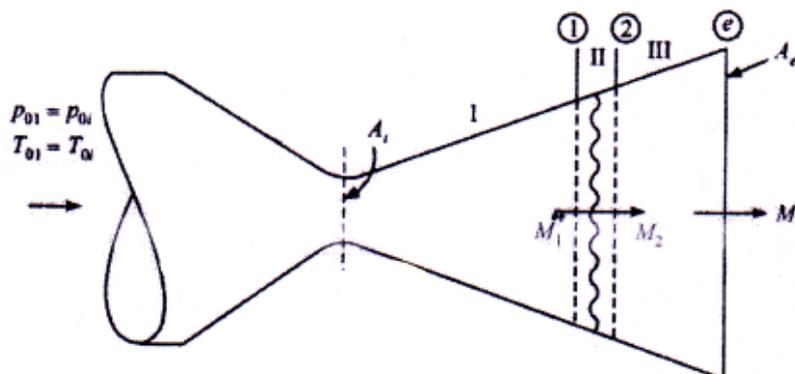
- b) Explain adiabatic process using Mollier Diagram. Also explain the fluid properties in adiabatic flow. [8]

- Q3) a)** Derive an expression for area variation as shown below for achieving compression and expansion process. [8]

$$\frac{dA}{A} = \left( \frac{1-M^2}{M^2} \right) \frac{d\rho}{\rho};$$

- b) Explain with neat sketches the fluid flow process that leads to the formation of a shock wave. [8]

- Q4) a)** A convergent-divergent nozzle has an exit to throat area ratio of 3.0. The stagnation properties of air at inlet are  $700 \text{ kN/m}^2$  and  $90^\circ\text{C}$ . The throat area is  $10 \text{ cm}^2$ . Due to its operation at the off design condition a plane normal shock is seen to stand at a section where  $M = 2$ . Determine the mach number, static pressure and static temperature at the exit of the nozzle. Assume isentropic flow before and after shock. [10]



- b) Explain normal shock using  $h - s$  diagram. [3]  
c) The flow process across shock is irreversible. Explain. [3]

**SECTION - II**

**Q5)** Write a short note on (Any three) : [18]

- a) Compression shock wave and expansion fan  
b) Nozzle and Diffuser  
c) Compressibility factor and its need  
d) Rankine Hugoniot relation for normal shock

**Q6) a)** What is Fanno flow? Show Fanno lines on  $h - v$  and  $h - s$  plane and explain. [8]

- b) With the help of sketches explain the difference between compression wave and an expansion wave. [8]

**Q7) a)** Explain in detailed [10]

- i) Rayleigh curve  
ii) Fanno curve

- b) Explain the Prandtl-Myer expansion fan. [6]

**Q8) a)** A combustion chamber in a gas-turbine plant receives air at 300 K, 55 kPa and 60 m/s. The fuel air ratio is 29 and the calorific value of the fuel is 42 MJ/kg. Assuming  $\gamma = 1.4$  and  $R = 0.287$  kJ/Kg K for the gas, determine. [12]

- i) Mach numbers at inlet and exit  
ii) Pressure, temperature and velocity of the gas at exit of combustion chamber.  
iii) Percentage loss in stagnation pressure and  
iv) Maximum attainable stagnation temperature.

- b) Explain with neat sketch detached shocks. [4]

## FLOW PROPERTIES DATA

Isentropic flow table ( $\gamma = 1.4$ )

| M    | $T/T_0$ | $p/p_0$ | $\rho/\rho_0$ | $A/A^*$ | $F/F^*$ | $(A/A^*) \cdot (p/p_0)$ | $M^*$   |
|------|---------|---------|---------------|---------|---------|-------------------------|---------|
| 0.10 | 0.99800 | 0.99303 | 0.99502       | 5.8218  | 4.6236  | 5.7812                  | 0.10943 |
| 0.20 | 0.99206 | 0.97250 | 0.98027       | 2.9635  | 2.4004  | 2.8820                  | 0.21822 |
| 0.30 | 0.98232 | 0.93947 | 0.95638       | 2.0351  | 1.6979  | 1.9119                  | 0.32572 |
| 1.40 | 0.71839 | 0.31424 | 0.43742       | 1.1149  | 1.03458 | 0.35036                 | 1.2999  |
| 1.50 | 0.68965 | 0.27240 | 0.39498       | 1.1762  | 1.04870 | 0.32039                 | 1.3646  |
| 1.60 | 0.66138 | 0.23257 | 0.35573       | 1.2502  | 1.06348 | 0.29414                 | 1.4254  |
| 1.70 | 0.63372 | 0.20259 | 0.31969       | 1.3376  | 1.07851 | 0.27099                 | 1.4825  |
| 1.80 | 0.60680 | 0.17404 | 0.28682       | 1.4390  | 1.09352 | 0.25044                 | 1.5360  |
| 1.90 | 0.58072 | 0.14924 | 0.25699       | 1.5552  | 1.1083  | 0.23211                 | 1.5861  |
| 2.00 | 0.55556 | 0.12780 | 0.23005       | 1.6875  | 1.1227  | 0.21567                 | 1.6330  |
| 2.20 | 0.50813 | 0.09352 | 0.18405       | 2.0050  | 1.1500  | 0.18751                 | 1.7179  |
| 2.40 | 0.46468 | 0.06840 | 0.14720       | 2.4031  | 1.1751  | 0.16437                 | 1.7922  |
| 2.60 | 0.42517 | 0.05012 | 0.11787       | 2.8960  | 1.1978  | 0.14513                 | 1.8572  |

Normal Shock table ( $\gamma = 1.4$ )

| M    | $M_2$    | $p_{02}/p_{01}$ | $p_2/p_1$ | $\rho_2/\rho_1$ | $T_2/T_1$ | $p_{02}/p_1$ | $M_1$ |
|------|----------|-----------------|-----------|-----------------|-----------|--------------|-------|
| 1.30 | 0.785957 | 0.979374        | 1.805000  | 1.515695        | 1.190873  | 2.7135       | 1.30  |
| 1.36 | 0.757181 | 0.967579        | 1.991200  | 1.620182        | 1.228998  | 2.9115       | 1.36  |
| 1.42 | 0.731436 | 0.953063        | 2.185800  | 1.724303        | 1.267643  | 3.1198       | 1.42  |
| 1.48 | 0.708290 | 0.936001        | 2.388800  | 1.827770        | 1.306948  | 3.3382       | 1.48  |
| 1.54 | 0.687388 | 0.916624        | 2.600200  | 1.930327        | 1.347026  | 3.5667       | 1.54  |
| 1.60 | 0.668437 | 0.895200        | 2.820000  | 2.031746        | 1.387969  | 3.8049       | 1.60  |
| 2.00 | 0.577350 | 0.720874        | 4.500000  | 2.666667        | 1.687500  | 5.6405       | 2.00  |
| 2.10 | 0.561277 | 0.674203        | 4.978333  | 2.811902        | 1.770450  | 6.1655       | 2.10  |
| 2.20 | 0.547056 | 0.628136        | 5.480000  | 2.951220        | 1.856860  | 6.7163       | 2.20  |
| 2.30 | 0.534411 | 0.583295        | 6.005000  | 3.084548        | 1.946801  | 7.2937       | 2.30  |
| 2.40 | 0.523118 | 0.540144        | 6.553333  | 3.211896        | 2.040332  | 7.8969       | 2.40  |
| 2.50 | 0.512989 | 0.499015        | 7.125000  | 3.333333        | 2.137500  | 8.5262       | 2.50  |
| 2.60 | 0.503871 | 0.460123        | 7.720000  | 3.448980        | 2.238343  | 9.1813       | 2.60  |
| 2.70 | 0.495634 | 0.423590        | 8.338333  | 3.558991        | 2.342892  | 9.8625       | 2.70  |

Rayleigh table ( $\gamma = 1.4$ )

| M    | $T/T^*$  | $p/p^*$  | $T_0/T_0^*$ | $p_0/p_0^*$ | $M^*$ |
|------|----------|----------|-------------|-------------|-------|
| 0.10 | 0.056020 | 2.366864 | 0.046777    | 1.259146    | 0.10  |
| 0.20 | 0.206612 | 2.272727 | 0.173554    | 1.234596    | 0.20  |
| 0.30 | 0.408873 | 2.131439 | 0.346860    | 1.198549    | 0.30  |
| 0.40 | 0.615148 | 1.960784 | 0.529027    | 1.156577    | 0.40  |
| 0.50 | 0.790123 | 1.777778 | 0.691358    | 1.114053    | 0.50  |
| 0.60 | 0.916704 | 1.595745 | 0.818923    | 1.075253    | 0.60  |
| 0.70 | 0.992895 | 1.423488 | 0.908499    | 1.043104    | 0.70  |



Total No. of Questions : 7]

SEAT No. :

P4127

[Total No. of Pages : 3

[4760]-1060

**M.E. (Part-II) (Mechanical-Heat Power Engg.)**

**AIR CONDITIONING TECHNOLOGY**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 7.*
- 2) *Draw Neat diagrams wherever necessary.*
- 3) *Use of Steam tables, p-h chart, Psychrometric chart and scientific calculator is allowed.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Figures to the right indicate full marks*

**Q1)** The following information is related to a Laboratory application.

Outdoor design: 32°C DBT, 13 gms/kg of dry air

Indoor design: 24 °C DBT, 10 gms/kg of dry air

RSH = 35 kW, RLH = 19 kW, Ventilation air quantity: 71 m<sup>3</sup>/min. The temperature difference between room air and supply air is 11°C maximum.

Find: i) ESHF, ii) ADP, iii) Reheat required with revised ESHF = 0.74,

iv) Supply air quantity, v) Grand total heat.

**[10]**

**Q2)** a) Explain the significance of ventilation air. Give an example where

100% fresh air is used for air conditioning application. Explain the procedure to calculate ventilation load. **[6]**

b) Explain the following related to IAQ: **[4]**

- i) Environmental Tobacco Smoke
- ii) Sick building syndrome

**P.T.O.**

**Q3)** The following details are related to design of an air conditioning system:[10]

- a) Sensible heat gain through glass, walls and roof= 10 kW,
- b) Lighting load = 1.5 kW,
- c) Occupancy load: Sensible = 3 kW, Latent = 2.5 kW
- d) Infiltration air = 150 m<sup>3</sup>/hr,
- e) Ventilation (Fresh) air = 13 m<sup>3</sup>/min
- f) Indoor condition: 24°C DBT and 10 gms/kg of dry air
- g) Outdoor condition: 43°C DBT and 17 gms/kg of dry air. Determine the cooling capacity of the system and the dehumidified air quantity. Assume bypass factor as 0.1 and ADP = 10 °C

**Q4) a)** Explain the significance of Fan curves? [2]

b) A centrifugal fan delivers 100 m<sup>3</sup>/min at Mumbai location. What will be the air quantity delivered by the same fan at Hyderabad location? Justify your answer. [2]

c) With suitable illustration (or example) explain the drawbacks of velocity reduction method of duct design. [6]

**Q5)** Compare between: [10]

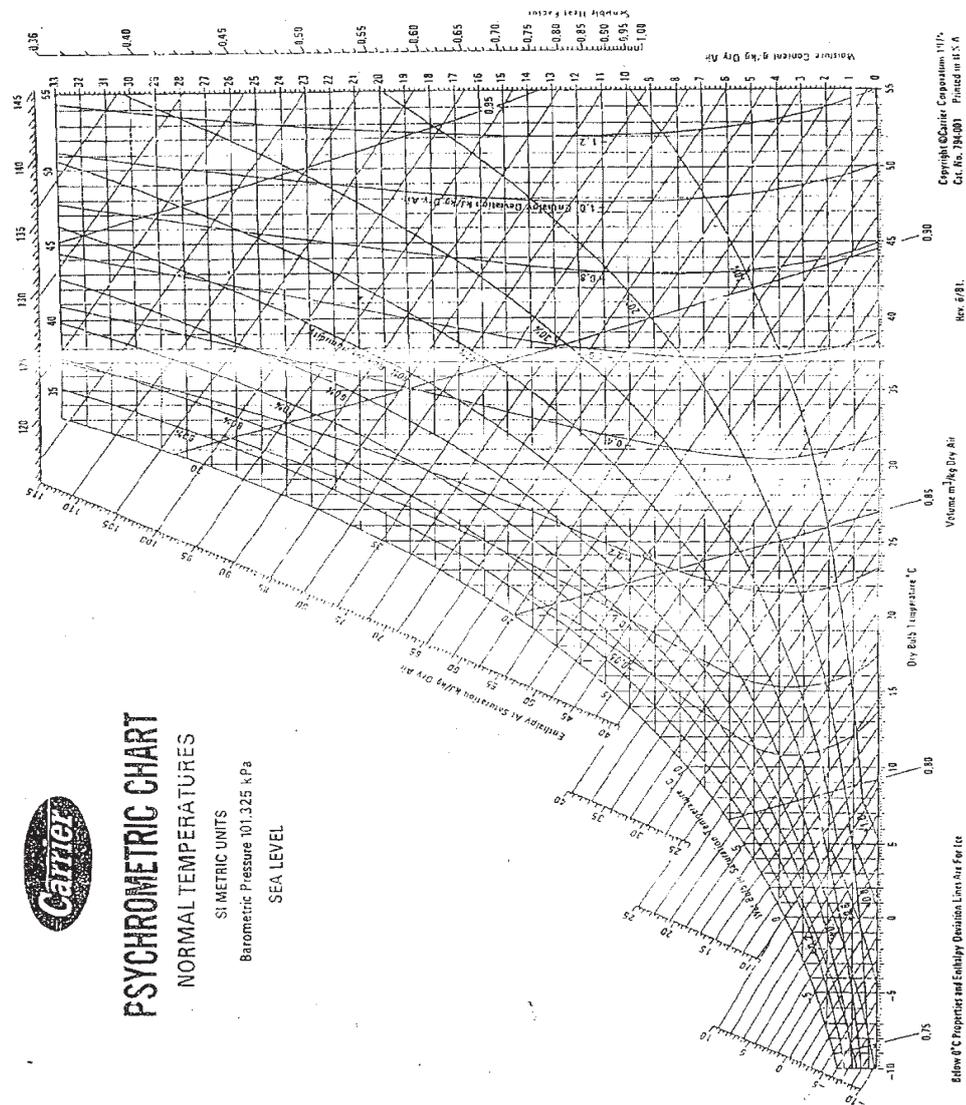
- a) Air cooled VRV and Water cooled VRV
- b) Displacement ventilation and VAV system

**Q6)** Write short note on: [10]

- a) Closed loop and open loop control systems
- b) Selection of control systems

Q 7) True or False. Justify your answers in maximum 5 sentences for each case:[10]

- For same DBT, Pune has lower WBT than Chennai
- Centrifugal fan generates less static pressure than axial fan
- During air conditioning load calculations, Solar heat gain coefficient (SHGC) is a term which is applicable for Partition walls
- Displacement ventilation is suitable for heating applications
- Static Regain method of duct design is based on trial and error method



Total No. of Questions : 8]

SEAT No. :

**P4608**

**[4760]-1061**

[Total No. of Pages : 3

**M.E. (Mechanical Heat Power)**  
**MEASUREMENTS AND CONTROLS**  
**(2013 Credit pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Answer any five questions.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Define sensitivity drift and zero drift. What factors can cause sensitivity drift and zero drift in instrument characteristics. **[5]**

b) Define the terms **[5]**

- i) Repeatability
- ii) Accuracy
- iii) Static sensitivity
- iv) Resolution
- v) Linearity

**Q2) a)** Explain the difference between systematic and random errors. What are the typical sources of these two types of error? **[5]**

b) The following measurements were taken with an analogue meter of the current flowing in a circuit (the circuit was in steady state and therefore, although the measurements varied due to random errors, the current flowing was actually constant): **[5]**

|        |        |        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 21.5mA | 22.1mA | 21.3mA | 21.7mA | 22.0mA | 22.2mA | 21.8mA | 21.9mA | 21.4mA | 22.1mA |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|

Calculate the mean value, the median value and the standard deviation of the data set.

**P.T.O.**

- Q3) a)** Describe the applications of flow measurements What are different factors which influence the choice of method used for measurement of flow. **[6]**
- b) A platinum resistance thermometer has a resistance of 140.5 and 100 $\Omega$  at 100°C and 0° respectively. If its resistance becomes 305.3 $\Omega$  when it is in contact with a hot gas. Determine the temperature of the gas. The temperature coefficient of platinum is 0.0039°C<sup>-1</sup>. **[4]**
- Q4) a)** Explain how nuclear radiation can be detected by the following methods. **[5]**
- i) Photo detectors
- ii) Scintillation counters
- b) In a lathe cutting test, the following data was obtained: tangential force = 795 N, axial force = 88 N, speed of spindle = 300 rpm, feed rate = 0.8mm per revolution, mean diameter of cut = 0.1m, and power input to 3 phase motor = 875 W/phase.  
Calculate the power absorbed in rotating the work piece and in feeding the tool along the work-piece. Calculate also the overall efficiency. **[5]**
- Q5) a)** Explain the construction and working of hydraulic load cells. Discuss their advantages and disadvantages. **[4]**
- b) A pilot tube is used to measure flow velocity in water of density 1000 kg/m<sup>3</sup>. **[6]**
- i) Determine the flow velocity at the head of the pilot tube if it produces a differential pressure of 10 kN/m<sup>3</sup> between its two outlets.
- ii) The same differential pressure is obtained in air at an altitude where the density of air is 0.65 kg/m<sup>3</sup>. Determine the velocity of air.
- Q6) a)** The data given below are obtained from student records. Calculate the rank correlation coefficient 'R' and coefficient of correlation 'r' for the data. **[6]**

|                     |      |      |      |      |      |      |      |      |      |      |
|---------------------|------|------|------|------|------|------|------|------|------|------|
| Subject             | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| Grade Point Average | 8.3  | 8.6  | 9.2  | 9.8  | 8.0  | 7.8  | 9.4  | 9.0  | 7.2  | 8.6  |
| Graduate exam score | 2300 | 2250 | 2380 | 2400 | 2000 | 2100 | 2360 | 2350 | 2000 | 2260 |

b) In what ways can the act of measurement cause a disturbance in the system being measured? [4]

**Q7)** a) An inductive pick up operating from a 120 tooth wheel is used with a digital frequency meter to measure the speed of rotation of shaft on which the wheel is mounted. The gating period is set to  $10^4 \mu\text{s}$ , and a reading of 0030 is obtained on the four digit display. What shaft speed does this present in RPS? [5]

b) What are mechanical tachometers? Explain with examples. Describe the advantages of mechanical tachometer. [5]

**Q8)** a) Explain how the addition of integral feedback a proportional control system eliminates steady-state error. [5]

b) Explain how the three elements of the PID control system work together to create a practical control system. [5]

*EEE*

Total No. of Questions : 7]

SEAT No. :

P4609

[Total No. of Pages : 3

[4760] - 1062

M.E. (Mechanical) (Heat Power Engineering)

COMPUTATIONAL FLUID DYNAMICS

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Assume suitable data, if necessary and mention it clearly.*

**Q1) a)** Derive an expression of divergence of velocity and explain its significance. **[4]**

b) Classify the following equations and briefly comment on the solution of these equations. **[6]**

i) 
$$\frac{\partial^2 T}{\partial x^2} - c^2 \frac{\partial^2 T}{\partial y^2} = 0$$

ii) 
$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

iii) 
$$\frac{\partial T}{\partial t} = D \frac{\partial^2 T}{\partial x^2}$$

**Q2) a)** Write in detail the CFD analysis of the supersonic flow over blunt nose body. Draw neat sketch and explain various region around the blunt body. **[5]**

b) Explain with neat sketches, different types of grid topology used in CFD. **[5]**

**P.T.O.**

- Q3) a)** Consider the steady, two-dimensional incompressible laminar flow over a flat plate. Far stream velocity of the flow is uniform and parallel to the plate. The flow and energy balance equations are given by [6]

$$u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = \nu \frac{\partial^2 u}{\partial y^2} \quad ; \quad u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} = \alpha \frac{\partial^2 T}{\partial y^2}$$

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

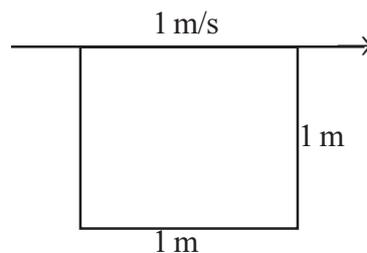
Assume suitable boundary conditions and find the velocity ( $u$ ) and temperature ( $T$ ) at nodal value ( $i+1, j$ ).

- b) What is Von-Neumann stability analysis? Explain using diffusion equation. [4]

- Q4) a)** What are the different types of algebraic grid generation method? Explain any one type of unidirectional method. [6]

- b) Discretize a two-dimensional wave equation using MacCormack scheme. Explain its order of accuracy. [4]

- Q5) a)** Write a stepwise solution using SIMPLE algorithm to solve a two-dimensional Lid driven cavity flow. [7]



- b) Consider the discretized form of the one-dimensional, transient diffusion equation. Assuming that the thermal diffusivity ( $\alpha = k/\rho C_p$ ) is constant, discuss the remainder or truncation error associated with suitable differencing of the transient heat conduction equation. [3]

- Q6)** a) What is artificial viscosity? Explain in detail with suitable scheme. [4]
- b) Write a short note on [6]
- i) Convergence acceleration technique
  - ii) TVD
- Q7)** a) What is two equation turbulence model? Explain any two-equation model used in practice with its advantage and disadvantage. [5]
- b) Write in detail CFD computations of any suitable example in commercial package. Explain each step using neat sketches or schematics. Enlist various issues encountered during the CFD simulation. [5]



Total No. of Questions : 4]

SEAT No. :

**P4128**

**[4760] - 1063**

[Total No. of Pages :2

**M.E. (Mechanical - Heat Power Engineering)  
DESIGN OF HEAT TRANSFER EQUIPMENTS  
(2013 Credit Pattern) (Semester - III) (602114)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q.No. 1 is compulsory.*
- 2) *Solve any TWO questions from remaining Q2/Q3/Q4.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of Calculator, heat transfer data book, steam table is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

**Q1) a)** Consider a concentric tube heat exchanger characterized by a uniform overall heat transfer coefficient and operating under the following conditions: **[12]**

Mass of cold and hot fluid flowing is same as 0.125 Kg/s

Specific heat of cold and hot fluid is 4200 and 2100 J/Kg.K respectively.

Inlet temperature of cold and hot fluid is 40°C and 210°C respectively.

Outlet temperature of cold fluid is 95°C.

- i) What is the maximum possible heat transfer rate?
  - ii) What is the heat exchanger effectiveness?
  - iii) Should the heat exchanger be operated in parallel flow or in counter flow?
  - iv) What is the ratio of the required areas for these two flow conditions?
- b) Draw sketch of: **[6]**

Single-pass divided -flow (TEMA J) exchanger with shell fluid mixed and show idealized shell and tube fluid temperature distributions.

**P.T.O.**

- Q2) a)** A boiler used to generate saturated steam is in the form of an unfinned, cross-flow heat exchanger, with water flowing through the tubes and a high-temperature gas in cross flow over the tubes. The gas, which has a specific heat of  $1120 \text{ J/kg K}$  and a mass flow rate of  $10 \text{ kg/s}$ , enters the heat exchanger at  $1400\text{K}$ . The water, which has a flow rate of  $3 \text{ kg/s}$ , enters as saturated liquid at  $450\text{K}$  and leaves as saturated vapor at the same temperature. If the overall heat transfer coefficient is  $50\text{W/m}^2\text{K}$  and there are 500 tubes, each of  $0.025\text{-m}$  diameter, what is the required tube length? **[12]**
- b) Write note on effect of fin density on fouling. **[4]**
- Q3) a)** Write note on: number of passes of tube side; and tube thickness selection using TEMA standard. **[8]**
- b) A counter flow double pipe heat exchanger is used in a power plant in which superheated steam is used to transfer heat to hot water at the rate of  $10500\text{kg/hr}$ . The steam enters the exchanger at  $180^\circ\text{C}$  and leaves at  $130^\circ\text{C}$ . Water enters at  $30^\circ\text{C}$  and leaves at  $80^\circ\text{C}$ . If the overall heat transfer coefficient from steam to water is  $814\text{W/m}^2\text{C}$  calculate heat transfer area for the counter flow arrangement. **[8]**
- Q4) a)** Explain tube layout in case of heat exchangers? State which layout is preferred in case of **[8]**
- i) compact HEX
  - ii) Cleaned air flow
  - iii) air with dust
- b) How burner locations are affecting performance of furnace. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P4129**

[Total No. of Pages : 3

**[4760] - 1064**

**M.E. (Mechanical) (Design Engineering)**

**ADVANCED MATHEMATICS**

**(Design / CAD-CAM / Auto Mobile)**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Find an orthonormal basis for the Euclidean space  $\mathbb{R}^3$ , by applying Gram - schmidt's method to the following vectors :  $(1,0,1)$ ,  $(1,0,-1)$  and  $(0,3,4)$ . **[5]**

b) If the potential function  $\phi$  is  $\log(x^2 + y^2)$ , find the flux function  $\psi$  and the complex function  $f(z) = \phi + i\chi$ . **[5]**

**Q2) a)** Evaluate  $\oint_C \frac{2z-1}{z(z+1)z-3} dz$ , where C is the circle  $|z|=2$ . **[5]**

b) Find the mechanical system which is governed by the differential equation, and with the given initial condition, **[5]**

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t} \sin t, \quad x(0) = 0, \quad x'(0) = 1$$

**Q3) a)** Find the laplace transform of the given function **[5]**

$$f(t) = 2t \sin t + \sin 2t u(t - \pi) + e^{-t} \sin 2t \delta(t - 2).$$

b) Solve the following differential equation by series method. **[5]**

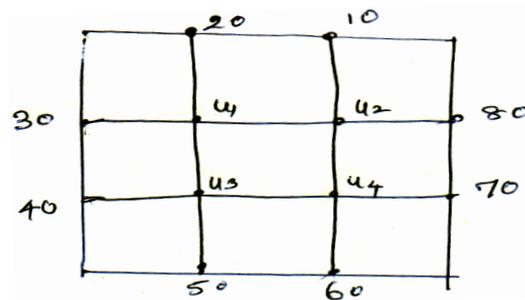
$$\frac{d^2y}{dx^2} - \frac{xdy}{dx} + x^2y = 0.$$

**P.T.O.**

- Q4) a)** Calculate by power method, the largest eigen value and vector of the matrix [5]

$$A = \begin{bmatrix} 1 & 2 & 0 \\ -2 & 1 & 2 \\ 1 & 3 & 1 \end{bmatrix} \text{ with } X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

- b) Solve the equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  for the following square mesh with boundary values as given in the figure [5]



- Q5) a)** Solve the equation  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  subject to the conditions [5]

$$u(x,0) = \begin{cases} 2x & ; 0 \leq x \leq \frac{1}{2} \\ 2(1-x) & ; \frac{1}{2} \leq x \leq 1 \end{cases} \text{ \& } u(0,t) = u(1,t) = 0.$$

carry out computation for four levels by taking  $h = \frac{1}{4}$  & choose  $k$  according to Bendre - schmidt method.

- b) Using Rayleigh Ritz method, solve the boundry value problem  $y'' - y + 4xe^x = 0$ ,  $y(0) = y(1) = 0$ . [5]

- Q6) a)** Find the function for which the functional [5]

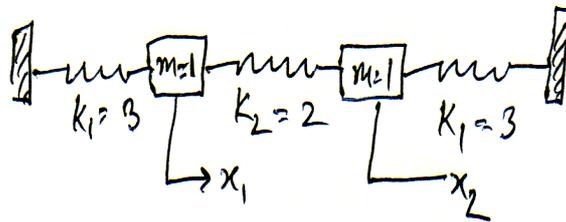
$$\int_0^{\pi/2} [y^2 + (y')^2 - 2y \sin x] dx, \quad y(0) = 0, \quad y\left(\frac{\pi}{2}\right) = 0, \text{ can be extremized}$$

- b) Solve the linear equation system using least square method [5]  
 $x - 2y = 1$ ,  $x + y = 2$ ,  $x + 2y = 4$

- Q7)** a) Show that the transformation  $w = z + \frac{1}{z} - 2i$  maps the circle  $|z| = 2$  onto an ellipse. [5]
- b) Using fourier transform show that [5]

$$\int_0^{\infty} \frac{2}{1+\lambda^2} \cos \lambda x d\lambda = \begin{cases} 0 & ; \quad x < 0 \\ \pi & ; \quad x = 0 \\ \pi e^{-x} & ; \quad x > 0 \end{cases}$$

- Q8)** a) For the system shown in the figure assuming there is no friction. Find natural frequencies of the system and corresponding normal mode of the vibration using matrix method. [5]



- b) Solve the boundary value problem  $U_{tt} = U_{xx}$  with conditions  $u(0,t) = u(1,t) = 0$ ,  $u_t(x,0) = 0$  and  $u(x,0) = \frac{1}{2}x$ . Find solution upto  $t = 0.4$  by using  $h = k = 0.1$ . [5]



Total No. of Questions : 7]

SEAT No. :

**P4392**

[4760] - 1065

[Total No. of Pages : 3

**M.E. (Mechanical) (Design Engineering)**  
**MATERIAL SCIENCE & MECHANICAL BEHAVIOUR OF**  
**MATERIALS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, whenever necessary.*

**Q1)** It is proposed to improve the wear resistance of a steel gear by hardening its surface. This is to be accomplished by increasing the carbon content within an outer surface layer as a result of carbon diffusion into the steel; the carbon is to be supplied from an external carbon rich gaseous atmosphere at an elevated and constant temperature. The initial carbon content of steel is 0.15 wt%, whereas the surface concentration is to be maintained at 0.95 wt%. For this treatment to be effective, a carbon content of 0.55 wt% must be established at 0.75 mm below the surface. Specify the appropriate heat treatment in terms of temperature and time for temperature at **[10]**

- i) 900°C
- ii) 950°C
- iii) 1000°C and
- iv) 1050°C.

Given that  $D_0$  and  $Q$  (for diffusion of carbon and  $\alpha$ -iron) are  $2.3 \times 10^{-5} \text{m}^2/\text{s}$  and 148000J/mole respectively.

**P.T.O.**

| $z$  | $\text{erf}(z)$ |
|------|-----------------|
| 0.40 | 0.4284          |
| 0.45 | 0.4755          |
| 0.50 | 0.5205          |
| 0.55 | 0.5633          |

**Q2)** The state of stress at a point to an xyz coordinate system is given by the stress matrix **[10]**

$$[\sigma] = \begin{bmatrix} -8 & 6 & -2 \\ 6 & 4 & 2 \\ -2 & 2 & -5 \end{bmatrix} \text{MPa}$$

Determine state of stress on an element that is oriented by first rotating the xyz axes  $45^\circ$  about the z axis and then rotating axes  $30^\circ$  about the new x axis.

**Q3)** At a point of interest in an engineering component, the stresses with respect to a convenient coordinate system are **[10]**

$$\sigma_x = 100 \text{ MPa}, \sigma_y = -60 \text{ MPa}, \sigma_z = 40 \text{ MPa}, \tau_{xy} = 80 \text{ MPa}, \tau_{yz} = \tau_{zx} = 0 \text{ MPa}$$

By using Mohr's circle determine the

- i) Principal stresses
- ii) Octahedral stresses
- iii) Maximum shearing stress

**Q4)** A specimen of an alloy is made into a cylindrical bar of 12.827mm diameter and 203.2 mm length. The bar is loaded in axial tension upto the proportional limit when the load is 42.85 kN. At this load the length was measured as 204.1 mm and diameter was measured as 12.808mm. Determine the following. **[10]**

- i) Proportional limit
- ii) Modulus of elasticity
- iii) Poisson's ratio

Also find true stress and true strain corresponding to load of 42.85kN.

**Q5)** The strains measured on the surface of a piece of sheet metal after deformation are  $\varepsilon_1 = 0.182$ ,  $\varepsilon_2 = -0.035$ . The stress-strain curve in tension can be approximated by  $\sigma = 30 + 40\varepsilon$ . Assume the von Mises criterion, and assume that the loading was such that the ratio of  $\varepsilon_2/\varepsilon_1$  was constant. **[10]**

Calculate the levels of  $\sigma_1$  and  $\sigma_2$  reached before unloading.

**Q6)** Explain residual shear stresses in solid circular cylinder in torsion. **[10]**

**Q7)** What is viscoelasticity? Explain Kelvin model of viscoelasticity. **[10]**



Total No. of Questions : 7]

SEAT No. :

P4130

[4760] - 1066

[Total No. of Pages :2

**M.E. (Mechanical - Design Engineering)**  
**ADVANCED STRESS ANALYSIS**  
**(2013 Credit Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data, if necessary, if required, but state the assumptions clearly.*

**Q1)** A stress function is given as under,  $\phi = \left[ C_1 \cdot r^4 + C_2 \cdot r^2 + C_3 + \frac{C_4}{r^2} \right] \cdot \cos 2\theta$

where  $r$  and  $\theta$  are polar coordinates.

Find out whether this is valid stress function.

Also determine the stresses.

[10]

**Q2)** Derive three differential equations of equilibrium in Cartesian Coordinates considering body force components per unit volume with neat diagram. [10]

**Q3)** The radii of curvature of two surfaces of semicircular discs at the point of contact are  $R_1 = 70\text{mm}$ ,  $R_1' = 150\text{mm}$ ,  $R_2 = 100\text{mm}$  and  $R_2' = 210\text{mm}$ . The angle between the principal planes of two bodies is  $50^\circ$ . determine the maximum principal stresses and maximum shearing stresses. Also locate the point where each of these stresses occurs. The load applied is  $5\text{kN}$ . Take  $E_1 = E_2 = 200\text{ GPa}$  and  $\nu_1 = \nu_2 = 0.29$ . [10]

**Q4)** Derive following expression for circular plate with a circular hole at the center.

$$\frac{dw}{dr} = \frac{a^2 b^2 m_1}{D(1-\mu)(a^2 - b^2)} \left[ \frac{1}{r} + \frac{(1-\mu)}{(1+\mu)} \cdot \frac{r}{a^2} \right] \quad [10]$$

*P.T.O.*

**Q5)** A steel specimen is mounted with three rectangular rosette strain gauges. The strain gauge readings for particular loading are given as: **[10]**

$$\epsilon_A = 100 \times 10^{-6} \quad \epsilon_B = 500 \times 10^{-6} \quad \epsilon_C = 600 \times 10^{-6}$$

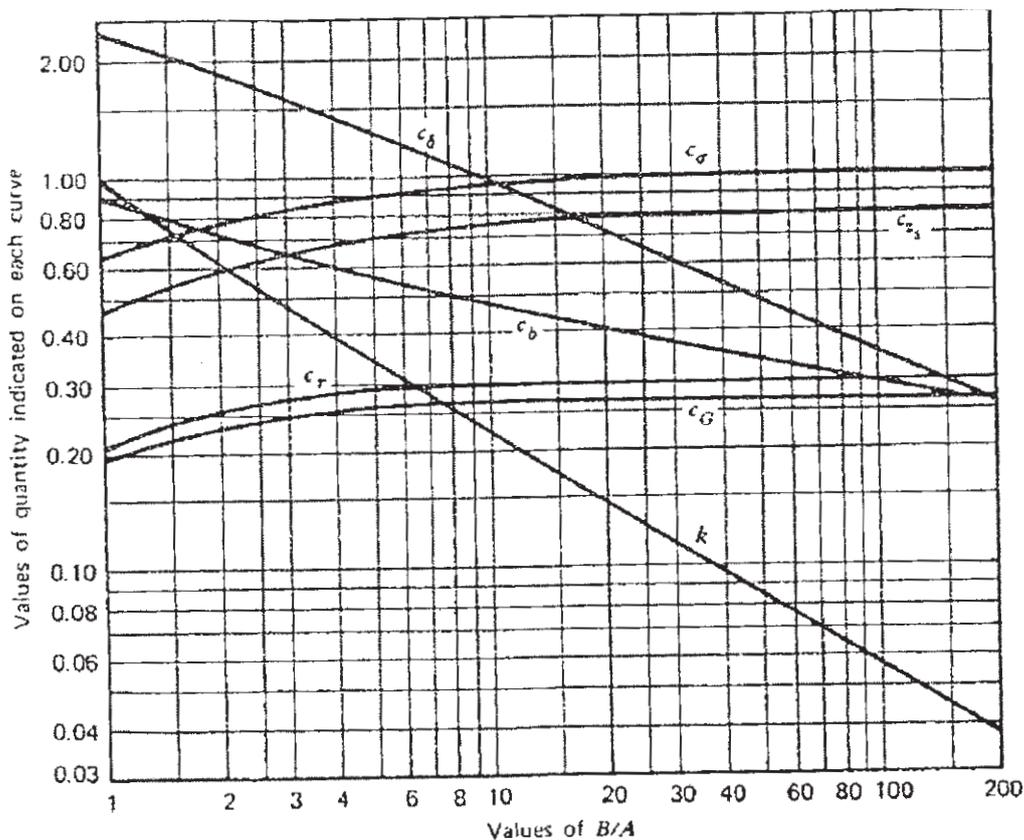
Determine the values and orientation of the principal stresses and maximum shear stress. Take  $\nu = 0.285$  and  $E = 200 \text{ GPa}$ .

**Q6) a)** Explain the effect of a stressed model in a circular polariscope in a light field arrangement. **[5]**

b) Explain dimensional analysis in experimental technique. **[5]**

**Q7) a)** Discuss different properties and applications of a composite-Fibre Reinforced Plastic. **[5]**

b) Explain isometric fringe pattern. **[5]**



[4760] - 1067

**M.E. (Mechanical) (Design Engg.) (Semester - II)**  
**ANALYSIS AND SYNTHESIS OF MECHANISMS**  
**(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1) a)** Explain the term 'Mobility of a mechanism'. Find the mobility of the linkages shown in Fig. 1 (a). Based on this, state whether the linkages shown are mechanisms with 1 DOF. If not, make suitable changes. The number of links should not be varied by more than 1. [5]

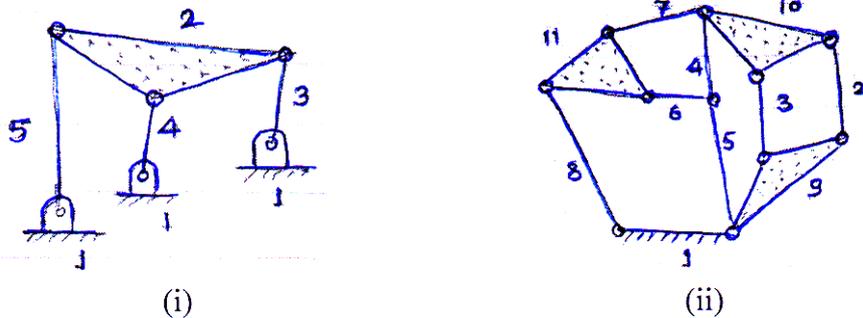


Fig.1(a)

- b)** Explain the term 'Kinematically Complex' mechanism. Discuss the terms with suitable examples [5]
- i) low degree of complexity &
  - ii) high degree of complexity.

P.T.O.

In the mechanism shown in the Fig.1 (b) below,  $\omega_2 = 10 \text{ rad/sec}$  (CW) (constant). Determine  $\omega_6$  &  $\alpha_6$ . (Use method of Normal Accelerations.)  
 Given:  $O_2A = 7.5 \text{ cm}$ ,  $AB = 5 \text{ cm}$ ,  $BC = 7.5 \text{ cm}$ ,  $O_5C = 6.25 \text{ cm}$  (and is vertical),  $CD = 10 \text{ cm}$ ,  $BD = 5 \text{ cm}$ ,  $O_6D = 5 \text{ cm}$ , Angle  $O_2AB = 110^\circ$ , Angle  $ABC = 115^\circ$ , Angle  $O_6DB = 117^\circ$ .

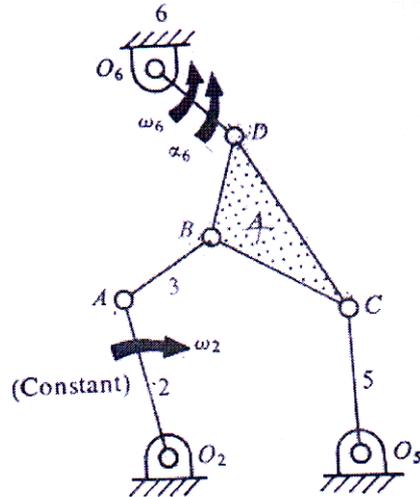


Fig.1(b)

- Q2)** a) State the 'Principle of Superposition'. Derive the equation of motion of a mechanism based on energy considerations. [5]  
 b) What are 'Elastic mechanisms'? Discuss the dynamic analysis of elastic mechanism. [5]
- Q3)** a) What is 'Inflection Circle'? Discuss in details the method/construction to locate 'inflection circle'. [5]  
 b) Explain in brief following : [5]  
 i) Bobilliar Construction  
 ii) Hartmann Construction  
 iii) Forms of Euler - Savary equation
- Q4)** a) Define the term 'Cubic of Stationary curvature'. Determine the cubic of stationary curvature for plane motion equivalent to the rolling of a circle along a fixed straight line. [5]  
 b) Discuss 3-position graphical synthesis of a 4-bar mechanism for body guidance. Synthesize a 4-bar mechanism to guide a rod AB through the three consecutive positions  $A_1B_1$ ,  $A_2B_2$  &  $A_3B_3$  as shown in Fig.4(b). [5]

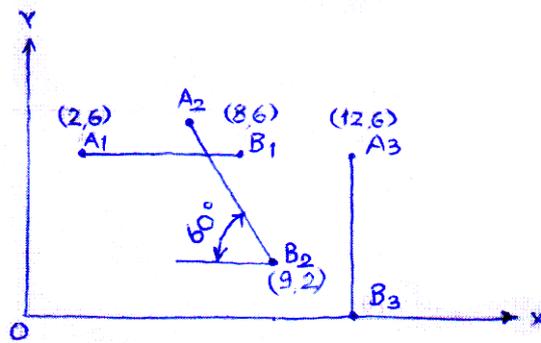


Fig.4(b)

- Q5) a) Explain with suitable example - [5]
- i) Motion generation
  - ii) Function generation
  - iii) Path generation
- b) Discuss the term ‘mechanical error’. Explain the analysis of ‘mechanical error’ & prove that the total mechanical error ( $\epsilon_m$ ) in the linkage is the sum of the individual errors due to each of the parameters considered separately. [5]

- Q6) a) Derive ‘Freudenstein’s equation for planar 4-bar linkage. Explain the algebraic synthesis of slider crank with 4- accuracy points using this equation. [5]
- b) Explain the method of algebraic synthesis using complex numbers for 4-bar mechanism with 3- accuracy points. Using this method, determine the link lengths of a 4-bar linkage that will in one of its position satisfy the following specifications of angular velocity & angular acceleration. Length of input link is to be unity. The subscript 1, 2, & 3 represent the input link, the coupler & the output link respectively. Draw the mechanism & comment on the resulting mechanism. (Use Complex number method.) [5]

| Angular velocity                    | Angular acceleration                |
|-------------------------------------|-------------------------------------|
| $\omega_1 = -10.00 \text{ rad/sec}$ | $\alpha_1 = 0 \text{ rad/sec}^2$    |
| $\omega_2 = 5 \text{ rad/sec}$      | $\alpha_2 = 0 \text{ rad/sec}^2$    |
| $\omega_3 = 0 \text{ rad/sec}$      | $\alpha_3 = 86.6 \text{ rad/sec}^2$ |

- Q7)** a) Discuss Denavit-Hartenberg (D-H) parameters with their importance in analysis of spatial mechanisms. Use D-H parameters to write a symbolic equation for the following mechanisms. [5]
- i) Planar 4R Mechanism
  - ii) Spherical 4R mechanism
- b) Derive displacement equations for the 4R Spherical mechanism (Hooke's Joint) using matrix method. [5]



[4760] - 1068

**M.E.(Mechanical Design Engineering)**  
**ADVANCED MECHANICAL VIBRATION**  
**(2013 Pattern)**

Time :3 Hours]

[Max. Marks :50

*Instructions to the candidates:*

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Assume suitable data if necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of non-programmable electronic calculator is allowed.

**Q1)** Estimate fundamental frequency of the lateral vibration of a shaft carrying three rotors (masses), as shown in Fig.1 with  $m_1 = 20\text{kg}$ ,  $m_2 = 50\text{ kg}$ ,  $m_3 = 40\text{kg}$ ,  $l_1 = 1\text{m}$ ,  $l_2 = 3\text{m}$ ,  $l_3 = 4\text{m}$  and  $l_4 = 2\text{m}$ . The shaft is made of steel ( $E = 2.07 \times 10^{11}\text{ N/m}^2$ ) with solid circular cross section of diameter 10cm. [10]

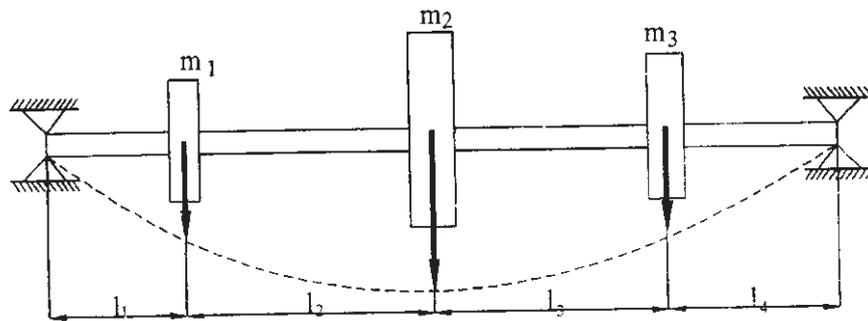
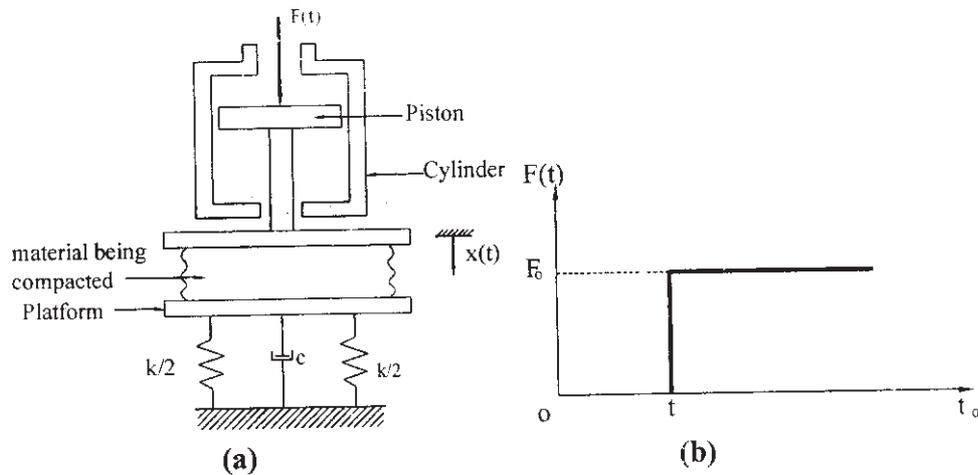


Fig.1

**Q2)** A bar fixed at one end is pulled at the other end with a force  $P$ . The force is suddenly released. Derive an expression for longitudinal vibration of the bar. [10]

P.T.O.

**Q3)** Find the response of the compacting machine shown in Fig.2 (a) when it is subjected to the force shown in Fig.(b). **[10]**



**Q4) a)** Explain single plane balancing of rotating machines using vibration analyzer? **[4]**

b) A 200 kg machine is attached to a spring of stiffness  $4 \times 10^5$  N/m. During operation the machine is subjected to a harmonic excitation of mass 500kg and frequency 50 rad/sec. Design an undamped vibration absorber such that the steady state amplitude of the primary mass is zero and the steady state amplitude of the absorber mass is less than 2mm. What are the natural frequencies of the system with absorber in place. **[6]**

**Q5) a)** What are various condition monitoring techniques? Explain time domain techniques in detail. **[6]**

b) Explain basic vibration measurement scheme with neat block diagram. **[4]**

**Q6) a)** Explain wide band and narrow band random vibrations. **[6]**

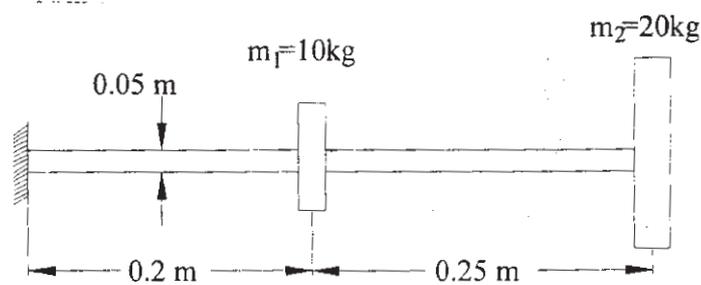
b) Explain power spectrum and power spectral density with suitable example. **[4]**

- Q7) a)** A single DOF system with natural frequency  $\omega_n = \sqrt{\frac{k}{m}}$  and damping  $\xi = 0.20$  is excited by the force; **[5]**

$$\begin{aligned}
 F(t) &= F \cos \frac{1}{2} \omega_n t + F \cos \omega_n t + F \cos \frac{3}{2} \omega_n t \\
 &= \sum_{m=1/2, 1, 3/2} F \cos m \omega_n t
 \end{aligned}$$

Determine the mean square response and compare the output spectrum with that of the input.

- b)** Determine the flexibility influence coefficient for the system shown in **[5]** Fig.3. Take  $E = 2.1 \times 10^{11} \text{ N/m}^2$ .



**Fig.3**

- Q8) a)** Explain phase plain method to solve transient vibration problems in detail. **[4]**
- b)** Write a short note on in - situ balancing of rotors. **[3]**
- c)** Explain experimental modal analysis? **[3]**



Total No. of Questions : 7]

SEAT No. :

P4134

[4760] - 1069

[Total No. of Pages :2

**M.E. (Mechanical Design)**  
**FINITE ELEMENT METHOD**

**(2013 Credit Pattern) (Semester - II) (502209)**

*Time : 2Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** Discuss finite element i.e. geometry of element, its nodes, nodal dof? [10]

**Q2)** Solve the following equation using Galerkin's Method (Use at least two parameters solution) [10]

$$dy/dx = 40(1 + \cos x) - 0.05y, 0 \leq x \leq 1$$

$$y(0) = 230$$

**Q3)** The fixed bar shown in fig 1. has axial forces applied at  $L/3$  and  $2L/3$ . Use FEM to compute the axial deflection and support reaction? [10]

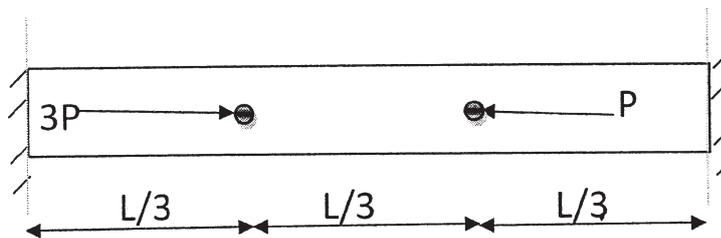


fig1.

**Q4)** Explain in detail shape functions linear and quadratic. [10]

*P.T.O.*

**Q5)** Determine the two eigenvalues and eigenvectors corresponding to the two nonzero masses, using the method of subspace iteration. **[10]**

$$[\mathbf{K}] = \begin{vmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & -1 & 0 \\ 0 & -1 & 2 & -0 \\ 0 & 0 & -1 & 1 \end{vmatrix}$$

$$[\mathbf{K}] = \begin{vmatrix} 2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

**Q6)** Explain in detail Adaptive finite element technique. **[10]**

**Q7)** What is explicit method? Explain it in detail? **[10]**



Total No. of Questions : 6]

SEAT No. :

P4393

[Total No. of Pages : 2

[4760]-1070

**M.E. (Mechanical Design Engineering)**  
**OPTIMIZATION TECHNIQUES**  
**(2013 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is the meaning of optimization? What are the different mathematical techniques for dealing optimization problems? **[6]**
- b) Describe the following : **[4]**
- i) Design constraints.
  - ii) Design Vector.
- Q2)** a) What is a convex set and non-convex set? **[4]**
- b) A manufacturer produces two types of machine parts  $P_1$  and  $P_2$ , using lathes and milling machines. The machining times required by each part on the lathe and the milling machine are given below :

|          |           | Machine Time (hr) required<br>by each unit on |                 |  |
|----------|-----------|---|-----------------|--|
| M/c Part | Lathe M/c | Milling M/c                                   | Profit per unit |  |
| $P_1$    | 5         | 2   | Rs. 200         |  |
| $P_2$    | 4         | 4   | Rs. 300         |  |

**P.T.O.**

If the total machining time available in a week are 500 hours on lathe and 400 hours on milling machines, determine the total number of units of  $P_1$  and  $P_2$  are to be produced per week so as to maximize the profit. [6]

- Q3)** a) Find the value of  $x$  in the interval  $[0, 3]$  using golden section method upto six iterations. [6]

$$F(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65 \times x \times \tan^{-1}\left(\frac{1}{x}\right).$$

- b) What are the advantages of Powell's method? [4]

### SECTION - II

- Q4)** a) Write in brief the important stages in genetic algorithm. [5]

- b) Write in brief the analogy used in simulated annealing method. [5]

- Q5)** a) Minimize the function  $F(x) = x \times (x - 1.5)$  using Newton-Raphson method with a starting point  $x_1 = 1.0$ . [5]

- b) What do you mean by topology optimization? Explain with a suitable example. [5]

- Q6)** a) Write the flow chart of the BESO (Bidirectional Evolutionary Structural Optimization) Method. [6]

- b) Write a short note on : [4]

- i) Neural network.
- ii) Fuzzy optimization.



Total No. of Questions : 8]

SEAT No. :

P4733

[Total No. of Pages : 2

[4760]-1071

M.E. (Mechanical) (Design Engineering)

MECHANICAL MEASUREMENT AND CONTROL

(2013 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any Five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Explain different types of errors in measurement. [5]

b) Explain uncertainty in measurement system. [5]

Q2) a) Computer Karl Pearson coefficient of correlation from the following data using 20 as mean for price, 70 as mean for demand. [6]

|        |    |    |    |    |    |    |    |    |    |
|--------|----|----|----|----|----|----|----|----|----|
| Price  | 14 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| Demand | 84 | 78 | 70 | 75 | 66 | 67 | 62 | 58 | 60 |

b) Differentiate between regression and correlation analysis. [4]

Q3) a) Computer correlation coefficient from the data [7]

$$N = 10, \sum x = 350; \sum y = 310, \sum (x - 32)^2 = 162, \sum (y - 32)^2 = 222,$$

$$\sum (x - 35)(y - 31) = 92$$

b) What are the properties of regression coefficients. [3]

Q4) a) Explain the construction and working of ultrasonic flow meter. [6]

b) Explain the working of thermal conductivity gauge with a neat sketch. [4]

Q5) a) Explain with neat sketch, principle of working of capacitance level gauge. [6]

b) How do you measure frequency and phase angle? [4]

P.T.O.

- Q6)** a) Differentiate between time domain and frequency domain based modelling approach. [5]  
b) Discuss the application of closed loop control system in automotive. [5]
- Q7)** a) Using Routh Horwitz criterion, find the stability of closed loop system given below  
 $C(s)/R(s) = (2s+1)/(s^3+3s^2+3s+1)$  [7]  
b) Discuss the importance of Transient response specifications w.r.t. performance of control system. [3]
- Q8)** a) Discuss the advantages of PID controller. [5]  
b) Explain frequency domain analysis using Bode plots. [5]



## M.E. (Mechanical - Mechatronics)

## SYSTEM MODELLING, IDENTIFICATION &amp; SIMULATION

## (2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

SECTION - I

Q1) a) For the mass spring damper system in Fig 1 (a):

[7]

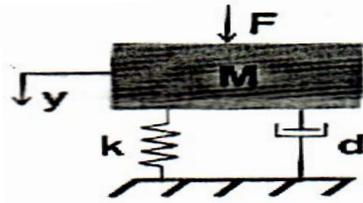


Fig 1 (a)

- i) Derive the governing differential equation using Lagrangian Mechanics.
  - ii) Assuming position and velocity to be the states of the system, determine the state space matrix A, B, C and D and write the system model in state space form.
- b) Write three distinct points of comparison between the state space modelling approach and the transfer function based modelling approach. [3]
- Q2) a) Draw the block diagram for the transfer function in Eq. (1) [6]

$$\frac{C(S)}{R(S)} = \frac{(s + 3)}{(s^2 + 10s + 24)}$$

- b) Define the following variables with respect to Bond Graph Modelling: Flow, Effort, Junction, Power Variable. [4]

P.T.O.

**Q3) a)** Write a short note on “Black Box Identification”. [7]

b) List 3 distinct reasons for the implementation of “Similarity Transformation:”. [3]

**Q4) a)** Draw the flow chart and explain the identification of straight line model using least square technique. [6]

b) List and draw four different types of membership functions. [4]

**Q5) a)** Differentiate between supervised and un-supervised learning. [5]

b) Draw a suitable diagram and explain the process of determination of frequency response, experimentally. [5]

**Q6) a)** Draw the flow chart and explain the workng of Linear kalman Filter. [7]

b) Write three distinct points of comparison between Fuzzy Logic and Artificial Neural Networks. [3]

**Q7) a)** Draw the bond graph for the mechanical system shown in Fig 7 (a). [5]

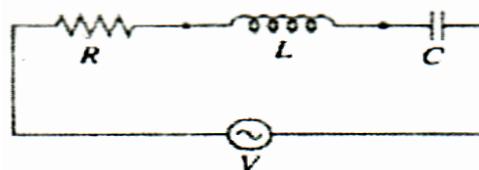


Fig 7 (a)

b) Identify a straight line model for below dataset. [5]

|     |     |     |   |   |     |   |     |
|-----|-----|-----|---|---|-----|---|-----|
| $x$ | 1   | 2   | 3 | 4 | 5   | 6 | 7   |
| $y$ | 0.5 | 2.5 | 2 | 4 | 3.5 | 6 | 5.5 |



[4760] - 1073

M.E. (Mechanical - Mechatronics)

CONTROL SYSTEMS - I

(2013 Pattern) (Semester - I)

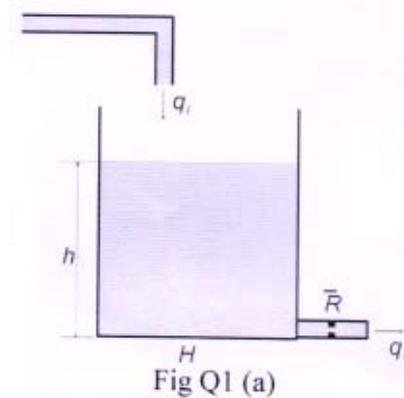
Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1)** Derive the governing differential equation for the hydraulic system in Fig Q1 (a) and write in state space form. [7]



b) Discuss the significance of the ratio Q/R in an LQR type optimal controller. [3]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\omega_n^2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad \text{Eq.(1)}$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

**P.T.O.**

- Q2)** a) Derive the equivalent transfer function for the state space model in Eq. (1). [5]
- b) For the state space model in Eq. (1) determine the location of the poles and comment on the stability of the system. [5]
- Q3)** a) Analyze the controllability and the observability of the state space model in Eq. (1). [6]
- b) Why does full state feedback control require a system to be controllable? Explain. [2]
- c) Why does full state feedback control require a system to be observable? Explain. [2]
- Q4)** a) For the state space model in Eq. (1), determine a full state feedback gain,  $k$ , such that the desired closed loop system has its poles located at  $-3\omega_n$ . Also, determine the equation for the control signal,  $u$ . [7]
- b) For the state space model in Eq. (1), determine the A matrix of the closed loop system using the full state feedback gain  $k$  from Q 4 (a). [3]
- Q5)** a) Using the Ackerman's method build an observer such that the observer poles are located at 5 times the closed loop poles. Consider the closed loop poles to be of the closed system from Q 4-(b). [7]
- b) For the system in Eq. (1), determine the A matrix for the compensator using the full state feedback gain  $k$ , and the observer gain  $L$  from Q 4 (a) and Q 5 (a) respectively. [3]
- Q6)** a) Write a short note on Integral Control with Full State Feedback. [7]
- b) Using Routh Hurwitz criterion assess the closed loop stability of system represented in Eq. (2). [3]

$$x^3 + 3x^2 + 3x + 1 = 0 \quad \text{Eq.(2)}$$

- Q7)** a) Draw a block diagram for a control system made up of the plant, the observer and the compensator. [7]
- b) Comment on following statement: “The poles of the observer must be faster than the poles of the closed loop system”. [3]





Total No. of Questions : 7]

SEAT No. :

**P4611**

**[4760]-1074**

[Total No. of Pages : 2

**M.E. (Mechanical-Mechatronics)**  
**SENSORS, TRANSDUCERS & INTERFACING TECHNIQUES**  
**(2013 Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures, diagrams wherever necessary.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain the Chauvenet's criterion with suitable example. [5]  
b) Discuss the various types of experimental errors. What are the causes of these errors. [5]
- Q2)** a) Explain the operation of variable resistance transducer with the help of neat diagram. [5]  
b) State the main features of digital storage oscilloscope. Also compare analog instruments with digital instruments. [5]
- Q3)** a) Using neat diagram explain the operation of Bridgeman gauge. Also indicate its advantages & drawbacks. [5]  
b) Explain the pirani thermal conductivity gauge with suitable diagram. [5]
- Q4)** a) Explain briefly: [5]  
i) Hot film anemometer.  
ii) Pressure probe.  
b) Explain impact of pressure in supersonic flow with neat diagram. [5]

**P.T.O.**

- Q5)** a) Explain the method of humidity measurement using neat diagram. [5]  
b) Explain the thermocouple compensation technique in detail. [5]
- Q6)** a) What is strain gauge? What are the different types of strain gauges? Draw the experimental set-up of strain measurement using instrumentation amplifier. [5]  
b) Discuss the different schemes of temperature compensation to be performed on resistance strain gauge. [5]
- Q7)** a) Enlist the important features of digital-to-analog converter. With the help of neat circuit diagram explain the R-2R ladder n/w based DAC. [5]  
b) Write short note on: [5]  
i) Signal conditioning.  
ii) Data transmission.



Total No. of Questions : 8]

SEAT No. :

P4525

[Total No. of Pages : 3

[4760] - 1075

**M.E. (Mechanical) (Mechatronics)**

**PLC PROGRAMMING**

**(2013 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** A motor control circuit with two stop buttons. When the start button is depressed. The motor runs. By sealing, it continues to run when the start button is released. The stop buttons stop the motor when they are depressed. The push - to - on button A and B are two start buttons, any one is to be pushed to start the motor. The motor continues to be on until two stop buttons are pushed. The push - to off buttons C and D are two stop buttons to be pushed simultaneously to stop the motor, Construct a Gate Logic Circuit for this statement. **[4]**

**b)** Write the Boolean expression and draw the gate logic diagram and typical PLC logic ladder diagram for a control system wherein a fan is to run only when all of the following conditions are met: **[6]**

- i) Input A is OFF
- ii) Input B is ON or input C is ON, or both B and C are ON
- iii) Inputs D and E are both ON
- iv) One or more of inputs F, G, or H are ON

**Q2) a)** List eight different types of data files. **[4]**

**b)** What instruction would you select for each of the following input field devices to accomplish the desired task? (State the reason for your answer.)

**[6]**

**P.T.O.**

- i) Turn on a light when a conveyor motor is running in reverse. The input field device is a set of contacts on the conveyor start relay that close when the motor is running forward and open when it is running in reverse.
- ii) When a pushbutton is pressed, it operates a solenoid. The input field device is a normally open pushbutton.
- iii) Stop a motor from running when a pushbutton is pressed. The input field device is a normally closed pushbutton.

- Q3)** a) Discuss the advantages of PLC over Hardwired contactor logic. [4]
- b) Identify with reason the type of counter you would choose for each of the following situations: [6]
- i) Count the total number of parts made during each shift.
  - ii) Keep track of the current number of parts in a stage of a process, as they enter and exit.
  - iii) There are 10 parts in a full hopper. As parts leave, keep track of the number of parts remaining in the hopper.

- Q4)** a) Enlist with significance the contents words in the timer file in PLC programming. [4]
- b) Develop a Gate Logic and corresponding PLC ladder logic diagram for any three of the following. [6]
- i)  $Y = ABC + D$
  - ii)  $Y = \bar{A} (B+CD)$
  - iii)  $Y = (A+B) (\bar{C}+D)$
  - iv)  $Y = (ABC + D) (E\bar{F})$

- Q5)** a) Compare on Delayed Timer and Off Delayed Timer instruction with one example. [6]
- b) Describe four tasks performed by input module. [4]

- Q6) a)** Write four manually operated switches and mechanically operated switches with one application each. [4]
- b)** Study the ladder logic program in Figure Q7-B, and answer the questions that follow: [6]
- What is the purpose of interconnecting the two timers?
  - How much time must elapse before output PL is energized?
  - What two conditions must be satisfied for timer T4:2 to start timing?

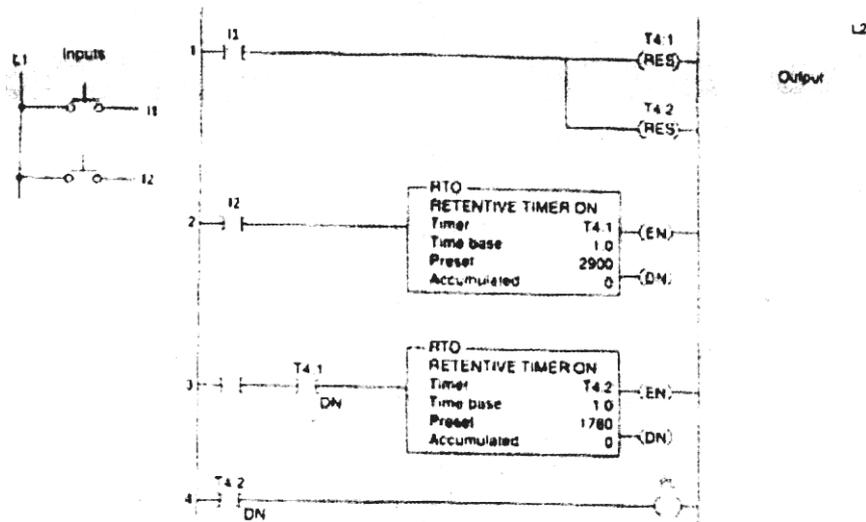


Figure Q7-B

- Q7) a)** Explain what is meant by a TRUE rung condition and a FALSE rung condition. [5]
- b)** Describe Examine ON and Examine OFF conditions in PLC Programming. [5]
- Q8) a)** Describe three basic elements of I/O Address [2]
- b)** Explain the function of input branching? [4]
- c)** Discuss counter Instruction used in PLC programming [4]



Total No. of Questions : 8]

SEAT No. :

P4612

[Total No. of Pages : 2

[4760]-1076

M.E. (Mechanical-Mechatronics)  
CONTROL SYSTEMS - II  
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) From the step response shown in Fig 1, identify the model of the system. [10]

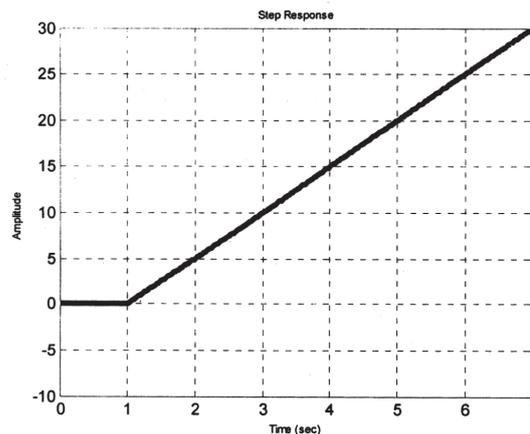


Fig 1

Q2) Identify the transfer function from the Bode Plot shown in Fig 2. [10]

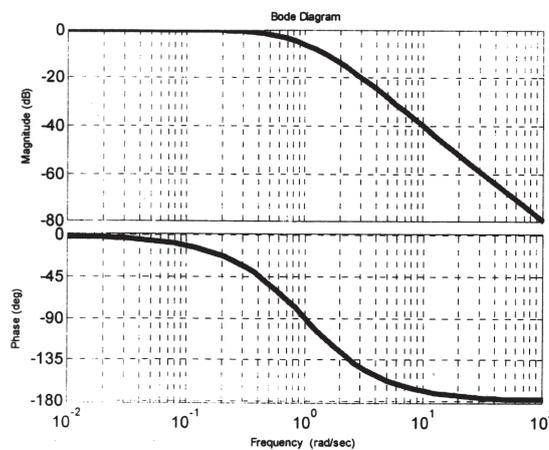


Fig 2

P.T.O.

- Q3)** Derive the transfer function for the PID controller in Parallel Form. Also, list the significance of the Integral as well as the Derivative term in this controller. **[10]**
- Q4)** Discuss the one disadvantage, each, of the Derivative as well as the Integral controller. Also, discuss a method to overcome these respective disadvantages. **[10]**
- Q5)** Using the ZN step response method determine the gains of the PID control for the step response in Fig 1. **[10]**
- Q6)** Draw a suitable block diagram and explain the construction and working of the Internal Model Controller. **[10]**
- Q7)** Draw suitable diagrams, write appropriate equations and discuss the relationship between Sensitivity and Gain Margin and Phase Margin. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P4394**

**[4760] - 1077**

[Total No. of Pages :2

**M.E. (Mechanical) (Mechatronics)**  
**INDUSTRIAL DRIVES AND ACTUATORS**  
**(2013 Credit Pattern) (Semester - II) (502809)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answers any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Explain the concept of Constant power and constant torque drive application by using closed loop control. **[10]**

**Q2)** Explain DC motor with separately excited field winding by using its equivalent circuit and torque speed characteristics. **[10]**

**Q3)** a) Discuss hydraulic power pack with respect to components used, safety measures and symbolic representation. **[5]**

b) Compare electro-hydraulics and PLC-hydraulics with respect to cost, significant advantages and disadvantages. **[5]**

**Q4)** Explain basic principle of operation of three phase induction motor and draw its equivalent circuit. **[10]**

**Q5)** a) Write a short note on counterbalance valve. **[5]**

b) Compare Meter-in and Meter-out circuits with respect to construction, working and one application. **[5]**

**P.T.O.**

- Q6)** a) Derive torque angle relationship for synchronous motor drive. [4]  
b) Write a short note on variable frequency classification converter for Induction motor drive. [6]

**Q7)** With hydraulic circuit and components used, discuss in brief the unloading circuits used in industrial hydraulics. [10]

**Q8)** Answer any two. [10]

- a) Explain Criteria for selecting Electric Drive with reference to thermal consideration.
- b) With a neat sketch, describe construction and working of sequence valves.
- c) Explain basic principle of operation of synchronous motor drive.
- d) Discuss with significance three center positions of directional control valve.



Total No. of Questions : 8]

SEAT No. :

**P3784**

**[4760] - 108**

[Total No. of Pages : 2

**M.E. (Mechanical) (Heat - Power Engineering)**  
**MEASUREMENT TECHNIQUES & DATA ANALYSIS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer three questions from section - I and three questions from section - II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a) Explain the various stages of Measurement. [8]**

b) Explain following terms : [8]

- i) Standard error.
- ii) Mean Standard Deviation.
- iii) Probable error.
- iv) Dynamic errors.

**Q2) a) Calculate the correlation co-efficient from the following data. [12]**

$$N = 10, \Sigma X = 350, \Sigma Y = 310,$$

$$\Sigma (X - 35)^2 = 162, \Sigma (Y - 31)^2 = 222$$

$$\Sigma (X - 35)(Y - 31) = 92.$$

Also find regression line Y on X.

b) Explain different types of correlations. [6]

**P.T.O.**

**Q3) a)** Find two regression equations from the following data [10]

|   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 57 | 58 | 59 | 59 | 60 | 61 | 62 | 64 |
| Y | 77 | 78 | 75 | 78 | 82 | 82 | 79 | 81 |

Estimate the value of Y when X = 65.

b) Differentiate between Regression and Correlation Analysis. [6]

**Q4) a)** Explain Beer - Lambert's Law. [6]

b) Describe with neat sketch the construction and working of hair hygrometer. [10]

### SECTION - II

**Q5) a)** Explain with a neat sketch the working of electromagnetic flow meter. State its advantages & limitations. [10]

b) Explain the working double beam spectro photometer. [6]

**Q6) a)** Explain the working of McLeod gauge for measuring Low pressure. [10]

b) For a McLeod gauge, with a capillary of 1 mm diameter and effective bulb volume of 80 cm<sup>3</sup>, find the reading of Mercury column due to pressure of 15 pa. [6]

**Q7) a)** Explain the working of vortex shedding flow meter. [8]

b) Explain the working of total radiation pyrometer. [8]

**Q8)** Write short notes on any three : [18]

- a) Noise meter.
- b) Capacitance level gauge.
- c) P + I + D controller.
- d) Chromatography.
- e) Turbine flow meter.



Total No. of Questions : 7]

SEAT No. :

**P4135**

[Total No. of Pages : 3

[4760] - 1081

**M.E. (Mechanical) (Automotive Engineering)**

**AUTOMOTIVE ENGINE DESIGN**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** The automobile has three litre SI V6 engine that operates on a four stroke cycle at 3600 RPM. The compression ratio is 9.5, the length of connecting rod is 16.6 cm, & the engine is square ( $B = S$ ). At this speed, combustion ends at  $20^\circ$  at TDC. **[10]**

Calculate :

- a) Cylinder bore & stroke length.
- b) Average piston speed.
- c) Clearance volume of one cylinder.
- d) Piston speed at the end of combustion.
- e) Distance the piston has travelled from TDC at the end of combustion.
- f) Volume in combustion chamber at the end of combustion.

***P.T.O.***

**Q2)** Design a connecting rod

Piston diameter = 100mm

Weight of reciprocating part = 1.8 kg.

Length of connecting rod = 315mm

Stroke = 140mm

Speed = 1500-2500

Compression ratio = 4:1

Max explosion pressure = 2.5 MPa

Rankine constant =  $1/6250$  **[10]**

**Q3)** List the requirements of selection of material for IC engine piston. Explain merits & limitations. **[10]**

**Q4)** a) What are different criterias considered while designing of valve gear. **[5]**

b) Why balancing of crankshaft is necessary? Explain how the balancing is done? **[5]**

**Q5)** A engine operating on ideal Otto cycle has compression ratio of 6:1. The pressure and temperature at start of compression are 1 bar & 300 k. Heat supplied during constant volume process is 1170 kJ/kg. Determine peak pressure and temperature, work output per kg of air & air standard efficiency. Assume  $C_v = 0.717 \text{ kJ/kg K}$  &  $r = 1.4$  for air. **[10]**

**Q6)** a) Explain the operating variables that affects performance of S1 engine. **[5]**

b) What is the importance of firing order in an engine. **[5]**

**Q7)** Write short note on any two :

**[10]**

- a) Cetane Number.
- b) EGR.
- c) Causes of torsional vibration in crankshaft.
- d) Design of cooling system.



Total No. of Questions : 7]

SEAT No. :

**P4136**

**[4760] - 1082**

[Total No. of Pages :2

**M.E. (Mechanical - Automotive Engineering )  
AUTOMOTIVE SAFETY AND REGULATIONS  
(2012 Course) (Semester - I) (502303)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

**Q1) a)** What is road safety? What are various causes of road accidents? Explain steps to achieve global road safety. **[5]**

b) Describe role of active and passive safety system with suitable example. **[5]**

**Q2) a)** Explain impact on pedestrian by vehicle hit on account of fatal and nonfatal injuries. Describe the activity of pedestrian during the time of injury. **[5]**

b) Describe with neat sketch following reference points used in pedestrian tests carried out in laboratory. Explain meaning of each. **[5]**

i) Bonnet leading edge reference line.

ii) Bonnet rear reference line.

iii) Corner of bumper.

iv) Impact and target point

**Q3) a)** What do you understand by Automobile structure? What are goals of structure towards crashworthiness? Explain. **[5]**

b) What is Federal Motor Vehicle Safety Standard (FMVSS)? Describe various requirements of testing involved in FMVSS. **[5]**

**P.T.O.**

**Q4)** a) Describe with suitable example classification Man-Machine system used in ergonomic design of automobile system. [5]

b) What is role of Safety belts? Explain types of safety belts used in automobile. [5]

**Q5)** a) Explain with neat sketch working of collapsible steering. What is the role in safety of vehicle? Explain. [5]

b) Describe with neat sketch construction and working of Head lamp. [5]

**Q6)** a) Explain Purpose of AIS and explain any one AIS of your choice used in Automobile safety regulation system. [5]

b) Describe Provision made in CMVR for registration of new motor vehicle, and renewal of old registration. [5]

**Q7)** Write Short note on the following (Any Two). [10]

a) Head Restraints

b) Test Procedure for Head Lamp

c) Day Light Running Lamps (DRL).



Total No. of Questions : 7]

SEAT No. :

P4137

[Total No. of Pages : 2

[4760] - 1083

M.E. (Mechanical) (Automotive Engg.) (Semester - II)

ENGINE COMBUSTION TECHNOLOGY

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt ANY FIVE questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** A petrol engine uses  $C_8H_{18}$  as a fuel. The measurement of fuel and air shows the air fuel ratio as 17.025:1 .Calculate stoichiometric air fuel ratio, mixture strength, and volumetric analysis of products of combustion. [7]

b) Explain the dissociation effect during combustion. [3]

**Q2) a)** Determine enthalpy of combustion of gaseous propane at 25°C and 1 atm. Using enthalpy of formation data. [5]

$$hf(CO_2) = -393520 \text{ KJ/Kmole}$$

$$hf(H_2O) = -285830$$

$$hf(\text{Propane}) = -103850 \text{ KJ/Kmole}$$

b) Explain Laminar and Turbulent flame propagation in engines. [5]

**Q3) a)** What are the basic requirements of a combustion chamber used in a gas turbine plant? [5]

b) Draw a neat diagram of annular type combustion chamber and explain its working. [5]

*P.T.O.*

- Q4)** a) Define flame velocity, ignition delay and residence time with reference to gas turbine. And discuss their effects on the performance of gas turbine plant. [5]
- b) What do you understand by flame stability? Why it is so important in the gas turbine combustion chamber. [5]
- Q5)** a) What are the factors affecting knocking and pre ignition in CI engine and explain the effects of variation in these factors in knocking and pre ignition. [5]
- b) What are the major factors to be considered for the design of SI engine combustion chamber. [5]
- Q6)** a) What are the advantages and disadvantages of [5]
- i) Lean burn combustion and
- ii) Stratified charged engine.
- b) Explain the effect of various engine variables on SI engine knock. [5]
- Q7)** a) Explain with figures various types of combustion chambers used in CI engines. [6]
- b) Compare induction swirl and compression swirl. [4]



Total No. of Questions : 5]

SEAT No. :

P4138

[Total No. of Pages : 2

[4760] - 1084

**M.E. (Mechanical) (Automotive Engineering)**

**NOISE VIBRATION AND HARSHNESS**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Solve any Two questions:

- a) What are the Interior sources of noise in vehicle? [5]
- b) Explain the principle of wave propagation. What do you mean by Transverse and Longitudinal sound waves? [5]
- c) A simply supported beam of 1 m length and 50 mm diameter is carrying a mass 100 kg at a distance of 0.25 m from one end. Find the natural frequency of transverse vibrations. Assume Young's modulus of beam material as 250 GN/ m<sup>3</sup> . [5]

**Q2)** Solve any Two questions :

- a) What do you mean by Inverse Square Law? Express the relation between sound intensity level and sound pressure level. [5]
- b) What are the different methods of noise source identification available?[5]
- c) Explain in detail different sound fields and state its significance. [5]

**Q3)** Solve any Two questions :

- a) Explain the single source structure-borne noise transmission path analysis. [5]
- b) What do you mean by sound intensity mapping? What is its significance in NVH? [5]

**P.T.O.**

- c) Two machines are working in noisy environments. The background noise when the machines are in operative is 55 dB. If the two machines having individual sound pressure levels of 85 and 89 dB are switched on simultaneously, determine the combined sound pressure level of the machines along with the background noise. [5]

**Q4)** Solve any Two questions :

- a) What do you mean by Experimental Modal Analysis? What are the different parameters are obtained by Experimental Modal Analysis and explain their significance. [5]
- b) Explain the working of reactive type silencer. [5]
- c) Explain Impedance tube(Kundt's tube) method (ASTM E1050) using two microphones for evaluating sound absorption coefficient. [5]

**Q5)** Write a Short Note (Any two):

- a) Damping Material. [5]
- b) Digital Signal Processing. [5]
- c) Pass by Noise measurement of Vehicle. [5]



Total No. of Questions : 7]

SEAT No. :

**P4139**

**[4760] - 1085**

[Total No. of Pages :2

**M.E. (Mechanical-Automotive Engineering)**

**AUTOMOTIVE CHASSIS DESIGN**

**(2013 Credit Pattern) (Semester - II) (502309)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) What are the objectives of employing a suspension system on an automobile? What purposes are served by the spring and the shock absorber in it? **[4]**
- b) Suspension system of a scooter is fitted with a helically coiled spring of free length 155 mm. Due to road jerk of 500 N it compressed to a length equal to 105 mm. If coil diameter has to be 8 times of wire diameter of the spring. Design the spring. The maximum shear stress should not exceed 65 N/mm<sup>2</sup>. Take  $G = 85 \text{ GPa}$ . Also calculate the spring stiffness and the strain energy absorbed by it. **[6]**
- Q2)** a) Explain difference between: **[5]**
- i) Toe in -Toe Out
  - ii) King pin inclination and steering column inclination.
- b) Describe principle of correct steering. Explain meaning of wheel lock and steering lock angles with sketch. **[5]**
- Q3)** a) Draw layout of a pneumatic brake system used on Bus, name that parts and explain the working. **[5]**
- b) A car has Kerb weight of 9700 N and wheel base of 2520 mm. Its CG is 1250 mm in front of rear axle and 655 mm above the level road. The coefficient of road wheels adhesion is 0.6. If the car is moving upward on a road inclined at an angle 25 degrees with horizontal, calculate the load distribution on the front and rear axles, the acceleration or retardation and stopping distance when, while moving at 60 kmph. **[5]**
- i) The front brakes are applied
  - ii) Rear brakes are applied
  - iii) All the four brakes are applied

**P.T.O.**

- Q4)** a) A truck has wheel base of 4.2 m and weights 66747 N, 75% of the weight being on rear axle. Its CG is 1075 mm above the ground. If the brake produce a deceleration of  $3.05 \text{ m/s}^2$ , find the weight transferred from rear to front axle during braking. [5]
- b) Derive an expression for stopping distance in meters of a truck with all four wheel brakes, in terms of coefficient of friction and speed in KMPH. [5]
- Q5)** a) What are various requirements of wheel? Enumerate the advantages and disadvantages of cast wheel over non-casted wheel. [5]
- b) Give detailed account of a tyre specification. How do the designations of radial and non-radial tyres differ from each other? Explain. [5]
- Q6)** a) Explain with sketch layout of transmission of rigid six wheel vehicles. [5]
- b) Describe purpose of Scammell articulated trailers. [5]
- Q7)** Write short note on the following: (Any Two) [10]
- a) Active suspension system.
- b) Tyre Retreading and Manufacturing.
- c) Wheel Balancing.
- d) Transmission of SIX wheeler.
- e) Aspect Ratio.



Total No. of Questions : 5]

SEAT No. :

P4140

[Total No. of Pages : 2

[4760]-1086

**M. E. (Mechanical) (Automotive Engineering)**

**VEHICLE DYNAMICS**

**(2013 Pattern) (Semester - III)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt ALL questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Attempt any TWO.

- a) Explain characterization of cornering behaviour of tires. **[5]**
- b) Describe ride properties of tires. **[5]**
- c) Compare Radial Ply tire for slip angle verses cornering force. **[5]**

**Q2)** Attempt any TWO.

- a) Derive the equation for maximum tractive effort that the tire ground can support in terms of coefficient of road resistance. **[5]**
- b) Write short notes on Electronic Stability Control. **[5]**
- c) Explain aerodynamic forces and moments. **[5]**

**Q3)** Attempt any TWO.

- a) Explain types of dependent and independent suspensions. **[5]**
- b) Find the geometry that would be necessary to achieve 100% anti-squat in the rear suspension and a geometry to achieve full anti pitch for the solid axle, rear wheel drive vehicle described below. Also find the pitch rate when the geometry is set for 100%anti-squat in rear suspension. The front and rear suspension spring rates are 285 and 11b/in respectively. The CG height is 20.5 inches and wheel base is 108.5 **[5]**
- c) Explain roll center analysis. **[5]**

**P.T.O.**

**Q4)** Attempt any TWO.

- a) Describe steering of tracked vehicles. [5]
- b) Explain the steady-state handling characteristics of a two-axle vehicle. [5]
- c) Sketch and explain the handling behaviour of car with and without vehicle stability control system. [5]

**Q5)** Attempt any TWO.

- a) Write short notes on relation between input and output spectral densities. [5]
- b) Explain the concept of active and semi active suspension with neat sketch. [5]
- c) Explain the effect of wheelbase in road and suspension modelling. [5]



Total No. of Questions : 8]

SEAT No. :

**P4718**

[Total No. of Pages : 2

[4760] - 1087

**M.E. (Mechanical Engineering)**  
**AUTOMOTIVE ENGINEERING**  
**Autotronics**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Draw suitable neat diagram, wherever necessary.*
- 2) *Assume suitable data, if required.*
- 3) *Solve any five questions.*

**Q1) a)** Write a note on Analog & Digital Conversion principles. **[5]**

b) Explain method of voltage to current conversion. **[5]**

**Q2) a)** Explain Fuel Injection System in Automotive **[5]**

b) How Emmission control system work? Explain with neat sketch. **[5]**

**Q3) a)** Give the list of type of faults in Automotive. Explain one of them in detail. **[5]**

b) Write a note on Digital Volt-ohmmeter. **[5]**

**Q4) a)** Write a note on Gas Analyzers. **[5]**

b) Explain 'Diagnostic Trouble Codes (DTCs)' **[5]**

**P.T.O.**

- Q5)** a) Explain construction & working of Air Intake System used in Automotive Air conditioning. [5]  
b) Explain working of evaporator, condenser & thermostatic expansion valve. [5]
- Q6)** a) Give the list of Safety Systems for driver & passenger. [5]  
b) What are the aspects of On-board diagnostic System. [5]
- Q7)** a) Discuss safety & comfort features of Airbag System. [5]  
b) Discuss in brief engine cooling & Warm-Up control. [5]
- Q8)** a) Explain recent trends in central locking. [5]  
b) Write short note on Batteries & regulation for charging. [5]



Total No. of Questions : 8]

SEAT No. :

**P4395**

**[4760] - 1089**

[Total No. of Pages : 2

**M.E. (Mechanical) (Energy Engineering) (Semester - I)**

**ADVANCED THERMODYNAMICS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain Law of corresponding states. **[5]**

b) Discuss the generalised compressibility chart with suitable diagram? **[5]**

**Q2) a)** Explain the phase change process from solid to gas with P-V, T-S and P-T diagram for a substance which shrinks in volume on melting and also for a substance which expands in volume on melting. **[5]**

b) On mollier diagram, why do the isobars diverge from one another. **[5]**

**Q3) a)** Explain increase in entropy principle and entropy generation. **[5]**

b) Discuss the Law of degradation of energy and availability function of closed and open system. **[5]**

**Q4) Write a note on**

a) T-dS relations **[5]**

b) Exergy Destruction. **[5]**

**P.T.O.**

**Q5) a)** Write a note on Maxwell relations. [5]

b) Derive the relation  $(C_p - C_v) = -T \left( \frac{\partial v}{\partial T} \right)_p^2 \left( \frac{\partial p}{\partial v} \right)_T$  [5]

**Q6) a)** Explain the enthalpy of reaction with suitable example. [4]

b) Find the adiabatic flame temperature for methane-air stoichiometric mixture. Consider Initially reactants are at 1 atm and 298 K. Use following data. [6]

| Species          | Heat of formation (kJ/kmol) | Specific Heat Cp at 1200 K(kJ/kmol.K) |
|------------------|-----------------------------|---------------------------------------|
| CH <sub>4</sub>  | -74831                      | --                                    |
| CO <sub>2</sub>  | -393546                     | 56.21                                 |
| H <sub>2</sub> O | -241845                     | 43.87                                 |
| N <sub>2</sub>   | 0                           | 33.71                                 |

**Q7) a)** Discuss the Amagat's Law and Kay's Rule. [5]

b) As applied to statistical thermodynamics, explain the principle of equipartition of energy. [5]

**Q8)** Write a note on

a) The criteria for chemical equilibrium. [5]

b) Explain Inversion Curve and Joule-Thompson Coefficient. [5]



Total No. of Questions : 8]

SEAT No. :

**P3935**

**[4760]-109**

[Total No. of Pages : 3

**M.E. (Mechanical-Heat Power)  
ADVANCED FLUID MECHANICS  
(2008 Course) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer-books.*
- 3) *Draw diagrams wherever necessary.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Assume suitable data wherever necessary.*

**SECTION-I**

**Q1) a)** Derive a generalized expression for total derivative and deduce the same for velocity, density, temperature and pressure. **[8]**

b)  $\bar{V} = (20y^2)\bar{i} - 20xy\bar{j}$ , determine: **[8]**

- i) Angular velocity.
- ii) Vorticity.
- iii) Stream function.
- iv) Velocity potential function. Also determine rate of flow between (1, 1) and (2, 2).

**Q2) a)** What is Stokes first problem, obtain the solution of velocity ( $u = u(y, t)$ ) at any point in the fluid at time 't' for an infinite, incompressible fluid resting on a flat horizontal plate located at  $y = 0$  and stretching to infinity in each direction. At time  $t = 0$  the plate is given a velocity zero. Use

similarity variable  $\eta = \frac{y}{\sqrt{vt}}$ . **[12]**

b) Steel sphere of 4 mm dia. falls in glycerine at a terminal velocity of 0.04 m/s. Assuming Stokes law is applicable, determine **[6]**

- i) Dynamic viscosity of glycerine.

**P.T.O.**

- ii) Drag force, and
- iii) Drag coefficient for the sphere.

Take sp. wt. of steel and glycerine as  $75 \text{ kN/m}^3$  and  $12.5 \text{ kN/m}^3$ .

**Q3) a)** Explain the four simple Potential flows with graphical representations. **[8]**

b) Derive an expression for lift on rotating cylinder (Kutta-Joukowski theorem). **[8]**

**Q4) a)** State the boundary layer theory assumptions. Obtain boundary layer equations in nondimensionalized form. **[8]**

b) Using Karman momentum integral equation calculate the local skin friction coefficient  $C_f$  for the following velocity profiles on a flat plate 1.5m long and 1m wide when placed in water flowing with a velocity of 0.2 m/s.

Take  $\mu = 0.001 \text{ ms/m}^2$   $\frac{u}{U_\infty} = \frac{3}{2}\eta - \frac{1}{2}\eta^3$ . Where  $\eta = y/\delta$ . **[8]**

### SECTION-II

**Q5) a)** Derive an expression of velocity profile in a smooth pipe for turbulent flow. **[8]**

b) Air flows over a smooth flat plate at a velocity of 4.4 m/s. The density of air is  $1.029 \text{ kg/m}^3$  and kinematic viscosity  $1.35 \times 10^{-5} \text{ m}^2/\text{s}$ . The length of the plate is 12m in the direction of flow. Calculate- **[8]**

- i) The boundary layer thickness at 20 cm and 12cm respectively, from the leading edge and
- ii) The drag coefficient for the entire plate surface (both side) considering turbulent flow.

**Q6) a)** What is a need of turbulence modeling? Discuss various turbulence models. [10]

b) Water is flowing through a rough pipe, 400 mm in dia. and 600m length at the rate of 0.65 m<sup>3</sup>/s. Calculate the power loss in overcoming friction per km length of pipe, if the roughness element height ( $\epsilon$ ) = 0.15 mm. Also calculate the maximum velocity. [8]

for laminar flow  $f = \frac{64}{\text{Re}}$

for turbulent flow  $\frac{1}{\sqrt{f}} = 2 \log_{10} \left( \frac{R}{\epsilon} \right) + 1.74$  .

**Q7) a)** Discuss the velocity and pressure variations in flow through Laval Nozzle. [8]

b) Derive an expression for speed of sound. What is the Mach number of flow of air of velocity 200 m/s at 400K? State the types of flow. [8]

**Q8) a)** Obtain expressions for stagnation pressure, stagnation density, and stagnation temperature in compressible flow. [8]

b) Derive an expression for Fanno line & Rayleigh line for normal shock. [8]



Total No. of Questions : 8]

SEAT No. :

P4396

[Total No. of Pages :3

[4760]-1090

M.E. (Mechanical-Energy Engineering) (Semster - II)

ADVANCED HEAT TRANSFER

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1)** Derive the generalized heat conduction equation in cylindrical co-ordinates. [10]

**Q2)** A long 20-cm-diameter cylindrical shaft made of stainless steel 304 (The properties of stainless steel 304 at room temperature are  $k=14.9 \text{ W/m}^\circ\text{C}$ ,  $S=7900 \text{ kg/m}^3$ ,  $C_p=477 \text{ J/kg}^\circ\text{C}$ , and  $\alpha=3.95 \times 10^{-6} \text{ m}^2/\text{s}$ ) comes out of an oven at a uniform temperature of  $600^\circ\text{C}$ . The shaft is then allowed to cool slowly in an environment chamber at  $200^\circ\text{C}$  with an average heat transfer coefficient of  $h=80 \text{ W/m}^2\text{C}$ . Determine the temperature at the center of the shaft 45 min after the start of the cooling process. Also, determine the heat transfer per unit length of the shaft during this time period. [10]

**Q3)** a) Draw velocity boundary layer and thermal boundary layer for flow through tubes and flow over plate. [6]  
b) Explain significance of any four dimensionless numbers in convection. [4]

**Q4)** The temperature of a gas stream is to be measured by a thermocouple whose junction can be approximated as a 1-mm-diameter sphere. The properties of the junction are  $k = 35 \text{ W/m}^\circ\text{C}$ , density= $8500 \text{ kg/m}^3$ , and  $C_p = 320 \text{ J/kg}^\circ\text{C}$ , and the convection heat transfer coefficient between the junction and the gas is  $h = 210 \text{ W/m}^2\text{C}$ . Determine how long it will take for the thermocouple to read 99 percent of the initial temperature difference. [10]

**P.T.O.**

**Q5) a)** Explain natural convection over surfaces in detail? [6]

b) Explain the term effective thermal conductivity in case of enclosure.[4]

**Q6) a)** Explain in detail flow boiling in vertical tube under forced convection. [6]

b) Explain the difference between film wise condensation and drop wise condensation. [4]

**Q7) a)** Explain the term radiation view factor? [5]

b) Write a note on radiation shields and radiation effects. [5]

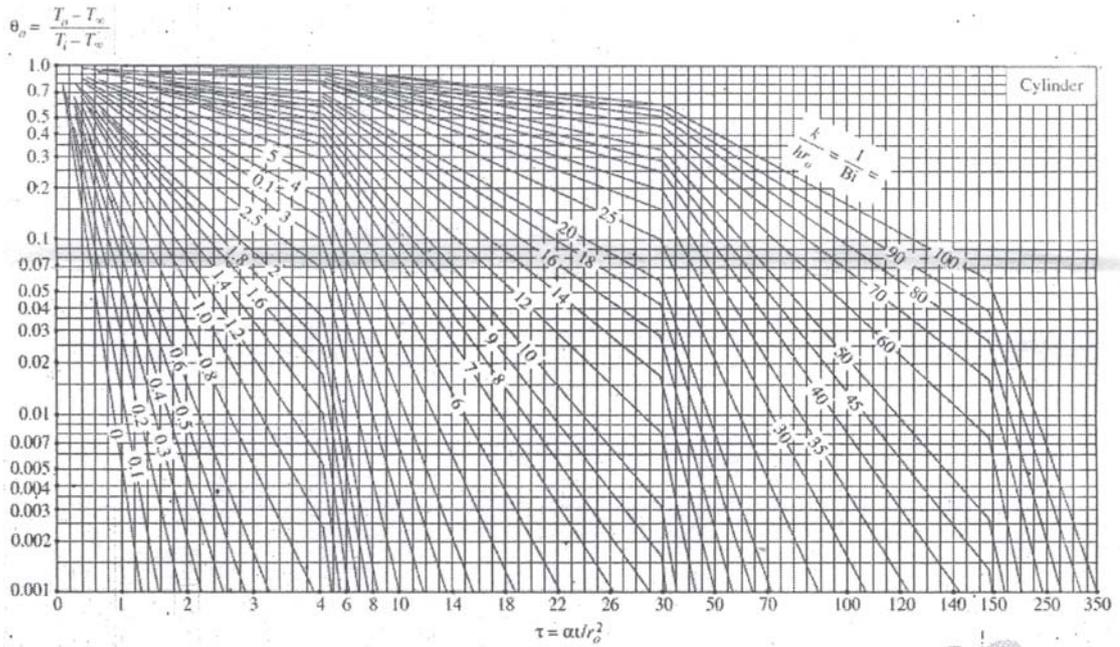
**Q8)** Consider the 5-m 5-m 5-m cubical furnace, whose surfaces closely approximate black surfaces. The base, top, and side surfaces of the furnace are maintained at uniform temperatures of 800 K, 1500K and 500 K, respectively.

Determine [10]

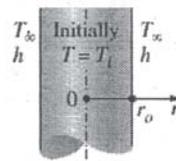
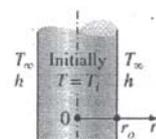
a) the net rate of radiation heat transfer between the base and the side surfaces

b) the net rate of radiation heat transfer between the base and the top surface, and

c) the net radiation heat transfer from the base surface.



(a) Centerline temperature (from M. P. Heisler)



(b) Heat transfer (from H. Gröber et al.)

$$Bi^2 t = h^2 \alpha t k^2$$



Total No. of Questions : 8]

SEAT No. :

P4397

[Total No. of Pages : 2

[4760]-1091

**M.E. (Mechanical-Energy Engineering)**  
**ENERGY CONVERSION SYSTEMS**  
**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** a) Explain in brief classification of energy sources. **[6]**

b) Write a short note on pressure velocity compounding. **[4]**

**Q2)** In an impulse steam turbine, steam is accelerated through nozzle from rest. It enters the nozzle at 9.8 bar dry and saturated. The height of the blade is 10 cm and the nozzle angle is  $15^\circ$ . Mean blade velocity is 144 m/s. The blade velocity ratio is 0.48 and blade velocity coefficient is 0.97. **[10]**

Find:

- a) Isentropic heat drop.
  - b) Energy lost in the nozzles and in moving blades due to friction.
  - c) Energy lost due to finite velocity of steam leaving the stage.
  - d) Mass flow rate.
  - e) Power developed per stage.
  - f) Diagram and stage efficiency. Take: Nozzle efficiency = 92%
- Blade angles at inlet = Blade angles at outlet Speed = 3000 rev/min

**P.T.O.**

- Q3)** a) For boiler at 8 kg/cm<sup>2</sup>(g) steam pressure. The following details are given  
 Saturation temperature of steam = 170°C  
 Sensible heat of water = 171 kCal/kg  
 Latent heat of evaporation = 490 kCal/kg  
 Moisture content in the steam = 4%  
 What is the total heat content of the steam? [5]
- b) The following are the ultimate analysis for coal: Calculate the stoichiometric air requirement. [5]  
 Carbon-38%, Ash-35%, Hydrogen-5%, Sulphur-2%.  
 For the same data, calculate the theoretical CO<sub>2</sub>.  
 If the actual measured CO<sub>2</sub> is 8%, find out the excess air levels?
- Q4)** a) Explain the operating principle of a waste heat recovery boiler with examples. [6]
- b) Explain the operating principle of a heat pump with examples. [4]
- Q5)** a) Explain capacity of the compressor and various efficiencies of the compressor. [5]
- b) Define various components of the compressed air system. [5]
- Q6)** a) Describe advantages of adopting Diesel power plants. [4]
- b) Describe system performance curve for centrifugal pump when they are connected in series. [6]
- Q7)** Explain in detail any two methods to improve the efficiency of gas turbine power plant with cycle analysis. [10]
- Q8)** a) List the factors affecting cooling tower performance. [5]
- b) Write detail classification of hydraulic turbines. [5]



Total No. of Questions : 7]

SEAT No. :

**P4613**

[Total No. of Pages : 2

**[4760] - 1092**

**M.E. (Mechanical Engineering) (Energy Engineering)**

**ENERGY MANAGEMENT**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain the Scope of Energy Management System. **[5]**

b) What are the roles of Energy Manager and Energy Auditor in an energy management program. **[5]**

**Q2) a)** Explain the importance of energy management program in industry. **[5]**

b) Discuss the various Instruments used in Energy Audit. **[5]**

**Q3) a)** Explain any one method of Condensate Heat Recovery. **[5]**

b) Explain the common insulating materials of thermal insulation. **[5]**

**Q4) a)** What is power factor? Explain the major benefits of power factor improvement. **[5]**

b) What are the types of lamps used in lighting system? Write down their features with typical applications. **[5]**

**P.T.O.**

**Q5) a)** Give details on the working principle of Recuperators with a neat diagram. [5]

b) What is Combined Cycle of Co-generation? Explain with neat sketch.[5]

**Q6) a)** Explain High level and Low level Nuclear Waste. [5]

b) Explain Regulations and policy issues of Nuclear waste Management.[5]

**Q7) Write a short note on (any two) :** [10]

a) Different Energy Conservation Opportunities in Boiler System.

b) Heat exchanger networking.

c) Heat pipe.



Total No. of Questions : 7]

SEAT No. :

**P4398**

**[4760] - 1093**

[Total No. of Pages : 2

**M.E. (Mechanical) (Energy Engineering) (Semester - III)**  
**NUCLEAR MATERIALS AND REACTOR FUNDAMENTALS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

**Instructions to the candidates:**

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** A sample of material contains 20 micrograms of californium -252. Californium -252 has a half-life of 2.638 years. **[6]**

Calculate:

- i) The number of californium -252 atoms initially present.
  - ii) The activity of the californium - 252 in curies
  - iii) The number of californium -252 atoms that will remain in 12 years
  - iv) The time it will take for the activity to reach 0.001 curies.
- b) Why uranium -235 fissions with thermal neutrons and uranium -238 fissions only with fast neutrons? Explain in detail **[4]**

**Q2) a)** Describe the following scattering interactions between a neutron and a nucleus: **[6]**

- i) Elastic scattering
  - ii) Inelastic scattering
- b) Explain the hardening and embrittlement of nuclear materials due to exposure of nuclear radiations. **[4]**

**P.T.O.**

- Q3)** a) Explain the fission process using the liquid drop model of a nucleus. [5]  
b) Describe the curve of Binding Energy per Nucleon Versus mass number and give a qualitative description of the reasons for its shape. [5]
- Q4)** a) Explain the following processes of nuclear fuel enrichment. [6]  
i) Gaseous diffusion  
ii) Centrifuge process  
b) Define the following terms: [4]  
i) Fissile material  
ii) Fissionable material  
iii) Fertile material
- Q5)** a) Explain the moderators used in the nuclear reactor. [5]  
b) What is In-situ leaching? Explain in detail [5]
- Q6)** a) How nuclear fuel rods are manufactured? Explain in detail. [5]  
b) Differentiate between boiling water reactor (BWR) Pressurized heavy water reactor (PWR) with neat sketch. [5]
- Q7)** Explain the following processes of nuclear fuel enrichment. [10]  
a) Gaseous diffusion  
b) Centrifuge process



Total No. of Questions : 7]

SEAT No. :

**P4399**

**[4760] - 1094**

[Total No. of Pages :2

**M.E. (Mechanical) (Energy Engineering)**  
**ENERGY SYSTEMS MODELLING & ANALYSIS**  
**(2013 Credit Pattern) (602514) (Semester -III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain two types of system study. **[5]**

b) What is a system? Explain the concept of system and system environment with an example? **[5]**

**Q2) a)** Enlist the types of model and explain any two of them. **[5]**

b) Explain interaction between models. **[5]**

**Q3)** The temperature (T) of a small copper sphere cooling in air is measured as a function of time (t) to yield the following data: **[10]**

|       |       |       |       |      |      |      |      |      |      |
|-------|-------|-------|-------|------|------|------|------|------|------|
| t(s)  | 0.2   | 0.6   | 1.0   | 1.8  | 2.0  | 3.0  | 5.0  | 6.0  | 8.0  |
| t(°C) | 146.0 | 129.5 | 114.8 | 90.3 | 85.1 | 63.0 | 34.6 | 25.6 | 14.1 |

An exponential decrease in temperature is expected from lumped mass modeling. Obtain a best fit to represent these data.

**Q4)** Write short note on. **[10]**

- a) Discrete and continuous system
- b) Necessity of system modeling.

**P.T.O.**

**Q5)** Use the Simplex method to find the maximum value of **[10]**

$$z = 3x_1 + 2x_2 + x_3$$

Subject to the constraints:

$$4x_1 + x_2 + x_3 = 30$$

$$2x_1 + 3x_2 + x_3 \leq 60$$

$$x_1 + 2x_2 + 3x_3 \leq 40$$

where  $x_1 \geq 0$ ,  $x_2 \geq 0$ , and  $x_3 \geq 0$ .

**Q6)** a) Explain basic approach of Lagrange multiplier method? **[6]**

b) What are different search methods? What is importance of search methods in thermal systems? **[4]**

**Q7)** a) Explain Pinch technology; write basis, objective and example. **[5]**

b) Find the minimum of  $f = x(x-1.5)$  using Sequential Dichotomous search method in the interval (0.0, 1.00); take  $\delta = 0.001$  and  $n = 6$ . **[5]**



Total No. of Questions : 7]

SEAT No. :

**P4141**

[Total No. of Pages : 2

[4760] - 1096

**M.E. (Mechanical) (CADME)**

**ADVANCED MACHINE DESIGN**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronics pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Derive the compatibility equations in Cartesian and polar co-ordinate system. **[10]**

**Q2)** a) Investigate what problem of plane stress is represented by the function **[5]**

$$\phi = \frac{3F}{4h} \left( xy - \frac{2Ry^3}{3h^2} \right) + \frac{P}{2} y^2$$

Where 'h' is half depth of beam, and 'F' as the concentrated load.

b) Explain Rayleigh-Ritz method and discuss important characteristics. **[5]**

**Q3)** a) Explain the following terms in context with creep : **[5]**

- i) Estimated time to rupture.
- ii) Stress relaxation.

b) Following creep data at a certain temperature is known

$$S_1 = 10.50 \text{ MPa} \quad \epsilon_1 = 0.012\% \text{ per } 1000 \text{ hrs}$$

$$S_2 = 14.00 \text{ Mpa} \quad \epsilon_2 = 0.025\% \text{ per } 1000 \text{ hrs}$$

Determine the constants of the hyperbolic sine law and calculate the creep rates for stresses 20 MPa and 28 MPa. **[5]**

**P.T.O**

- Q4)** a) Write short note on Low cycle and High cycle fatigue. [4]  
b) What are the factors that affect endurance limit of the machine part. [3]  
c) What is difference between design for finite and infinite life problem. [3]
- Q5)** a) Derive an expression for maximum space efficiency of helical springs. [5]  
b) Write short note on Surge in springs. [5]
- Q6)** a) Explain the use of composite materials in mechanical engineering with two examples, state reasons for preference in favour of such materials. [4]  
b) What is Belleville spring? What are the advantages and applications of Belleville spring. [6]
- Q7)** a) Write short note on Transverse shear effect in composite laminates. [3]  
b) Two  $20^\circ$  full depth gear of 20 and 30 teeth are to be designed on the extended centre distance system using the recommended values for clearance  $f = (0.25/P_d)$ . Make the calculations for  $P_d = 1$ . Find the following:  
i) Values of  $q_1$  and  $q_2$ .  
ii) The actual angle  $\phi$ .  
iii) The radius of actual pitch circle and centre distance.  
iv) The tooth thickness on actual pitch circle. [7]



Total No. of Questions : 7]

SEAT No. :

**P4400**

**[4760] - 1097**

[Total No. of Pages :1

**M.E.Mechanical(CADM&E)  
COMPUTERAIDED DESIGN  
( 2012 Course) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*
- 5) Use of Calculator is allowed.*

**Q1)** Explain with neat sketch, Bezier curves and State its advantages. **[10]**

**Q2)** Explain the Boundary representation approach of solid modelling **[10]**

**Q3)** Explain the parametric equations for the following analytical curves **[10]**

- a) Circle
- b) Parabola

**Q4)** Explain in detail the concept of Sweep Representation in solid? **[10]**

**Q5)** Derive the parametric representation of B-Spline surface? **[10]**

**Q6)** What is Graphics standards, explain IGES and PDES? **[10]**

**Q7)** What is meant by hidden line removal feature in modeling? Explain briefly with example. **[10]**



Total No. of Questions : 7]

SEAT No. :

**P4538**

**[4760] - 1098**

[Total No. of Pages : 1

**M.E. (Mechanical) (Computer Aided Design Manufacturing & Engineering)**

**COMPUTER INTEGRATED MANUFACTURING  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions from following.*
- 2) *Figures to the right side indicate full marks.*

**Q1)** What are elements of CIM? How product is developed through CIM brief with case study. **[10]**

**Q2)** What is importance of database models? Explain EDM and PDM data management? **[10]**

**Q3)** Explain and represent with application : **[10]**  
a) Manufacturing integration model  
b) Flexible manufacturing strategy

**Q4)** What is cellular manufacturing? What are its elements and application? **[10]**

**Q5)** Brief the concept of : **[10]**  
a) Manufacturing integration model  
b) Master production schedule and capacity planning.

**Q6)** Explain web based manufacturing for Casting and forming process with one application. **[10]**

**Q7)** Explain in brief : **[10]**  
a) Lean manufacturing: Principles and characteristics  
b) Functions of Lean production and performance measures and benefits.



Total No. of Questions : 7]

SEAT No. :

**P4401**

[Total No. of Pages : 1

**[4760]-1099**

**M.E. (Mechanical Engineering) (CADME)**

**INDUSTRIAL PRODUCT DESIGN & PRODUCT  
LIFECYCLE MANAGEMENT**

**(Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

- Q1)* Explain QFD and state its application for product planning. [10]
- Q2)* Explain concept generation and concept selection. [10]
- Q3)* Explain benchmarking and establishment of engineering specification. [10]
- Q4)* What is the impact of DFM on development cost & Product quality? [10]
- Q5)* State & explain different characteristics of PDM. [10]
- Q6)* Define PLM, explain architectures of PLM system? [10]
- Q7)* Explain Product work flow. [10]



Total No. of Questions : 8]

SEAT No. :

P4289

[Total No. of Pages : 2

[4760] - 11

**M.E. (Civil) (Construction and Management)**

**PROJECT RISK ANALYSIS AND MITIGATION TECHNIQUES**

**(2008 Pattern) (Elective - II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Q. 1 and Q. 5 are compulsory, Solve any two questions from the remaining from Q.2, Q.3 & Q.4 for Section-I and Solve any two questions from the remaining Q. 6, Q. 7 & Q. 8 for Section-II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary*

**SECTION - I**

- Q1)** a) Explain the role of risk manager in any construction projects ? [9]  
b) Explain briefly, the role of Insurance Management in Risk mitigation? [9]
- Q2)** a) Write a brief note on --- Sensitivity analysis . [8]  
b) Show how decision tree analysis may be used for analyzing sequential decision making in face of risk. [8]
- Q3)** a) Why risk identification is important? Enlist various tools for risk Identification. [8]  
b) Discuss the various steps involved in mitigation of risk. [8]
- Q4)** a) Discuss the duties of Project Manager, Project team member & Risk Manager in carrying out the plan ? [8]  
b) Explain in detail with example - Importance of Risk management in any Infrastructural ? [8]

**P.T.O.**

## **SECTION - II**

- Q5)** a) Write a note on- Break-Even analysis. [9]  
b) Discuss the various steps involved in simulation analysis. [9]
- Q6)** a) Write down different types of risks in construction Industry? Explain any three in details ? [8]  
b) Discuss in briefly requirements for Effective Risk Management System? [8]
- Q7)** a) What are the prons and cons of simulation analysis. [8]  
b) Write a brief note on - Three Point Estimated Method in Risk Measurement? [8]
- Q8)** a) Explain in detail procedure for Monte Carlo Simulation? [8]  
b) Write a note on - Method of risk control in construction Industry. [8]



Total No. of Questions : 8]

SEAT No. :

**P4308**

**[4760] - 110**

[Total No. of Pages :2

**M.E. (Mech.) (Heat Power)**

**INTERNAL COMBUSTION ENGINES FUELS**

**(2008 Pattern) (Semester - II) (Elective - III) (502111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume Suitable data , if necessary*

**SECTION - I**

- Q1)** a) Explain the effect of volatility, antiknock quality, gun deposit, sulphur content in fuel on SI and CI engine. [8]
- b) Discuss the suitability of the Bio gas & Bio Diesel in CI Engine. [8]
- Q2)** a) Explain the basic requirements of a good combustion chamber of S.I. engine and draw a neat sketch of I-head combustion chamber. [8]
- b) Explain the phenomenon of pre-ignition. How pre-ignition leads to detonation and vice-versa? Explain how pre-ignition can be detected?[8]
- Q3)** a) Explain fuel rating of CI and SI Engine. [8]
- b) Describe the SI engine combustion on P- $\theta$  graph. [8]

**P.T.O.**

- Q4)** a) What are the potential sources of biodiesel in India? Explain feasibility of it in India. [8]
- b) What are the potential sources engine variables to optimize the combustion in SI engine? [10]

### SECTION - II

- Q5)** a) Compare induction swirl and compression swirl in CI engine. [8]
- b) Explain the stage of combustion in CI engine. [8]
- Q6)** a) What do you understand by transient mixture requirements? [8]
- b) Explain with neat sketches the different types of compressor for power boosting. [8]
- Q7)** a) What are the air-fuel mixture requirements during the following range of operations of SI and CI engine [8]
- i) Idling and no low load
- ii) normal power range
- iii) maximum power range
- b) Explain the limitation of turbocharging for SI engine. [8]
- Q8)** a) Explain the latest trends in CI engine for performance enhancement and emission reduction. [10]
- b) Explain the various methods of turbocharging for IC engine? Enlist the advantages and limitations over each other. [8]



Total No. of Questions : 7]

SEAT No. :

**P4142**

**[4760] - 1100**

[Total No. of Pages :1

**M.E. (Mechanical) (CADM & E)**  
**AUTOMATED MANUFACTURING SYSTEM MODELING**  
**(2013 Credit Pattern) (502409)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** Discuss in detail Flexible Manufacturing System. What are its advantages. **[10]**

**Q2)** Discuss working of Open Queue and Closed Queue Networks with suitable example. **[10]**

**Q3)** Explain the Queues with General Distributions and Queues with Breakdowns. **[10]**

**Q4)** Discuss GSPN Modeling of Kanban Systems. **[10]**

**Q5)** What is the role of Performance modeling tools in Manufacturing? Discuss. **[10]**

**Q6)** Explain Semi-Markov Processes in Manufacturing with example and analysis. **[10]**

**Q7)** Explain steady state analysis of M/M/1 Queue. **[10]**



Total No. of Questions : 7]

SEAT No. :

**P4143**

[Total No. of Pages : 1

**[4760]- 1101**  
**M.E. (Mechanical) (CADME)**  
**SIMULATION MODELING**  
**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of Calculators is allowed.*
- 5) Assume suitable data if necessary.*

**Q1) a)** Define System and Environment? Discuss Discrete and Continuous System Simulation. **[10]**

**Q2) a)** Explain the procedure for Model Building using Simulation Package with suitable example. Why verification and validation is necessary? **[10]**

**Q3)** Explain Mid Square Method and Mid Product Method for Random Number Generation. **[10]**

**Q4)** Define Modeling of System Randomness. Explain various Sources of Randomness and their effect on Machine Downtime. **[10]**

**Q5)** Describe Uniform Distribution and Weibull distribution in detail. **[10]**

**Q6)** Discuss in detail output Analysis for Terminating Simulation. **[10]**

**Q7)** Discuss in detail Triangular Distribution and Empirical Continuous Distribution. **[10]**



Total No. of Questions : 7]

SEAT No. :

P4717

[Total No. of Pages : 1

[4760] - 1102

**M.E. (Mechanical) (CADM&E)**  
**OPTIMIZATION TECHNIQUES**  
**(Semester - III) (2013 Pattern)**

*Time :3Hours]*

*[Max. Marks :50*

*Instructions to the candidates:-*

- 1) Answer any five questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

**Q1)** Explain Cubic Search Method and Successive Quadratic Estimation. [10]

**Q2)** What is Swarm Intelligence? Discuss in detail Particle Swarm Optimization.  
List Advantages. [10]

**Q3)** Find Optimum solution using Variable Elimination Method. [10]  
Minimize  $F(X_1, X_2) = [X_1^2 + X_2 - 11]^2 + [X_1 + X_2^2 - 7]^2$

**Q4)** Explain in detail Optimality Conditions for One Dimensional and Multi Dimensional Optimization. [10]

**Q5)** Solve using Powell's Method. [10]  
 $F = X_1^2 + X_2^2 - 2X_1 - 4X_2 + 5$

**Q6)** Explain the concept of Simulated Annealing. [10]

**Q7)** Minimize using Linear Programming. [10]  
 $F = 4X + 5Y$   
subjected to

$$\begin{aligned} 10X + Y &\geq 10 \\ 5X + 4Y &\geq 20 \\ 3X + 7Y &\geq 21 \\ X + 12Y &\geq 12 \\ X &\geq 0 \text{ and } Y \geq 0 \end{aligned}$$



Total No. of Questions : 8]

SEAT No. :

**P4144**

[Total No. of Pages : 1

**[4760] - 1103**

**M.E. (Electrical Control System)**

**COMPUTER TECHNIQUES IN CONTROL SYSTEM**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answers Qu 1 or 2, Qu 3 or 4, Qu 5 or 6, Qu 7 or 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Use analytical method to investigate for extremum point  $F(x) = -3x^4 + 10x^3 - 20$ . **[9]**

**Q2)** Use the Lagrange multiplier approach to minimize the function  $F(x) = 4x_1^2 + 5x_2^2$  subjected to  $g(x) = 2x_1 + 3x_2 - 6 = 0$ . **[9]**

**Q3)** Explain what do you understand by Lagrange Function. **[9]**

**Q4)** Explain what do you understand by Multivariable Optimization with no constraint. Write necessary and sufficient condition. **[9]**

**Q5)** Write & Explain Simplex method for solving LPP. **[16]**

**Q6)** Find condition for minimization of the following condition by classical method  $F(x) = 0.5 k_2 x_1^2 + 0.5 k_3 (x_2 - x_1)^2 + 0.5 k_1 x_2^2 - P x_2$ . **[16]**

**Q7)** a) Explain the integer nonlinear programming. **[8]**

b) Explain the Gomory's cutting plane method. **[8]**

**Q8)** Minimize  $f = -3x_1 - 4x_2$  **[16]**  
Subject to  $3x_1 - x_2 + x_3 = 10$   
 $3x_1 + 11x_2 + 2x_4 = 64$   
 $x_i \geq 0, i = 1$  to 4 and  $x_i$  is integer



Total No. of Questions : 6]

SEAT No. :

P4145

[Total No. of Pages :2

[4760]-1104

**M.E. (Electrical) (Control System)**  
**PROCESS CONTROL MANAGEMENT**  
**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Explain in detail the classification of Motivation. [6]
- b) Does the sampling period affect the stability of a discrete time system? Explain with proper example. [6]
- c) Explain Ziegler-Nichols closed loop method for tuning in detail. [6]

OR

- Q2)** a) What are formal & informal groups? Describe each with example. [6]
- b) Explain with suitable example control strategies for designing of control system. [6]
- c) Explain series and parallel structure of a system in process industry.[6]

- Q3)** a) Explain generalized block diagram for feed forward-feedback control systems. [8]
- b) Draw a block diagram of Feedback control system & for each component write transfer function relating its output to input. [8]

OR

**P.T.O.**

- Q4)** a) Develop a feed forward control system for Heat exchanger. [8]  
b) Explain cascade control system for Continuous Stirred Tank Reactor.[8]

- Q5)** a) Define Relative Gain Array [RGA]. Give its significance. [8]  
b) Explain the effect of interaction on stability of process control system.[8]

OR

- Q6)** a) Explain the Relative Gain Array for a process with two inputs and two out puts. [8]  
b) What is one way decoupling of two control loops? Why it could be acceptable? [8]



Total No. of Questions : 6]

SEAT No. :

**P4146**

**[4760] - 1105**

[Total No. of Pages :2

**M.E. (Electrical) (Control System)**  
**NONLINEAR CONTROL SYSTEMS**  
**(2013 Credit Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain with neat diagram **[4]**

- i) Jump resonance
- ii) Amplitude - frequency dependence for nonlinear control system.

b) Explain describing function for ON-OFF relay with dead zone. **[5]**

c) State and explain various singular points present in nonlinear system. **[4]**

d) A unity feedback control system has the forward path transfer

$$G(s) = \frac{2}{s(s+1)}$$
 in cascade with relay whose output amplitude is  $\pm 1$  and

dead zone is  $d = \pm 1$  for unit step input using isocline method, construct the phase plane trajectory. Also comment on stability. **[5]**

OR

**Q2) a)** Explain phase plane trajectory method. **[4]**

b) Determine the frequency and amplitude of limit cycle if it exist and comment on stability of the system for unity feedback control system with ideal relay of out put  $\pm 1$  is connected in cascade with forward

transfer function  $G(s) = \frac{1}{s(s+2)}$ . **[5]**

c) Explain describing function for stability analysis. **[4]**

d) Explain the scalar function given below in Quadratic form and test it for definiteness. **[5]**

$$v(x) = 2x_1^2 + x_2^2 + 3x_3^2 - x_1x_2 + 2x_2x_3 - x_1x_3$$

**P.T.O.**

- Q3)** a) Explain Liapunov direct method to determine stability. [8]  
b) Explain generation of Liapunov function  $v(x)$  by using Krasovskii method. [8]

OR

- Q4)** a) For the LTI system  $\dot{x} = Ax$ , derive the expression  $A^T P + PA = -Q$  where P and Q are Square symmetric positive definite matrices. [8]  
b) Apply Liapunov direct method to determine stability of the system. [8]

$$\dot{x}_1 = -x_1 + x_2 \quad \dot{x}_2 = x_2^2$$

**Q5)** Write short note on: [16]

- a) Input-Output Linearization  
b) Notion of sliding mode control.

OR

**Q6)** Explain clearly steps involved in Input-Output Linearization and Input state Linearization for the system [16]

$$\dot{x}_1 = x_1^2 + 2x_2 + 4$$

$$\dot{x}_2 = x_1 + 4$$



Total No. of Questions : 4]

SEAT No. :

**P4147**

**[4760]-1106**

[Total No. of Pages : 2

**M.E. (Electrical) (Power Systems/ Control Systems/  
Power Electronics and Drives)  
RESEARCH METHODOLOGY  
(2013CreditPattern) (Semester-I)**

*Time :3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1) a)** Distinguish between research methods and research methodology. **[5]**

OR

- a) Explain the different online tools available for literature survey. **[5]**
- b) Explain clearly with examples the difference between applied and fundamental research. **[4]**

OR

- b) Explain the following terms. **[4]**
  - i) Monograph.
  - ii) Treatise.

**Q2) a)** What are the steps of sample design? **[5]**

OR

- a) Explain any two methods of collecting primary data. **[5]**
- b) Explain the characteristic of good sampling design. **[4]**

OR

**P.T.O.**

- b) Explain the following operations in context of data collection and analysis.
- i) Editing [4]
  - ii) Classification

**Q3)** a) What are the standard contents of a thesis? [6]

OR

- a) Explain the significance of bibliography and writing footnotes. [6]
- b) What are the different tools used for making an effective oral Presentation? [4]

OR

- b) What are the different types of reports? [4]
- c) Briefly explain the use of Latex in technical writing. [6]

OR

- c) Discuss various ways in which research misconduct may take place. [6]

**Q4)** a) Name some of the funding agencies in engineering research. Also, explain in detail the format used for writing proposals. [8]

OR

- a) Clearly mention the important parts of a journal paper. [8]
- b) Write the need of a survey paper. [4]

OR

- b) Clearly mention the difference between a journal and conference paper. [4]

- c) Explain different aspects of Intellectual property rights. [4]

OR

- c) What are copyright and patent? [4]



[4760] - 1107

M.E. (Electrical) (Control System)

MULTIVARIABLE AND OPTIMAL CONTROL SYSTEM

(2013 Pattern)

*Time : 3 Hours]**[Max. Marks : 50**Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Represent multivariable control system in **[4]**

- i) State space form
- ii) Transfer Matrix form

Also discuss advantages and disadvantages of representing above mentioned forms.

b) Investigate the observability and controllability of the following system.

$$\dot{x} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} x(t) + \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{bmatrix} u(t) \quad y(t) = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x(t) \quad [5]$$

c) Write short notes on : **[4]**

- i) Model matching control
- ii) Decoupling or Non interactive control.

**P.T.O.**

- d) Obtain typical performance Index for Optimal control of [5]
- i) Minimum fuel problem
  - ii) Minimum time problem
  - iii) Tracking problem

OR

- Q2)** a) Explain the structure of process control multivariable control system with neat block diagram. [4]
- b) Define and explain concept of controllability and observability for multivariable control system. [5]
- c) Explain with neat block diagram the pole allocation using linear state variable feed back in multivariable control system. [4]
- d) State and give out line of procedure to obtain infinite time state regulator problem. [5]

- Q3)** a) Define Hamiltonian and explain briefly the procedure for obtaining optimal control using Hamiltonian method. [8]
- b) Explain clearly the Bang-Bang control strategy. [8]

OR

- Q4)** a) State and give outline of procedure for pontryagin's minimum principle. [8]
- b) Consider the linear time invariant first order system. [8]

$$\dot{x}(t) = u(t)$$

using Hamiltonian method, find optimal control  $u^*(t)$  which minimizes

the PI  $J = \frac{1}{2}x^2(t) + \frac{1}{2}\int_0^1 u^2(t) dt$  where  $x(0) = 0$ ,  $x(1) = -1$ .

**Q5) a)** For linear time invariant system find optimal control  $u^*(t)$  described by state equations.

$$x_1(t) = u(t)$$

$$x_2(t) = x_1(t)$$

Which transfer the state from  $(1, 0)$  to final state  $(0, 0)$  in minimum time with the constraint  $|u(t)| \leq 1$ . **[8]**

b) Explain advantages, disadvantages, constraint of Dynamic programming and pontryagin's minimum principle. **[8]**

OR

**Q6) a)** Explain dynamic programming by **[8]**

i) The imbedding principle

ii) The optimality principle

b) Discuss about singular control solution. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P4705**

**[4760] - 1108**

[Total No. of Pages : 3

**M.E. (Electrical) (Control Systems)**  
**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** In detail explain how a system is identified using the following methods.[6]

- i) Spectral Analysis
- ii) Correlation Analysis

b) Compute the QR factorization of the matrix. [4]

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

OR

**Q2) a)** For a model given by  $Y = \Phi\theta$ , derive the least square estimate of  $\theta$ . Also determine the least square estimate of the parameter 'b' for a model given by  $y(t) = b$ . Discuss the result. [6]

b) What is the importance of a persistently exciting input signal in system identification? What order of p.e. is the PRBS? [4]

**Q3) a)** What are the various model structures used for system identification. What is the criterion for choosing a particular structure? [6]

b) Explain how learning is done in a redundant computer configuration.[2]

**P.T.O.**

OR

**Q4)** Write notes on : **[8]**

- a) Pattern Recognition
- b) Learning without supervision
- c) Recursive Estimation
- d) Maximum Likelihood Method

**Q5)** a) With the help of a block diagram explain the working of a self-tuning regulator. **[4]**

- b) Explain the pole placement design and derive the Diophantine equation. **[8]**
- c) What is the need for adaptive control? How should one choose a suitable adaptive scheme. **[4]**

OR

**Q6)** a) With the help of a real world example discuss how a particular adaptive scheme has been incorporated to improve performance. **[8]**

- b) What are the various adaptive schemes and how are they implemented? **[8]**

**Q7)** Using both the MIT rule and Lyapunov theory, design and MRAS for a system

described by  $G(s) = \frac{b}{s+a}$ , where  $a$  and  $b$  are unknown. The controller is given by  $u(t) = \theta_1 u_c(t) + \theta_2 y(t)$ , and the desired closed loop model is  $\frac{dy_m}{dt} = -a_m Y_m + b_m u_c$ . Draw the simulation diagram and compare the two

methods. Assume  $V(\theta) = \frac{1}{2} \left[ e^2 + \frac{1}{b\gamma} (b\theta_2 + a - a_m)^2 + \frac{1}{b\gamma} (b\theta_1 - b_m)^2 \right]$ . **[16]**

OR

**Q8)** a) Derive the MIT rule and explain the sign-sign algorithm. Why is the choice of adaptation gain important? **[6]**

b) Consider a position servo described by  $\frac{dv}{dt} = -av + bu$  and  $\frac{dy}{dt} = v$ ;

where  $a$  and  $b$  are unknown. Assume the control law  $u = \theta_1(u_c - y) - \theta_2v$  is used and that it is desired to control the system in such a way that the transfer function from command signal to process output is given by

$G_m(s) = \frac{\omega^2}{s^2 + 2\xi\omega s + \omega^2}$ . Determine an adaptive control law that adjusts

the parameters so that the desired objective is obtained. [10]



Total No. of Questions : 3]

SEAT No. :

**P4149**

**[4760] - 1109**

[Total No. of Pages :1

**M.E. (Electrical : Control System)**  
**ADVANCED DIGITAL CONTROL TECHNIQUES**  
**(2013 Credit Pattern) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer all questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1) Solve any three: [18]**

- a) Explain the concept of digital re-design in detail.
- b) Explain the concept of warping and prewarping.
- c) The closed loop poles of the given system are desired to place at  $Z = -3$  and  $Z = -4$  by a state feedback controller with the control  $u = -kx$ . Determine the state feedback gain matrix  $K$  and the control signal.

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -1 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u(x); \quad Y(x) = [1 \quad 0]x(t)$$

- d) Explain decimation and interpolation process with the help of spectral analysis.
- e) Write a short note on digital PID controller.

**Q2) Solve any two: [16]**

- a) Draw and explain block diagram of an adoptive filter as a noise canceller.
- b) State and explain key features of TMS 320 C5X processor.
- c) Explain finite word length effect in digital filters.
- d) Give the applications of TMS 320 typical DSP processors.

**Q3) Solve any two: [16]**

- a) What are the advantages of TMS 320 C54X?
- b) What is Discrete Wavelet Transform? Explain in detail.
- c) Draw and explain memory architecture of TMS 320C54X processor.
- d) Explain instruction set of TMS 320C54X DSP.



Total No. of Questions : 8]

SEAT No. :

**P3785**

**[4760]-111**

[Total No. of Pages : 2

**M.E. (Mechanical - Heat Power)**

**CRYOGENICS ENGINEERING**

**(2008 Course) (Semester - II) (Elective - III) (502111)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer for the two sections should be written in separate answer books.*
- 3) *Neat diagrams should be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of pocket calculator & different gas charts as applicable is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Define Cryogenics. What is the temperature threshold distinguishing Cryogenics from Refrigeration and Air conditioning. [6]
- b) State important landmarks achieved in the field of Cryogenics since its inception. [6]
- c) State boiling points for the gases viz. Helium, Hydrogen, Argon, Nitrogen, Oxygen, Ammonia. [6]
- Q2)** a) Explain Meissner effect with neat sketch. What are the different applications of Meissner effect phenomena in present day world. [10]
- b) State two isotopes in which Helium is found. [6]
- Q3)** a) Explain with neat sketch simple Linde Hampson liquefaction system. [8]
- b) Explain precooled Linde Hampson system with neat sketch. [8]

**P.T.O.**

- Q4)** a) Explain inversion curve with neat sketch. What is the preferred Joules thompson coefficient to achieve cooling. [10]
- b) What are the different performance parameters used in liquefaction systems. [6]

### SECTION - II

- Q5)** a) Explain with neat sketch Stirling refrigerator. [10]
- b) Explain the difference with neat sketch between Cryogenic Refrigerator system and a Cryogenic Liquefaction system. [6]
- Q6)** a) Explain with neat sketch Dilution refrigerator. [10]
- b) Explain the construction of Dewar vessel with neat sketch showing all the components and there function. [6]
- Q7)** a) What are the different piping arrangements possible in Dewar Vessel.[6]
- b) Explain different insulations used in the field of Cryogenics in the increasing order of performance. [6]
- c) State different methods / instruments used to height of liquid level in Dewar vessel. Explain any one. [6]
- Q8)** a) State the different vacuum pumps used in the field of Cryogenics in th increasing order of vacuum achieved. State the operating range of each of the vacuum pump. Explain any one Vacuum pump with neat sketch.[10]
- b) Explain operating range for different Vacuum gauges. [6]

*EEE*

Total No. of Questions : 6]

SEAT No. :

**P4402**

**[4760] - 1110**

[Total No. of Pages :2

**M.E. (Electrical) (Control System)**  
**ADVANCED DRIVES AND CONTROL**  
**(2013 Credit Pattern) (Semester - III) (603101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answers any three questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Compare A.C. Drives and D.C. Drives from following point of view.**[5]**

i) Available supply and nature of output voltage of the controller.

ii) Electric motor of the drive and controller action.

b) With the help of the detail block diagram of the field controlled d.c. motor, derive the transfer function of a variable speed drive. How is the field weakening achieved? **[4]**

c) In reference to the wave form of the output voltage of the controllers across the induction motor windings, explain, with the help of equivalent circuit of induction motor, the effect of **[5]**

i) The space harmonics

ii) The time harmonics

d) Explain, in connection with speed control of induction motor, the following terms: **[4]**

i) Direct vector control

ii) Indirect vector control

OR

**P.T.O.**

- Q2)** a) State and explain the factors affecting the starting time and energy during starting of electric drive system. [4]
- b) Explain how system model and transfer function of converter fed d.c. motor is derived. [5]
- c) Write note on P.W.M.Inverter. [4]
- d) Explain the static krammer control of drive using induction motor. [5]

- Q3)** a) With reference to control of synchronous motor drive, explain dynamic d-q model. [8]
- b) Explain the solid state controller for permanent magent synchronous motor drive. [8]

OR

- Q4)** a) Explain in detail following, with reference to synchronous motor drive, the trapezoidal SPM drive. [8]
- b) Write a note on synchronous reluctance motor. [8]

- Q5)** a) In closed loop control of electric drive, explain the effect of RMS voltage variation on the performance. [8]
- b) Explain with reference to phase locked loop (PLL) [8]
- i) The principle of phase lock
- ii) Design procedure of current controller

OR

- Q6)** a) Explain the modern trends in the drive control. [8]
- b) Explain the role of following controller in closed loop control system of electric drive [8]
- i) Proportional & integral controller
- ii) PID controller.



Total No. of Questions : 6]

SEAT No. :

**P4150**

**[4760] - 1111**

[Total No. of Pages :3

**M.E. (Electrical) (Control System)**  
**COMPUTER AIDED CONTROL SYSTEM DESIGN**  
**(2013 Credit Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Derive the transfer function of the following compensating networks and draw the corresponding Bode diagrams: **[6]**

- i) Phase- lag network
- ii) Phase-lead network

**b)** Define the following design specifications of linear control system and show them on Bode diagrams and polar plot. **[4]**

- i) Gain margin
- ii) Phase margin

**c)** Describe the computer method for obtaining the root-locus plot of a closed -loop linear control system. Draw the flow chart and write its algorithm. **[8]**

OR

**Q2) a)** A control system is represented in state space form **[6]**

$$\dot{x}(t) = A x(t) + B u(t)$$

$$y(t) = C x (t)$$

outline the computer method to determine the controllability and observability of this system. Draw the flow chart and give its algorithm.

**P.T.O.**

- b) What are the merits and demerits of an observer system? Draw the block diagram showing the structure of an observer system. [4]
- c) Explain with algorithm the computer method for simulating the control system containing 'saturation' non-linearity using describing function method. How to determine the stability of non-linear control system using DF method? [8]

- Q3)** a) Explain with diagram the working of P, PI and PID controller. [6]
- b) Explain why the derivative controller is not used in isolated mode. [4]
- c) Explain step by step the design procedure of tunable PID controller using Ziegler-Nichols method. Give its algorithm. [6]

OR

- Q4)** a) Explain clearly the standard compensator structures of P, PI and PID control. [6]
- b) Consider a process control plant with plant transfer function: [10]

$$G_p(s) = \frac{36}{s^3 + 11s^2 + 36s + 36}$$

Design a PID controller for this system using Ziegler-Nichol's method.

- Q5)** a) Draw the functional block diagram of a typical digital control system and clearly explain the working of each block. [4]
- b) Explain clearly the effect of sampling period on stability of the digital control system. [4]
- c) A digital control system is represented by the difference equation [8]

$$x(k+1) = F x(k) + G u(k)$$

With usual notations. Explain the computer method for obtaining closed-loop system response. Draw its flow chart or Give its algorithm.

OR

**Q6)** a) Derive the equivalent discrete-time version of the continuous time system.  
 $\dot{x}(t) = A x(t) + B u(t)$

$$y(t) = c x(t)$$

What are the guidelines for selecting the sampling period 'T'? [6]

b) State and explain the discrete, regulator problem. [4]

c) Explain the following design specifications for digital control system:[6]

- i) Steady- state accuracy
- ii) Control effort constraints
- iii) Sensitivity to parameter variations
- iv) Disturbance rejection.



Total No. of Questions : 3]

SEAT No. :

**P4151**

[Total No. of Pages : 1

**[4760] - 1112**

**M.E. (Electrical) (Power Systems)  
COMPUTER APPLICATIONS IN POWER SYSTEMS  
(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

**Q1) Solve any THREE**

- a) Minimize  $f(x_1, x_2, x_3) = \frac{1}{2} (x_1^2 + x_2^2 + x_3^2)$  subjected to  $g_1 = x_1 - x_2 = 0$   
and  $g_2 = x_1 + x_2 + x_3 = 1$  by direct substitution method. **[18]**
- b) Explain Lagrange's multiplier method for optimization with equality constraints.
- c) Explain steepest descent method for multivariable optimization.
- d) Derive the equation used in AC-DC load flow analysis.

**Q2) Solve any TWO:**

**[16]**

- a) Explain solution economic load dispatch problem using Newton-Raphson method.
- b) Explain classical economic load dispatch with algorithm considering limits.
- c) Two units of the system have following cost curves

$$f(P_{G1}) = 0.00889P_{G1}^2 + 10.333P_{G1} + 200 \text{ Rs / h}$$

$$f(P_{G2}) = 0.00741P_{G2}^2 + 10.833P_{G2} + 240 \text{ Rs / h}$$

The transmission loss are given by

$$P_L = 0.001P_{G1}^2 + 0.002P_{G2}^2 - 0.0004P_{G1}P_{G2}$$

where  $P_G$  is in MW. Determine the economic operating schedule to meet the demand of 150 MW using classical method perform one iterations.

**Q3) Solve any TWO:**

**[16]**

- a) Derive general formula of fault current and fault voltage for LL type fault.
- b) Derive transmission loss coefficient using sensitivity factor.
- c) Explain economic load dispatch for active and reactive power balance.



Total No. of Questions : 6]

SEAT No. :

**P4152**

[Total No. of Pages : 2

**[4760]-1113**

**M.E. (Electrical) (Power Systems)**

**POWER SECTOR ECONOMICS & MANAGEMENT**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator & steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain price-cap and revenue cap regulation also explain RPI-X regime. **[5]**

b) Explain role of central electricity Authority. **[4]**

OR

**Q2)** Explain regulatory process in India. State functions of SERC and CERC. **[9]**

**Q3) a)** Explain wholesale and retail competition models. **[5]**

b) Calculate life cycle cost for following investment first cost Rs. 100000. The revenue generated for subsequent five years Rs. 30000, Rs. 30000, Rs. 25000, Rs. 25000 and Rs. 20000. Take discounting factor as 12%. **[4]**

OR

**Q4)** Explain models of power systems based on contractual arrangement. How to calculate ARR. **[9]**

**Q5) a)** What is market power? Why does it exists? Explain impact of market power on market operation. **[8]**

OR

**P.T.O.**

Explain pricing mechanism for economic dispatch based pricing and for reactive power.

- b) Explain Locational marginal pricing, nodal pricing. [8]

OR

With respect to power market explain following terms.

- i) Demand and price elasticity.
- ii) Market efficiency strategic bidding.

- Q6)** a) What is congestion in power network? How congestion is predicted ?  
What are technical ways to counteract congestion? [8]

OR

What are ancillary services? Explain ancillary services auction.

- b) Explain various methods of pricing of transmission services. Explain effect on congestion on pricing. [8]

OR

What are physical transmission rights? Explain effect of these rights on network operation.



Total No. of Questions : 7]

SEAT No. :

**P4153**

[4760] - 1114

[Total No. of Pages :2

**M.E. (Electrical) Power System  
POWER SYSTEM MODELING**

**(2013 Credit Pattern) (Semester - I) (503203)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Total Four questions. Answer any 1 from Q1 or Q2, Q3 or Q4, and Q5 or Q6 each, Q7 is compulsory.*
- 2) *Assume suitable data, if necessary.*
- 3) *Write down all the assumptions made.*

Given  $F^{abc} = [P] F^{dq0}$ , where Park's transformation

$$[P] = \begin{bmatrix} k_d \cos \theta & k_q \sin \theta & k_o \\ k_d \cos \left( \theta - \frac{2\pi}{3} \right) & k_q \sin \left( \theta - \frac{2\pi}{3} \right) & k_o \\ k_d \cos \left( \theta + \frac{2\pi}{3} \right) & k_q \sin \left( \theta + \frac{2\pi}{3} \right) & k_o \end{bmatrix}$$

(Where,  $K_d = K_q = \sqrt{2/3}$  and  $K_o = \sqrt{1/3}$ )

**Q1)** A synchronous machine is having one damper winding on  $d$ - axis and two damper windings on  $q$ - axis. Derive the stator and rotor voltage equations and torque equations in  $dq0$  frame of reference for this machine. Write down assumptions involve in it. **[18]**

OR

**Q2)** A synchronous generator is represented by an EMF behind a synchronous reactance. For this machine governor controls the shaft input power and the excitation system controls the internally generated EMF  $E_g$ . A synchronous generator is operating at a lagging power factor with current  $I_1$ , internally generated voltage  $E_{g1}$ , and terminal voltage  $V_t$ . Assume that the input power is held constant by governor. With these initial operating conditions, assume that the excitation is decreased to new value  $E_{g2}$ . Assume that the bus voltage is held constant by other machine operating in parallel with this machine. Draw equivalent circuit diagram and with the help of phasor diagram, determine the new value of current  $I_2$ , the new power factor  $\cos \Phi_2$ , and the new torque angle  $\delta_2$ . **[18]**

**P.T.O.**

**Q3)** Explain working of self excited dc exciter with the help of equivalent circuit diagram/the block diagram. **[10]**

OR

**Q4)** Explain with the help of suitable block diagram, the working of solid state voltage regulators. **[10]**

**Q5)** Develop the model of long transmission line. Discuss about the assumptions and approximations involved in it. **[10]**

OR

**Q6)** State the basic types of SVCs. Explain the operating characteristics of variable impedance type SVC. **[10]**

**Q7)** Short note on **[12]**

- a) d-q transformation using  $\alpha - \beta$  variables.
- b) Electromechanical voltage regulators.



Total No. of Questions : 8]

SEAT No. :

**P4154**

[Total No. of Pages : 2

**[4760] - 1116**

**M.E. (Electrical) (Power System)**

**POWER SYSTEM DYNAMICS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Total Five questions. Answer any Two from Q1, Q2 and Q3. Answer 1 question from Q4 or Q5, and Q6 or Q7 each. Q8 is compulsory.*
- 2) *Assume suitable data if necessary.*
- 3) *Write down all the assumptions made.*

**Q1)** Write down the characteristic equation for single machine system neglecting AVR and considering field flux decay and discuss the dynamic stability using coefficient of different power of 's' applying Routh's criterion. **[9]**

**Q2)** Explain the equal area criterion method for the numerical solution of the swing equation for the study of transient stability. State clearly the assumptions made. **[9]**

**Q3)** Explain in brief the operation of power system stabilizer (PSS) with the help of neat block diagram. **[9]**

**Q4)** Derive an equivalent swing equation for two interconnected non coherent machines. The machines are having inertia constants  $H_A$ , and  $H_B$  and load angles  $\delta_A$  and  $\delta_B$ . Prove that the equation of such case is equivalent to swing equation of single machine connected to infinite bus system. **[10]**

OR

**P.T.O.**

**Q5)** Power plant A and Power plant B are operating in two coherent groups. Calculate equivalent inertia constant for this system on a base of 200 MVA, if data given for both plants as.

Power plant A has 4 identical generators each rated 100 MVA and having an inertia constant of 5 MJ/MVA.

Power plant B has 2 identical generators each rated 200 MVA and each having an inertia constant of 2.5 MJ/MVA. **[10]**

**Q6)** Explain

- a) PV curve and
- b) VQ curve; and their use in the analysis of voltage stability of SMLB system. **[10]**

OR

**Q7)** Explain with the help of generator, infinite bus and load bus the concept of voltage and angle instability. Draw separate system diagram and waveform to explain each. **[10]**

- Q8)** a) Two finite machines are connected through ' $\pi$ ' circuit transmission line. Assuming mechanical input constant, calculate the equivalent machine angle and inertia constant if  $H_1 > H_2$ . Also state the mode in which system will operate. **[6]**
- b) Explain voltage instability and voltage collapse. **[6]**



Total No. of Questions : 7]

SEAT No. :

P4712

[Total No. of Pages : 2

[4760]-1117

**M.E. (Electrical) (Power Systems) (Semester - II)**  
**POWER SYSTEM PLANNING & RELIABILITY**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve total four questions. Solve any two from Q1, Q2 and Q3. Solve Q4 or Q5. Solve Q6 and Q7.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1)** What are the factors which affect load forecasting? Explain in detail extrapolation and peak load forecasting methods. [9]

**Q2)** Explain in detail binomial distribution and normal distribution. [9]

**Q3)** Explain Markov process and its application in reliability analysis. [9]

**Q4)** a) Describe various factors affecting generation planning. [6]

b) Explain data required for composite system reliability evaluation. [10]

OR

**Q5)** a) Explain the concept and evaluation technique of loss of load expectation (LOLE) index. [6]

b) What are the objectives of transmission planning? Explain the concept and application of state selection. [10]

*P.T.O.*

- Q6)** a) Explain various factors to be considered in distribution system planning. [6]
- b) Explain the effect of protection failure and effect of transferring load in distribution system. [10]

OR

- Q7)** a) Explain additional interruption indices in distribution system reliability evaluation. [6]
- b) Explain in detail basic reliability evaluation techniques for parallel and meshed network. [10]



Total No. of Questions : 5]

SEAT No. :

**P4155**

**[4760]-1118**

[Total No. of Pages : 2

**M.E. (Electrical) (Power System)**  
**HVDC AND FLEXIBLE AC TRANSMISSION**  
**(2013 Credit Pattern) (Semester-II) (503209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right side indicate full marks.*
- 3) Use of calculator is allowed.*
- 4) Assume suitable data if necessary.*

**Q1) Solve Any Three:**

**[18]**

- a) Explain the working of static synchronous series compensator (SSSC).
- b) Explain the operation and function of UPFC with a block diagram.
- c) Explain the inverter control scheme in STATCOM with control block diagram.
- d) Explain in detail the operation of TCSC and effect of delay angle on its reactance.

**Q2) a)** In a mono-polar HVDC link which is energized with 3-phase 50Hz 400kV source and with six pulse operation, the commutation reactance is 10 ohm and the rectifier end DC voltage is 500 kV. For a delay angle 20 degree, Find, **[8]**

- i) DC link current.
  - ii) Commutation angle.
  - iii) If AC voltage is reduced to 200kV, find the commutation angle.
- b) Compare HVDC and EHVAC. **[8]**

OR

**P.T.O.**

**Q3) a)** Explain the details of HVDC system with functions of different components. [8]

b) Explain the importance of HVDC grounding & how it is achieved in practice. [8]

**Q4) a)** Write about multi terminal HVDC systems configurations. [8]

b) What are the controls in VSC DC system implemented. [8]

OR

**Q5) a)** Derive expression for harmonics present in AC side current, of 12-pulse converter in an HVDC link. [8]

b) Explain the HVDC protection schemes used against over voltages. [8]



Total No. of Questions : 6]

SEAT No. :

**P4156**

[Total No. of Pages : 2

**[4760]- 1119**

**M.E. (Electrical) (Power System) (Semester - III)**

**ADVANCED POWER SYSTEM PROTECTION**

**(2013 Pattern)**

*Time : 2 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2 Q. 3 or Q.4 Q.5 or Q. 6.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables slide rule, mollier charts electronic pocket calculator and steam tables is allowed.*
- 5) All questions carry equal marks.*
- 6) Assume suitable data, if necessary.*

**Q1) a)** Explain numerical overcurrent protection. **[9]**

b) Explain digital protection scheme based upon fundamental signal. **[9]**

OR

**Q2) a)** Explain digital protection of synchronous generator based upon 2nd harmonic current injection. **[9]**

b) Explain protection of transformer using digital filtering scheme. **[9]**

**Q3) a)** Explain directional multizone distance relay. **[10]**

b) Explain co-ordination of overcurrent relays. **[6]**

OR

**Q4) a)** Write a note on computer graphics display. **[8]**

b) Explain integrated operation of national power system. **[8]**

**P.T.O.**

- Q5)** a) Develop algorithm for short-circuit studies. [10]  
b) Explain transformation to symmetrical components. [6]

OR

- Q6)** a) Explain ultra-high speed protective relays. [8]  
b) Explain S.C. Studies in multiphase systems. [8]



Total No. of Questions : 8]

SEAT No. :

**P4309**

**[4760] - 112**

[Total No. of Pages :2

**M.E. (Mech.) (Heat Power Engineering)**  
**NON CONVENTIONAL POWER PLANT**  
**(2008 Pattern) (Semester - II) (Elective - III) (502111 C)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume Suitable data , if necessary*

**SECTION - I**

- Q1)** a) What is the potential of wind energy sources in India? Which is the most commonly used method to collect the information of wind resources? **[8]**
- b) What are the advantages and disadvantages of thermal solar energy conversion? **[8]**
- Q2)** a) What do you understand by CO<sub>2</sub> reduction potential of renewable energy? Explain. **[8]**
- b) Write a note on silent features of electricity act 2003. **[8]**
- Q3)** a) Explain factors considered while designing the central tower type power plant. **[8]**
- b) Write notes on Impact of Green house effect. **[8]**

***P.T.O.***

**Q4)** Write notes on:

**[18]**

- a) Solar flat plate collector
- b) Thermal Energy Storage method.
- c) Economic analysis of a Micro Hydro Power Plant.
- d) Renewable electricity and key elements.

### **SECTION - II**

**Q5)** a) With neat sketch explain horizontal axis and vertical axis with machines. Write down the problems in operating large wind power generators. **[8]**

b) What are the main components of tidal power plants? Explain with sketch working of a double basin operation. **[8]**

**Q6)** a) What are the advantages and disadvantages of solar energy over other energy forms? **[8]**

b) Explain financing mechanisms for non-conventional power plants. **[8]**

**Q7)** a) Write a short note on effect of temperature and concentration ratio on efficiency of solar power plant. **[8]**

b) Explain with neat sketch flash type geothermal power plant. **[8]**

**Q8)** Write notes on:

**[18]**

- a) Applications of fuel cells.
- b) Tidal Power Plant
- c) Solar Chimney



Total No. of Questions : 8]

SEAT No. :

**P4157**

**[4760] - 1120**

[Total No. of Pages :2

**M.E. (Electrical Power Systems)  
POWER QUALITY ASSESSMENT & MITIGATION  
(2013 Credit Pattern) (Semester - III) (603202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve total five questions. Answers any two from Q1, Q2 and Q3. Solve Q4 or Q5, and Q6 or Q7, Q.8 is compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Define term power quality. State various power quality issues. How these are characterized? **[9]**

**Q2)** Explain in detail EMC, immunity and emission in connection with power quality. **[9]**

**Q3)** Discuss causes of over voltages in power systems. Explain mitigation methods for over voltages. **[9]**

**Q4)** Explain impact of reactive power management on RMS voltage variation and different techniques used for reactive power management. **[10]**

OR

**Q5)** Explain voltage sag characteristics such as magnitude, phase angle jump, point on wave initiation and point on wave recovery. **[10]**

**P.T.O.**

**Q6)** Explain impacts of harmonics on power system equipment's and also explain consequences of harmonic resonances. **[10]**

OR

**Q7)** Explain the role of intelligent systems in power quality monitoring. Enlist various equipment's used for power quality monitoring. **[10]**

**Q8)** Explain power quality state estimation, state variable model and observability analysis in detail. **[12]**



Total No. of Questions : 5]

SEAT No. :

**P4158**

[Total No. of Pages : 2

**[4760] - 1121**

**M.E. (Electrical) (Power Electronics & Drives)**  
**MODELING AND ANALYSIS OF ELECTRICAL MACHINES**  
**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) From the basic two-pole machine theory, develop the voltage and torque equations a primitive machine. **[9]**
- i) Synchronous machine.
  - ii) Single phase induction motor.
- b) Derive the expression for instantaneous speed of dc motor and hence comment on the transient behavior of motor for various disturbances. **[9]**

OR

- Q2)** a) Discuss and derive the transformations for currents between a rotating balanced 3- phase winding and a pseudo-stationary 2-phase (d, q) winding. **[9]**
- b) Using voltage matrix, derive the expression for instantaneous torque of a three- phase induction motor. **[9]**

- Q3)** a) The parameters of a 3-phase 50 Hz cylindrical-rotor synchronous machine are:
- Self-inductance per phase = 102 mH
- Armature leakage inductance = 0.23 mH
- Calculate the mutual inductance between armature phases and its Synchronous reactance. **[8]**
- b) Write the impedance matrix for a 3-phase 4-salient pole synchronous machine fitted with amortisseurs. Hence obtain an expression for instantaneous torque. **[8]**

**P.T.O.**

OR

- Q4)** a) Discuss the theory on armature mutual inductance of salient pole synchronous machine from a consideration of its basic parameters. [7]  
b) Discuss how Park's transformations transform equations in ( a, b, c ) variables to (d, q, 0 ) variables. [9]

**Q5)** Write the short notes on (any two): [2 × 8 = 16]

- a) Linearised model of Synchronous machine.  
b) Linearised model of Induction motor.  
c) Small displacement stability.



Total No. of Questions : 6]

SEAT No. :

**P4159**

[Total No. of Pages : 1

**[4760]-1122**

**M.E. Electrical (Power Electronics & Drives) (Semester - I)  
Energy Management and Power Quality in Electrical Drives  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q. 1 or Q. 2 and Q. 3 or Q. 4 and Q. 5 or Q. 6.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Enlist different types of power quality disturbances. **[9]**

**b)** What are various control strategies used for blower Fans? **[9]**

OR

**Q2) a)** What are harmonics? Explain different causes of harmonic generation. **[9]**

**b)** Explain capacitor size and location fixation criteria and cause of power losses. **[9]**

**Q3) a)** What is power quality benchmarking? Explain in detail. **[8]**

**b)** Explain various voltage regulation devices & its operation. **[8]**

OR

**Q4) a)** Explain the term harmonics and corrective measures to be applied in detail. **[8]**

**b)** Discuss a case study for harmonic filter design. **[8]**

**Q5) a)** Explain the application of intelligent system in power quality monitoring. **[8]**

**b)** List various power quality monitoring instruments and briefly explain their use. **[8]**

OR

**Q6) a)** Explain objectives and consideration of power quality monitoring. **[8]**

**b)** Discuss various power quality monitoring standards. **[8]**



Total No. of Questions : 6]

SEAT No. :

**P4160**

[4760] - 1123

[Total No. of Pages :2

**M.E. (Electrical) (Power Electronics & Drives)**

**POWER CONVERTERS**

**(503303) (2013 Credit Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1) a)** Explain the operation of Buck converter with necessary waveforms. **[8]**
- b) Explain the working of a Single Phase fully controlled bridge converter supplying RLE load with a neat diagram and waveform. Derive the expression for average output voltage. **[10]**

OR

- Q2) a)** Describe the working principle of a single phase CSI when its load is a capacitor. Also show that the frequency of input voltage to CSI is twice the frequency of triggering of thyristors. **[8]**
- b) Explain three phase voltage source inverter (180° conduction mode) with necessary waveforms and derive the line-line output voltage equation using fourier series. **[10]**

- Q3) a)** Describe ZVS resonant converters with appropriate circuit diagram and waveforms. **[10]**
- b) What are the advantages and limitations of ZCS converter? **[6]**

OR

- Q4) a)** Explain voltage source series resonant inverters. **[10]**
- b) What are the advantages and limitations of ZVS converter? **[6]**

*P.T.O.*

- Q5)** a) What are the advantages and disadvantages of bidirectional control? Explain single phase bi directional controller with R load. [10]
- b) A single phase AC voltage regulator feeds an RL load having an impedance angle of  $60^\circ$ . For the conduction angle of  $140^\circ$ , determine the firing angle and load voltage as a ratio of the supply voltage. [6]

OR

- Q6)** a) Explain the working of  $3\phi - 1\phi$  cycloconverter with a neat diagram and relevant waveforms. [10]
- b) What are the advantages and disadvantages of cycloconverters? [6]



Total No. of Questions : 7]

SEAT No. :

**P4161**

[Total No. of Pages : 2

**[4760] - 1125**

**M.E. (Electrical) (Semester - II)**  
**POWER ELECTRONICS & DRIVES**  
**Ac And Dc Drives**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Questions No.1 & 7 is compulsory out of remaining attempt one question.*
- 2) Figure to the right indicates full marks.*

**Q1) a)** Explain speed control of DC separately excited dc motor fed by a full converter. **[10]**

Discuss:

- i) The output waveforms and its effect on torque
  - ii) Two quadrant operation of the drive
  - iii) Equations for converter output
  - iv) Overall performance of the drive and applications
- b) Discuss four quadrant converter fed to DC motor with constant excitation. Sketch the characteristics in all quadrants showing changes in firing angle of switching devices. **[8]**

OR

**Q2) a)** Discuss four quadrant operation of DC Chopper fed separately excited dc motor. Write all the expressions to justify the operation of the drive. **[10]**

- b) Explain regenerative braking of dc motor. Justify your explanation using torque speed curves. What is maximum braking speed? **[8]**

**P.T.O.**

- Q3)** a) With necessary diagrams, explain static Kramer drive system. Explain how the change in speed is achieved by changing firing angle of inverter. [10]
- b) With necessary sketches, discuss VSI fed 3-phase induction motor. Discuss on harmonics and their effect on motor performance. [6]

OR

- Q4)** a) Draw the space phasor diagram and explain the principle of field oriented control in induction motor. Compare DC motor control analogy with vector controlled induction motor. [8]
- b) Draw the schematic block diagram and explain direct vector control of induction motor. [8]

- Q5)** a) On switched reluctance motor, explain the following aspects. [10]
- i) Construction,
  - ii) Principle of torque generation and speed reversal.
  - iii) Inductance profile of Stator phase winding.
- b) Explain the construction, types and applications of stepper motor. [6]

OR

- Q6)** a) What is the basic constructional difference between brushed and brushless dc motor. Explain how the unidirectional torque is generated in brushless dc motor. [8]
- b) Discuss the modes of operation and speed control of switched reluctance drive. State the advantages of switched reluctance motor drive over other ac motor drives. [8]

### COMPULSORY QUESTIONS

- Q7)** a) From the modeling equations of dc motor, draw the closed loop control system where reference input is armature voltage and speed is the controlled output. [6]
- b) Write the dynamic model of dc separately excited motor and derive the transfer function for armature controlled separately excited dc motor. [10]



Total No. of Questions : 8]

SEAT No. :

**P4162**

[Total No. of Pages : 2

**[4760] - 1126**

**M.E. (Electrical) (Power Electronics and Drives)  
DESIGN OF POWER ELECTRONIC SYSTEMS  
(2013 Pattern)**

*Time : 2.30 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any one from 1&2,3&4,5&6,7&8*
- 2) *Neat Diagrams to the right indicate full marks*
- 3) *Use of calculator is allowed*
- 4) *Assume suitable data if necessary*

**Q1)** Derive mathematical model of 1GBT **[9]**

OR

**Q2)** Derive the mathematical modeling of single phase inverter using circuit averaging method **[9]**

**Q3) a)** Design a heat sink for a dc-dc Buck system **[6]**

- b) For the Buck converter , find the peak device current, the peak dissipation and the case to ambient thermal resistance. Use maximum junction temperature of 150°C and the ambient temperature to be at 40°C and the case temperature should not exceed 60°C. Duty ratio is 40%. The thermal impedance at 400mS is  $Z = 0.4 \text{ } ^\circ\text{C/W}$  **[3]**

OR

**Q4)** An inductor is to be designed to meet the following specifications.  $L = 5$  millihenries ;  $I_{rms} = 3$  A sinewave ;  $f = 100$  kHz ;  $T_s = 90$  C and  $T_a = 30$  C . The inductor is to be fabricated on a double-E core made from 3F3 ferrite. The windings are be made with foil conductors which have  $k_{cu} = 0.6$ . A core size of  $a = 2$  cm is chosen for the design. The emissivity E of the surface of the completed inductor equals 0.9 and that the vertical height is  $3a$ . **[9]**

- a) Determine the conductor cross-sectional area,  $A_{cu}$ , and number of turns N. Ignore eddy currents and the proximity effect.
- b) Specify the length of the airgaps in the core. Assume four distributed airgaps.

**P.T.O.**

**Q5)** Explain the zero voltage switching technique in a Buck converter with necessary diagrams and waveforms [16]

OR

**Q6)** Design a 2.5V, 1A Buck converter from a 12V dc source. The output voltage ripple should be less than 1% of the dc output voltage magnitude. The switching frequency is required to be 50 KHz Consider the minimum load current to be 10% of load to maintain Continuous conduction mode. [16]

**Q7) a)** Explain R and R-C based thyristor firing circuit with circuit diagram and their respective limitations [7]

b) For step down converter circuit, the dc input voltage  $V_d = 500V$ , the load current  $I_0 = 500A$ , and the switching frequency is 1kHz. The free wheeling diode has a reverse recovery time  $t_{rr} = 10\mu s$ . The GTO has a current fall time  $t_{fi} = 1\mu s$ , a maximum applied voltage rate  $dv/dt = 50 V/\mu s$ , and a maximum controllable anode current  $I_{AM} = 1000A$  [9]

i) Find the appropriate values for resistance  $R_s$  and capacitance  $C_s$  for the turn-off snubber circuit.

ii) Estimate the power dissipated in the snubber resistance

OR

**Q8) a)** Explain how gate drive of MOSFET is provided with isolation using optical isolator [8]

b) Explain turn on snubber in detail [8]



Total No. of Questions : 4]

SEAT No. :

**P4163**

**[4760]-1127**

[Total No. of Pages : 2

**M.E. (Power Electronics and Drives)  
ADVANCED CONTROL SYSTEMS  
(2013 Credit Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronic calculator is allowed.*

**Q1) a) Draw diagram and explain Luenberger observer. [4]**

b) Consider a plant described by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

and has a performance index

$$J = \int_0^{\infty} (x^T Qx + u^T Ru) dt \quad \text{where } Q = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix} \text{ and } R = [2]$$

Determine the optimal feedback gain matrix  $k$ . [5]

**Q2) a) Explain the concept of robust control. Also define small gain theorem. [3]**

b) Explain all signal norms. [2]

c) Explain Input Output Linearization in detail. [4]

OR

**P.T.O.**

- c) Obtain IO linearization of the system [4]

$$\dot{x}_1 = -x_1 + \frac{2+x_3^2}{1+x_3^2}u$$

$$x_2' = x_3$$

$$x_3' = x_1x_3 + u \text{ and } y = x_2$$

- Q3)** a) Define and explain Sliding Mode Control. [5]

- b) Write difference between Variable Structure System and Sliding Mode Control. [5]

c) 
$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & 3 & 1 \end{bmatrix}x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}u + \begin{bmatrix} 0 \\ 0 \\ \sin(t) \end{bmatrix}$$

Design a sliding surface for the system to get  $\xi = 0.8$  and  $\omega_n = 5$ . [6]

- Q4)** a) Find the transfer function of buck boost converter. [5]

- b) Describe the control of solar system. [5]

- c) List all power quality devices. Explain any two in detail. [6]



Total No. of Questions : 6]

SEAT No. :

**P4164**

[Total No. of Pages : 2

**[4760] - 1128**

**M.E. (Electrical) (Power Electronics and Drives)**

**POWER ELECTRONICS APPLICATIONS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 3 questions Q. 1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume Suitable data, if necessary.

- Q1)** a) What are the different power system components? Explain each of them with their characteristics. **[4]**
- b) Draw the block diagram of the solar PV system and explain the operation in detail. **[4]**
- c) Write short note on : Filters for harmonic elimination in HVDC system. **[4]**
- d) Explain TSC, TSR by covering the following points. **[6]**
- i) Diagram
  - ii) Operation
  - iii) V-I Characteristics

OR

- Q2)** a) Explain any one application of power electronics in power system. **[4]**
- b) What are the different methods of generator control in a wind energy system. **[4]**
- c) Draw the six pulse Graetz circuit and analyze the circuit without overlap. **[4]**
- d) Explain with a neat sketch and waveforms the SSSC type of series controller. **[6]**
- Q3)** a) Describe the controls in Unified Power flow Controllers for shunt and series converters. **[8]**
- b) Starting with basic principle explain the operation of UPFC connected to sending end. **[8]**

OR

**P.T.O.**

- Q4)** a) Describe any two applications of STATCOM using schematic diagram. **[8]**  
b) Draw the building block and explain the working of six pulse STATCOM. **[8]**

- Q5)** a) Draw the block diagram of adjustable speed drives in an air conditioning system. Explain the working of each block. **[8]**  
b) Explain its working of switch mode welder. What are the problems associated with high frequency. **[8]**

OR

- Q6)** Describe following power electronics applications using various possible techniques
- i) Switched mode power supply **[8]**
  - ii) AC-DC electric locomotive systems **[8]**



Total No. of Questions : 6]

SEAT No. :

**P4165**

**[4760] - 1129**

[Total No. of Pages :1

**M.E. (Electrical) (PED)**  
**POWER ELECTRONICS IN SMART GRID**  
**(2013 Credit Pattern) (Semester - III)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Figures to the right side indicate full marks.*
- 3) Use of electronic pocket calculator is allowed.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Explain the main factors of utility deployment. [9]  
b) Explain a HFAC power distribution for telecommunications. [9]

OR

- Q2)** a) Explain various Power quality mitigation methods. [9]  
b) Explain how the Distributed Generation Contributes to Power Quality Problems. [9]

- Q3)** a) Describe Home Area Network (HAN) in detail. [8]  
b) Explain Zig Bee Network and its applications. [8]

OR

- Q4)** a) What is GPS? What are its applications? [8]  
b) Write down a note on CLOUD computing. [8]

- Q5)** a) Explain operation of D-STATCOM along with decoupled current control method. [8]  
b) Explain voltage control scheme used with D-STATCOM. [8]

OR

- Q6)** a) Explain design and working of dynamic voltage sag/swell restorer. [8]  
b) Explain AC/AC electromechanical voltage regulator. [8]



Total No. of Questions : 8]

SEAT No. :

P4310

[Total No. of Pages : 4

[4760] - 113

M.E. (Mechanical Engineering) (Heat Power)

HEAT EXCHANGER SYSTEM DESIGN AND PERFORMANCE

(2008 Pattern) (Elective - IV)

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary and mention it clearly.*
- 6) *Use of steam tables, heat transfer data book, and electronic pocket calculator is allowed.*

**SECTION - I**

- Q1)** a) What are the various correction ( $j$ ) factors considered for shell side heat transfer coefficient in Bell Delaware method? [8]
- b) Outline the step by step thermal hydraulic design procedure for design/performance analysis of Gasketed plate heat exchanger. [8]
- Q2)** a) Water is to be heated from  $10^{\circ}\text{C}$  to  $30^{\circ}\text{C}$  at the rate of 300 kg/s by the atmospheric pressure steam in a single pass shell and tube heat exchanger consisting 25.4 mm scheduled 40 steel pipe. The surface coefficient on the steam side is estimated to be  $11350 \text{ W/m}^2\text{K}$ . An available pump can deliver the desired quantity of water provided that pressure drop through the pipe does not exceed 101 kPa. Calculate the number of tubes in parallel and length of each tube necessary to operate the heat exchanger with the available pump. [8]

**P.T.O.**

- b) Air enters at 101.3 kPa and 30°C enters in the core of the finned tube heat exchanger. The air flow rate is 1500 kg/h perpendicular to the tubes and exits with the mean temperature of 100°C. The core is 0.5 m long with a 0.25 m<sup>2</sup> frontal area. Calculate the total pressure drop between the air inlet and outlet and the average heat transfer coefficient. Use following mean properties of air : [8]

$$\rho_o = 1.038 \text{ kg/ m}^3$$

$$C_p = 1007 \text{ J/kg.K}$$

$$\mu = 2.04 \times 10^{-5} \text{ kg/m.s}$$

$$\text{Pr} = 0.719$$

Inlet and out air densities are  $\rho_i = 1.177 \text{ kg/ m}^3$  and  $\rho_o = 0.954 \text{ kg/ m}^3$

- Q3)** Water with a flow rate of 60 kg/s enters a baffled shell-and-tube heat exchanger at 32°C and leaves at 25°C. Heat via be transferred to 140 kg/s of raw water coming from supply at 20°C. Design and estimate constructional parameters of heat exchanger. A single shell and two tube pass is preferable. The tube diameter is 19 mm OD and 16 mm ID and tubes are laid out on 25.4 mm sq. pitch. The maximum length of heat exchanger required is of 5 m because of space limitation. Estimate [16]

- shell side heat transfer coefficient by Kern method
- tube side heat transfer coefficient
- shell side pressure drop
- tube side pressure drop

Assume constant properties. The properties of the fluid at average temperature are :

| Properties                           | Tube side fluid        | Shell side fluid      |
|--------------------------------------|------------------------|-----------------------|
| Specific heat, $C_p$ (J/kg.K)        | 4182                   | 4179                  |
| Dynamic viscosity, $\mu$ (Pa.s)      | $10.02 \times 10^{-4}$ | $8.15 \times 10^{-4}$ |
| Thermal conductivity, $k$ (W/m.K)    | 0.598                  | 0.612                 |
| Density, $\rho$ (kg/m <sup>3</sup> ) | 998.2                  | 996                   |
| Prandtl number, Pr                   | 7.01                   | 5.75                  |

- Q4)** Write short notes on (any three) : **[18]**
- a) Rating and sizing of heat exchanger
  - b) Rod baffles in heat exchanger
  - c) Causes and effects of fouling
  - d) Heat wheels

### SECTION - II

- Q5)** A shell and tube heat exchanger used as a condenser in a power plant. It is made up of a single shell and 30000 tubes is made with two pass. The tubes are of 25 mm diameter and made up of thin wall. The outside heat transfer coefficient is 10,000 W/m<sup>2</sup>K. The total heat transfer rate of condenser is  $2 \times 10^6$  kW. This is achieved with cooling water supply of  $3 \times 10^4$  kg/s (the flow rate per tube is therefore 1 kg/s), entering at 20°C. The condensation takes place at 50°C. Estimate exit temperature of cooling water, length of tube required per pass, using NTU method. Water properties- **[16]**

$$\rho = 997 \text{ kg / m}^3$$

$$C_p = 4179 \text{ J/Kg.K}$$

$$\mu = 855 \times 10^{-6} \text{ N.s/m}^2$$

$$k = 0.613 \text{ W/m.K}$$

$$Pr = 5.83$$

- Q6)** a) Explain the design considerations of oil/gas fired boiler. **[8]**
- b) With neat sketch explain the radiative heat exchanger. **[8]**
- Q7)** a) Draw the sketch of Single-pass divided-flow (TEMA J) exchanger with shell fluid mixed and show idealized shell and tube fluid temperature distributions. **[8]**
- b) The distribution of burners in a furnace has a significant impact on heat transfer within it – Justify the statement. **[8]**

- Q8) a) Write a note on – use of fins in heat exchanger. [6]
- b) What is Heat pipe? Explain principle of working with block diagram. Describe heat pipe integrated heat exchanger. [6]
- c) A counter flow double pipe heat exchanger is used in a power plant in which superheated steam is used to transfer heat to hot water at the rate of 10500 kg/hr. The steam enters the exchanger at 180°C and leaves at 130°C. Water enters at 30°C and leaves at 80°C. If the overall heat transfer coefficient from steam to water is 814W/m<sup>2</sup>C. Calculate heat transfer area for the counter flow arrangement. [6]

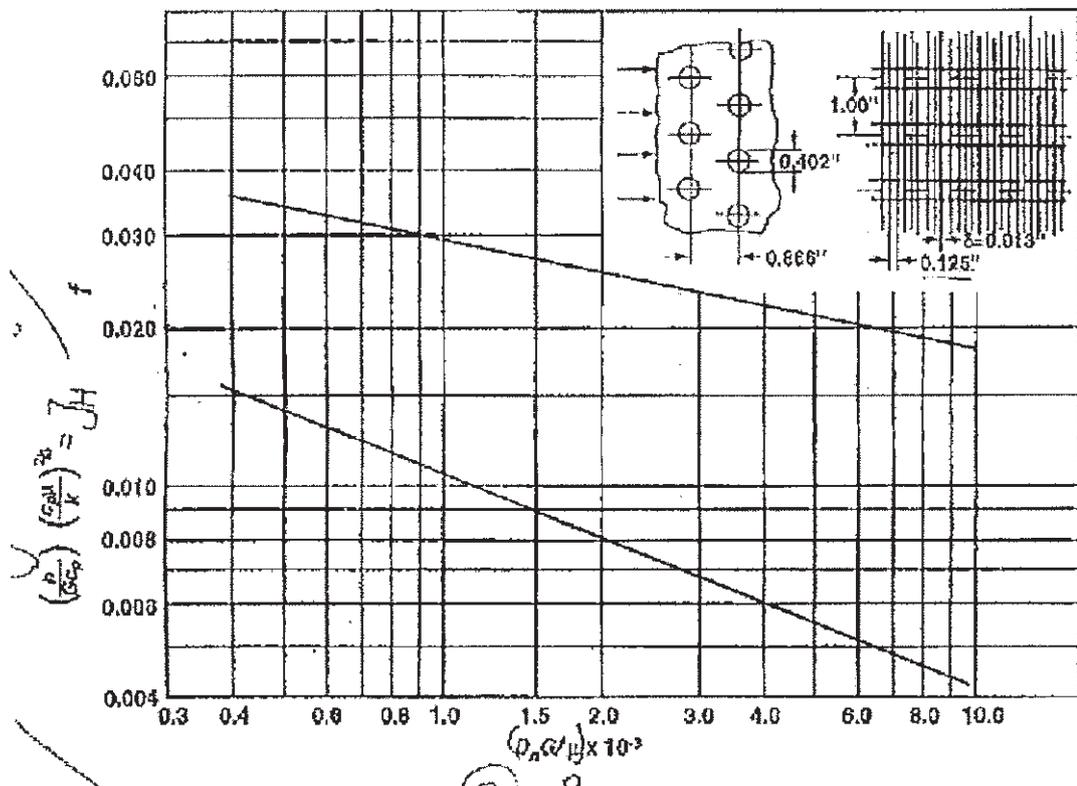


Fig. 1: Heat transfer and friction factor for a circular tube continuous fin heat exchanger.



Total No. of Questions : 8]

SEAT No. :

**P4166**

[Total No. of Pages : 2

**[4760] - 1130**

**M.E. (E&TC) (Microwave) (Semester - I)**  
**ELECTROMAGNETICS AND ANTENNA THEORY**  
**(2013 Pattern) (Revised)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1)** a) Write the electromagnetic boundary conditions, derive and illustrate the applications in solving the electromagnetic problem. **[5]**  
b) Write a note on the following **[5]**  
i) Huygens Principle  
ii) Uniqueness theorem
- Q2)** a) Solve the Helomoltz equation for conductors and explain the propagation of electromagnetic wave in good conductor with mathematical expressions. **[5]**  
b) Explain the principle of pattern multiplication and explain its application to find the field equations of half wave dipole. **[5]**
- Q3)** a) The plane wave  $\vec{E} = 30 \cos(\omega t - z) \hat{a}_x$  V/m in air normally hits a lossless medium  $\mu = \mu_0, \epsilon = 4\epsilon_0$  at  $z = 0$ . **[6]**  
i) Find Reflection coefficient, transmission coefficient and standing wave ration.  
ii) Calculate the reflected electric and magnetic field.  
b) Derive the array factor for N element linear array of isotropic elements. **[4]**
- Q4)** a) Explain the difference between the following **[5]**  
i) Directivity and gain.  
ii) Isotropic and Omni directional.  
iii) Circular and elliptical polarization.  
b) Design a YagiUda Antenna of 6 elements to provide a gain of 15dB at the operating frequency 300GHz. **[5]**

**P.T.O.**

- Q5)** a) Find the average power radiated by the Hertzian Dipole Antenna and find its radiation resistance. [6]  
b) Explain the detailed procedure for Aperture Antenna Analysis with principles and theorems. [4]
- Q6)** Write short notes on [10]  
i) Helical Antenna  
ii) Lens Antenna  
iii) Parabolic Reflector  
iv) Corner reflector
- Q7)** Calculate the array coefficients using Design Dolph-Tschebyscheff's procedure for  $N=12$  and side lobe level to be below 35dB. [10]
- Q8)** a) Explain the Structural details, dimensions, radiation pattern, specifications, features and applications of Microstrip Antenna and explain the design procedure. [6]  
b) Explain the various feeding techniques for Micro Strip Antenna with illustrative diagrams. [4]



Total No. of Questions : 8]

SEAT No. :

P4167

[Total No. of Pages :3

[4760]-1131

**M.E. (E & TC) (Microwave)**  
**RF AND MICROWAVE CIRCUIT**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, wherever necessary.*

**Q1) a)** Derive the expressions for Propagation Constant, Impedance and Power Flow for the Lossless Coaxial Line. **[5]**

b) Design a single-section quarter-wave matching transformer to match a  $10\Omega$  load to a  $50\Omega$  transmission line at  $f_0 = 3$  GHz.

Determine the percent bandwidth for which the  $SWR \leq 1.5$ . **[5]**

**Q2) a)** Four different load impedances: **[5]**

i)  $Z_L = 50\Omega$

ii)  $Z_L = 48.5\Omega$

iii)  $Z_L = (75+j25)\Omega$

iv)  $Z_L = (10-j5)\Omega$ ,

are sequentially connected to a  $50\Omega$  transmission line. Find the reflection coefficients and the SWR circles. Also determine return loss in dB.

b) A two port network is known to have the following scattering matrix:**[5]**

$$[S] = \begin{bmatrix} 0.15\angle 0^\circ & 0.85\angle -45^\circ \\ 0.85\angle 45^\circ & 0.2\angle 0^\circ \end{bmatrix}$$

**P.T.O.**

Determine if the network is reciprocal and lossless. If port 2 is terminated with a matched load, what is the return loss seen at port 1? If port 2 is terminated with a short circuit, what is the return loss seen at port1?

- Q3)** a) Explain with equivalent circuit diagram working of: [5]
- i) Wilkinson Power divider
  - ii) Lange Coupler
- b) Write a note on dynamic range and sources of noise in microwave circuits. [5]
- Q4)** a) A 2W power source is connected to the input of a directional coupler with  $C = 20\text{dB}$ ,  $D = 35\text{ dB}$  and insertion loss of  $0.7\text{ dB}$ . find the output powers (in dBm) at the through, coupled and output ports. Assume all ports are to be matched. [5]
- b) Explain the concept of Inter Symbol Interference (ISI) in microwave.[5]
- Q5)** a) Design a BJT Colpitts oscillator for 200 MHz in common emitter configuration having bias point of  $V_{ce} = 3\text{V}$ ,  $I_c = 3\text{mA}$ . Following circuit parameters are given at room temperature of  $25^\circ\text{C}$ .  $C_{BC} = 0.1\text{fF}$ ,  $r_B = 2\text{ K}\Omega$ ,  $r_{CE} = 10\text{K}\Omega$ ,  $C_{BE} = 10\text{fF}$ . If the inductance should not exceed  $L_3 = L = 5\text{nH}$ , Find the values for capacitances in the feedback loop. [5]
- b) Describe in detail operating principal of IMPATT diode. [5]
- Q6)** a) For a Si pn junction transistor the doping concentrations are given as  $N_A = 10^{18}\text{cm}^{-3}$  and  $N_D = 5 \times 10^{15}\text{cm}^{-3}$  with an intrinsic concentration of  $n_i = 1.5 \times 10^{10}\text{ cm}^{-3}$ . Find the barrier voltage for  $T=300^\circ\text{K}$ . [5]
- b) Explain in detail the working of p-channel MOSFET and its Electronic applications. [5]

**Q7)** An RF amplifier has following S-Parameters: **[10]**

$$S_{11} = 0.3\angle-70^\circ, S_{12} = 0.2\angle-10^\circ, S_{21} = 3.5\angle85^\circ, S_{22} = 0.4\angle-45^\circ.$$

Furthermore, the input side of the amplifier is connected to voltage source with  $V_s = 5V$  and source impedance  $Z_s = 40\Omega$ . The output is utilized to drive an antenna which has an impedance of  $Z_L = 73\Omega$ . Assuming that S-parameters of the amplifier are measured with reference to a  $Z_0 = 50\Omega$  characteristic impedance, find the following quantities:

- i) Transducer gain  $G_T$ , Unilateral transducer gain  $G_{TU}$ , available gain  $G_A$ , operating power gain  $G$ , and
- ii) Power delivered to the load  $P_L$ , available power  $P_A$ , and incident power to the amplifier  $P_{inc}$ .

**Q8)** a) Explain working of Quartz oscillator along with its equivalent circuit. **[5]**

- b) Explain in details the concept of unilateral design for power amplifiers. **[5]**



Total No. of Questions : 6]

SEAT No. :

**P4168**

[4760] - 1132

[Total No. of Pages :2

**M.E. (E & TC)**

**MICROWAVE MEASUREMENT  
(2013 Credit Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Draw and explain the equivalent circuit for two conductor transmission line with losses. [6]  
b) Explain the plane electromagnetic waves with necessary equation. [4]
- Q2)** a) Explain the generalised scattering parameters for two port device. [6]  
b) State the rules to analyse the signal flow graphs. [4]
- Q3)** a) Explain the calibration of a coaxial power sensor at a frequency of 18 GHz. [6]  
b) State any four specifications of coaxial connector. [4]
- Q4)** a) Draw and explain dual channel voltage ratio system. [8]  
b) What is IF substitution method. [2]
- Q5)** State the different types of noise source and explain any one in detail. [10]
- Q6)** State the standard specification of vector network analyzer and explain its working in detail. [10]



Total No. of Questions : 8]

SEAT No. :

**P4169**

**[4760]-1133**

[Total No. of Pages : 2

**M.E.(Electronics) (Digital Systems& Common to all E&TC  
Specializations)**

**RESEARCH METHODOLOGY  
(2013Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2.*
- 2) *Solve any two questions from Q.3 to Q.5.*
- 3) *Solve any two questions from Q.6 to Q.8.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Figures to the right indicate full marks.*

- Q1)** a) Define the concepts related to objective of research, measures of satisfactory research and what factors need to be consider in motivation of research work. **[5]**
- b) What do you mean by research? Explain its significance in modern times. How to differentiate- need based research and fundamental research.**[5]**
- Q2)** a) What are the different steps need to be taken in real time research.Explain it with suitable example. **[5]**
- b) Classify the different static and dynamic characteristics of instruments with example. **[5]**
- Q3)** a) Give the procedure to collect real time data in computer? Make remark on data acquisition module and signal converters. **[5]**
- b) Write short notes on: **[5]**
- i) Pilot survey.
  - ii) Regression analysis
- Q4)** a) Elucidate concept of Principal Component Analysis with application in technology. **[5]**
- b) Write short note on Parameter estimation for development of algorithm. **[5]**

**P.T.O.**

- Q5)** a) ‘The different non-linearity needs to be consider in real time research’ explain the statement with suitable example. [5]
- b) Clarify the need of real time experimentation in research work with emphasize on validation of developed mathematical algorithms. [5]
- Q6)** a) Enlist the different factors required for verification of process performance. Explain each in short. [5]
- b) What are the different points need to be included in research proposal? Explain each in short. [5]
- Q7)** a) What are defferences between individual proposals and institutional proposals? What care should be taken during the submission of institutional proposals. [5]
- b) Develop a short proposal of your work (or any research) for submission to government agency with emphasizing national and international importance. [5]
- Q8)** a) What is meaning of modeling for research? Discuss the concept of multiscale modeling. [5]
- b) Discuss the research scope in agricultural automation in the view of electronics and communication field. [5]



Total No. of Questions : 8]

SEAT No. :

P4539

[Total No. of Pages : 2

[4760]-1134

M.E. (E & TC) (Microwave)

COMPUTATIONAL ELECTROMAGNETICS

(2012 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any five questions.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data wherever necessary.

- Q1)** a) Explain in detail the finite difference analysis for guiding structures. [6]  
b) State different errors in numerical solutions and explain how they affect the accuracy and stability of FD solution. [4]

- Q2)** a) What is an electromagnetic problem? Explain the most common steps to solve an EM problem with flowchart. [5]  
b) Derive Greens function corresponding to PDE for free space. [5]

- Q3)** a) What are band matrix methods and iteration methods? Explain in brief.[5]  
b) Explain strengths and weaknesses of FDM or FDTD modeling. [5]

- Q4)** a) Given the functional [5]

$$I(\Phi) = \int_s \left[ \frac{1}{2} (\Phi_x^2 + \Phi_y^2) - f(x, y)\Phi \right] dx dy$$

Obtain the relevant Euler's equation.

- b) Using MoM derive expression for field distribution using integral form of potential equation. [5]

P.T.O.

- Q5)** a) State various computational methods. What is use of computational methods in EM. [5]  
b) List the applications of Ritz approach. [3]  
c) Compare FEM and MOM. [2]
- Q6)** a) Explain the Rayleigh-Ritz method of solution of electromagnetic problem and explain procedure to solve poisson's equation using this method.[7]  
b) Explain Helholt'z wave equation and how do you solve it numerically.[3]
- Q7)** a) Write short note on absorbing boundary conditions for FDTD. [5]  
b) Find the functional for ordinary differential equation. [5]  
 $y''+y + x = 0$ , where  $0 < x < 1$ .  
Subject to  $y(0) = y(1) = 0$ .
- Q8)** a) Explain strengths and weaknesses of method of moments. [4]  
b) Explain how MOM is used for solution of integral equations with an example. [6]



Total No. of Questions : 7]

SEAT No. :

**P4704**

[Total No. of Pages : 2

[4760] - 1135

**M.E. (Electronics and Telecom) (Microwave) (Semester - II)**

**RF AND MMIC TECHNOLOGY**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) Compare the HMICs and MMICs Enlist their advantages, disadvantages and applications. [5]

b) Enlist various methods available for synthesis of non-linear MMICs. Explain one of the methods in detail. [5]

**Q2)** a) Where do we use microstrip couplers and power splitters? Describe their working principles. [5]

b) What is the synthesis of MIC? Explain need of matrix representation for microwave. [5]

**Q3)** a) Explain network matrix decomposition of microwave circuits. [5]

b) Describe micro-grounding microstrip lines with via holes. [5]

**Q4)** a) Explain harmonic balance method used for synthesis of MMICs. [5]

b) Explain synthesis of n-port on the base of elementary two port. [5]

**Q5)** a) Explain complete MMIC design cycle. [5]

b) Write short note on MMIC test system. [5]

**P.T.O.**

- Q6)** a) Explain CAD package features and circuit simulation engines. [5]  
b) Explain device and circuit measurement techniques in MMIC. [5]
- Q7)** a) Explain GaAs FET MMIC switches. [5]  
b) Write short note on : [5]  
i) Applications of MMIC in broadcast systems  
ii) Future trends in MMICs



Total No. of Questions : 8]

SEAT No. :

**P4170**

**[4760]-1136**

[Total No. of Pages : 3

**M.E. (E & TC) (Microwave)  
WIRELESS COMMUNICATION SYSTEM  
(2013 Credit Pattern) (Revised) (Semester-II) (504309)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** How the following terms are related to tele traffic engineering and Define each of them with relevant mathematical expressions (if any). **[5]**

- i) Blocked Call Held (BCH).
- ii) Blocked Call Delayed (BCD).
- iii) Blocked Call Cleared (BCC).
- iv) Erlangs.
- v) Traffic Intensity.

**b)** Draw the UMTS system architecture and Radio Interface Protocol Stack, and explain. **[5]**

**Q2) a)** Write the Poisson's and Erlang C Traffic Formula and explain the application of the same. **[5]**

**b)** Explain the Broadcast Multicast (BMC) protocol with reference to UMTS. **[5]**

**P.T.O.**

**Q3) a)** Draw the basic Hexagonal cell geometry and derive the expression for Co channel interference. [6]

b) Explain the attenuation over the reflecting surface with illustrative diagram, write attenuation factor and explain. [4]

**Q4) a)** Consider a base station transmitting to a mobile station in free space. The following parameter relate to this communication system. [7]

Distance between base station and mobile station: 6000m

Transmitting frequency: 2GHz

Base Station transmitting power  $P_t = 10W$

Total system losses: 8dB

Mobile receiver noise figure  $N_f = 5 \text{ dB}$

Mobile receiver noise temperature: 290K

Mobile receiver bandwidth 1.5MHz

Antenna gains are 10 dB and 0 dB for the base station and mobile station

Antenna heights at the base station and mobile station are 30m and 2m, respectively

Calculate the received signal power at the mobile receiver antenna and signal to noise ratio (SNR) of the received signal.

b) Write a short note on evolution of Wireless Communication Systems. [3]

**Q5) a)** Illustrate the complete radio forward channel of CDMA with relevant diagrams. [4]

- b) A trunk accumulation 0.75 Erlang of usage while 9 calls were carried in an hour with no overflow. What is the average holding time per call in seconds? [4]
- c) Explain the function of Block interleaver, Orthogonal modulator in CDMA reverse channel. [2]
- Q6)** a) Explain the Cost 231 path loss model with all the expressions and also mention the assumptions and applications. [6]
- b) Draw the entire frame structure of GSM and explain. [4]
- Q7)** a) Write a detailed note on beyond 3G, 4G features and applications. [4]
- b) Write the functions and relevance of following components in GSM with reference to GSM architecture and also the draw the GSM system architecture. BTS, BSC, VLR, HLR, AUC, OMC. [6]
- Q8)** a) Write the polynomial used to specify the long code in CDMA forward channel and explain its function. [2]
- b) If there are 60 radio channels in a cell to handle all the calls and the average call holding time is 120 seconds, how many calls are handled in this cell with a GoS of 2%? [4]
- c) What are the Radio Link Control functions with reference to UMTS? Explain. [4]



Total No. of Questions : 6]

SEAT No. :

**P4545**

[Total No. of Pages : 2

**[4760] - 1137**

**M.E. (E&TC) (Microwave) (Semester - III)**

**EMI AND EMC TECHNIQUES**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Draw diagram wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1)** a) What are sources of EMI. What are various mechanisms in which electromagnetic interference can travel from its sources to the receptor. **[5]**

b) Explain modelling of interferences. **[5]**

**Q2)** a) Explain steps for transmitter & receiver design. **[5]**

b) Explain amplitude culling and frequency culling. **[5]**

**Q3)** a) Compare four different approaches for measurement of radiated emission (RE) from an equipment & radiation susceptibility (Rs) of an equipment. **[5]**

b) Explain common mode conducted interference & differential mode conducted interference. **[5]**

**Q4)** a) Explain system grounding for EMC in detail. **[5]**

b) Explain shielding integrity at discontinuities. **[5]**

**P.T.O.**

- Q5)** a) Explain characteristic & uses of band Reject filters. [5]  
b) Explain the operation of common mode choke. [5]
- Q6)** a) Write short note on Federal communication commission & CISPR/IEC standards. [5]  
b) Compare shielding, grounding & bonding. [5]



Total No. of Questions : 8]

SEAT No. :

P4715

[Total No. of Pages : 2

[4760] - 1138

M.E. (E&Tc) (Microwave)

**RADAR & SATELLITE COMMUNICATION**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain the basic principles of a radar system with neat block diagram. Give the limitations and applications of radars. [6]
- b) Derive the radar range equation? Explain the factors that affect the maximum range of radar. [4]
- Q2)** a) Explain with neat block diagram the working principle of Moving Target Indicator (MTI) radar. [5]
- b) Explain basic principle of Pulsed radar system. [5]
- Q3)** a) Write short notes on: [4]
- i) Blind speeds.
  - ii) Continuous Wave Radar
- b) Discuss the ambiguity in radar range equation. [3]
- c) Explain how the radar is used in remote sensing. [3]
- Q4)** a) Explain the concept of Correlation and Convolution with respect to radars. [6]
- b) Explain the Doppler effect in Radar system. [4]

**P.T.O.**

- Q5)** a) With respect to satellite communication explain the following multiple access techniques: [4]
- i) SDMA
  - ii) Random Access
- b) Explain with neat block diagram concept of TTC&M in satellite communication. [6]
- Q6)** a) Comment on various interferences and noise sources in satellite communication system. [4]
- b) Explain in brief the concept of link design for Geostationary satellites.[6]
- Q7)** a) Which conditions should be fulfilled to attain a geostationary orbit? [2]
- b) Explain various advantages & limitations of satellite communication?[4]
- c) Define elevation & inclination angles along with their significance. [4]
- Q8)** a) What are the primary factors needed for defining an orbit of a satellite?[4]
- b) What is antenna misalignment loss? Propose a solution to overcome these losses. [3]
- c) Discuss the design considerations of a communication satellite. [3]



Total No. of Questions : 8]

SEAT No. :

**P4171**

[Total No. of Pages : 2

**[4760] - 1139**

**M.E. (Electronics and Telecommunications)**

**DIGITAL CMOS DESIGN**

**VLSI & Embedded System**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain MOS diffusion capacitance model. Explore dynamic behaviour of MOSFET capacitances. [5]  
b) List various CMOS technologies. Explain in brief any two of them. [5]
- Q2)** a) What are different layout techniques? Explain stick diagram of any one combinational logic circuit. [5]  
b) What is process variation? What are its effects? [5]
- Q3)** a) What is meant by logical efforts? Explain with appropriate example. [4]  
b) List the sources & mitigation techniques of cross talk. [4]  
c) What is design margin? Explain in brief. [2]
- Q4)** a) Explore various power dissipations. Derive expressions. [4]  
b) Explore any one delay estimation technique in detail. [4]  
c) Why are parasitics of interconnects important? Give example. [2]
- Q5)** a) Draw & explain I bit latch using transmission gates. What are the limitations? How to overcome? [4]  
b) Design CMOS logic for  $Y = ABC + DEF + GH + I$ . Compute active area on chip. [4]  
c) List sources & mitigation techniques of hazards. [2]

**P.T.O.**

- Q6)** a) Draw FSM diagram & VHDL code for 1101 Moore sequence detector. [4]  
b) Draw voltage transfer characteristics of CMOS inverter. Explore in detail. [4]  
c) What will happen if transistor sizing is not done? [2]
- Q7)** a) Explore BiCMOS circuit with appropriate example. What are merits & limitations? [4]  
b) What are the techniques of low power logic design? Explain each in detail. [4]  
c) Explain dynamic circuits. [2]
- Q8)** a) Explore any one CMOS fabrication process in detail. [4]  
b) List layout design rules. [4]  
c) Draw equivalent circuits of MOSFET & explain each parameter in brief. [2]



Total No. of Questions : 8]

SEAT No. :

P4758

[Total No. of Pages : 3

[4760] - 114

**M.E. (Mechanical) (Heat Power Engineering)**

**COMPUTATIONAL FLUID DYNAMICS**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary and mention it clearly.*

**SECTION - I**

**Q1)** a) For an infinitesimally small 2D control volume of size dx, dy, show

$$\text{that } \frac{Du}{Dt} = -\frac{1}{\rho} \frac{\partial p}{\partial x} + \frac{1}{\rho} \left( \frac{\partial \tau_{xx}}{\partial x} + \frac{\partial \tau_{yy}}{\partial y} \right) + \bar{F}_x$$

Draw a neat diagram and show all the x-direction body force and surface forces. Explain the term  $F_x$  in detail. [12]

b) Derive the equation of divergence of velocity with its significance. [6]

**Q2)** a) Classify the following equations and briefly comment on the solution of these equations. [8]

i)  $\frac{\partial^2 T}{\partial x^2} - c^2 \frac{\partial^2 T}{\partial y^2} = 0$

ii)  $\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$

iii)  $\frac{\partial T}{\partial t} = D \frac{\partial^2 T}{\partial x^2}$

b) Derive the steady state heat transfer equation through a rectangular pin fin. [8]

**P.T.O.**

- Q3)** a) Write an algorithm to find the temperature distribution in the pin fin. Assume the suitable cross-section of the pin fin and boundary conditions. The governing equation for the heat transfer is given

$$\text{by } \frac{d^2T}{dx^2} - \frac{hP}{kA} (T - T_f) = 0 \quad [12]$$

- b) What is finite difference method? Write expressions for various types of first order accurate difference equations. [4]

- Q4)** a) What are the different types of boundary conditions? Explain in detail. [8]

- b) Derive the following finite difference approximations for applications in 2D fluid flow at point (i) Discuss its order of accuracy.

$$\frac{\partial^2 u}{\partial x^2} = \frac{2u_i - 5u_{i+1} + 4u_{i+2} + u_{i+3}}{(\Delta x)^2} \quad [8]$$

## SECTION - II

- Q5)** a) What is “transformation” in grid generation? Explain its need with the help of physical and computational domain. [10]

- b) What is artificial viscosity? Discuss its aspects in detail. [6]

- Q6)** a) What is Von-Neumann stability analysis? Explain using diffusion equation. [6]

- b) Compute the solution of the equation  $\frac{\partial u}{\partial t} + C \frac{\partial u}{\partial x} = 0, C = \text{constant} > 0$

For the first steps using Lax-Wendroff scheme. The initial condition and boundary conditions are given below.

$$\text{Initial condition: } u(x, 0) = \begin{cases} x - x^2, & 0 \leq x \leq 1 \\ 0, & x > 1 \end{cases}$$

Boundary condition:  $u(0, t) = 0$ , for all  $t$

$$\text{Take } \Delta x = 0.25, c \frac{\Delta t}{\Delta x} = 0.25 \quad [12]$$

- Q7)** a) Explain use of Simple algorithm for solution of Navier Stokes equations in two dimensional flows. **[8]**  
b) Explain MacCormack's technique with predictor and corrector step.**[8]**

- Q8)** Write a short note on (Any four) **[16]**  
a) Adaptive Grids  
b) Upwind methods  
c) Finite volume method  
d) Couette Flow  
e) CFD analysis of blunt body

**XXXX**

Total No. of Questions : 8]

SEAT No. :

P4172

[Total No. of Pages :2

[4760]-1140

M.E. (E & TC) (VLSI & Embedded Systems)

EMBEDDED SYSTEM DESIGN

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Identify & briefly discuss the steps that comprised V-life cycle model.[4]

b) What are the characteristics of embedded systems? [3]

c) What is the purpose & goals of Architectural design. [3]

**Q2)** a) What is design metrics? Explain in detail. [4]

b) What are the objectives of analysis phase of product design and briefly explain dynamic analysis. [3]

c) Explain with suitable example any one model for the development of embedded system. [3]

**Q3)** a) Write a short note on (any one). [5]

i) Development tools for embedded systems

ii) General purpose processor

b) Why should capitalization & reuse consider being important activities in the development of any Product? [5]

**P.T.O.**

- Q4)** a) Explain With the help of block diagram ARM-9 TDMI processor.[4]  
b) Explain ARM architectural support for system development? [3]  
c) Explain the ARM floating Point architecture. [3]
- Q5)** a) Explain BIOS versus boot-loader. What are the challenges of boot loader? [4]  
b) Explain in detail Linux kernel construction. [3]  
c) Explain the concept of Linux device drivers in detail. [3]
- Q6)** a) Explain in brief the Kernel configuration (Kconfig) file. [5]  
b) Explain concept of Boot-loader. [5]
- Q7)** a) What is "Android manifest"? Explain in brief the structure of an Android manifest file. [4]  
b) Explain in detail Architecture of Android Operating System. [3]  
c) Explain Telephony and SMS for android operating system. [3]
- Q8)** a) Write a short note on following (Any Two). [4]  
i) Network services and APIs  
ii) Intents  
iii) Content Providers and services  
b) Explain with android technology Audio Video using the Camera. [3]  
c) Explain in detail Structure of Android applications. [3]



Total No. of Questions : 8]

SEAT No. :

**P4173**

**[4760] - 1141**

[Total No. of Pages :2

**M.E. (E & TC - VLSI & Embedded System)**

**RECONFIGURABLE COMPUTING**

**(2013 Credit Pattern) (Semester - I) (504203)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to right indicate full marks.*
- 4) *Assume suitable data wherever necessary.*

- Q1)** a) State & explain reconfigurable device characteristics. [4]  
b) Explain static, Quasistatic & dynamic configuration. [3]  
c) What is context? How it is important in RC. [3]
- Q2)** a) Compare FPGA, GPP, ASIC with respect to functional capacity data density & functional diversity. [3]  
b) Discuss various reconfigurable devices developed yet. [3]  
c) Why is multiplier considered as test operation? Compare different architectures based on their performances for multiplication. [4]
- Q3)** a) What is peak performance density? Explain with the help of determining parameters. [4]  
b) Give the issues in Reconfigurable Network Design. [3]  
c) Write short note on configurable, programmable & fixed function devices. [3]
- Q4)** a) Draw & explain architecture of Matrix. [4]  
b) Which is the general purpose computing issue? [3]  
c) What are the problems with simple networks? Explain in detail with example. [3]

**P.T.O.**

- Q5)** a) Explain Network utilization efficiency. [4]  
b) With the help of suitable example explain difference between reconfigurable machines & conventional processor. [3]  
c) What is need of instruction compression? What are its techniques? Which is best suitable for RD? [3]
- Q6)** a) Explain hierarchical interconnects in detail. [4]  
b) What is Rent Rule? Explain its importance. [3]  
c) What are the effects of interconnect granularity? [3]
- Q7)** a) What are working RC examples? What tasks are being performed by them. [5]  
b) Give mathematical analysis of switch, channel & wire growth. [5]
- Q8)** a) Explain RP space area model mathematically. [5]  
b) Draw & explain architecture of DPGA? Explain each block in detail. Highlight on its limitations. [5]



Total No. of Questions : 8]

SEAT No. :

P4174

[Total No. of Pages : 5

[4760] - 1142

M.E. (E & TC) (VLSI & Embedded Systems) (Semester - II)

ANALOG CMOS DESIGN

(2013 Pattern)

Time : 3 Hours]

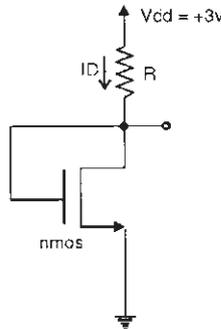
[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary.

**SECTION - I**

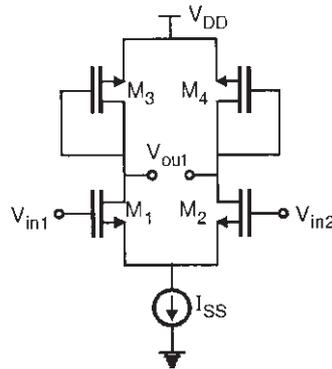
- Q1) a) For the circuit shown in figure, Find 'R' and the d.c. voltage ' $V_D$ ' If the drain current  $I_D$  is  $80\mu\text{A}$ . The NMOS transistor used have  $V_t = 0.6\text{V}$ ,  
 $\mu_n C_{OX} = 200\mu\text{A}/\text{V}^2$ ,  $L = 0.8\mu\text{m}$ ,  $W = 4\mu\text{m}$ . [5]



- b) Draw the transistorized network of Common source amplifier, Common gate amplifier and common drain amplifiers. Differentiate these amplifiers with respect to following terms, [5]
- i) Input resistance
  - ii) Output Resistance
  - iii) Intrinsic Voltage Gain

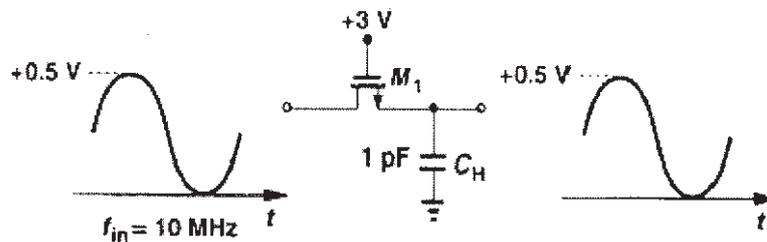
P.T.O.

- Q2) a)** Determine the voltage gain of the circuit shown in Figure. Assume  $\lambda \neq 0$ . Assume  $M_1$  is identical to  $M_2$  and  $M_3$  is identical to  $M_4$ . [5]



- b) Explain how CMOS inverter can be used as an amplifier. Draw the neat circuit diagram of two stage CMOS OP-Amp and explain its operation. [5]

- Q3) a)** In the circuit shown in figure calculate the minimum and maximum on-resistance of  $M_1$ . Assume  $\mu_n C_{ox} = 50 \mu A/V^2$ ,  $W/L = 10/1$ ,  $\gamma = 0$ ,  $V_{TH} = 0.7 V$  and  $V_{DD} = 3V$ . [4]



- b) Draw and Explain following analog CMOS circuits [4]
- i) LNA
  - ii) Mixer
  - iii) DAC
  - iv) Tuned Amplifiers
- c) What is source degeneration? Explain the effect degeneration resistance on the voltage gain of CS amplifier. [2]

- Q4) a)** Design a fully differential telescopic op-amp with the following specifications: [4]

$V_{DD} = 3\text{ V}$ , differential output swing = 3V, power dissipation = 10mW, voltage gain = 2000. Assume  $\mu_n C_{ox} = 60\mu\text{A}/\text{V}^2$ ,  $\mu_p C_{ox} = 30\mu\text{A}/\text{V}^2$ ,  $\lambda_n = 0.1\text{V}^{-1}$ ,  $\lambda_p = 0.2\text{V}^{-1}$  (for an effective channel length of 0.5  $\mu\text{m}$ )  $\gamma = 0$ ,  $V_{THN} = |V_{THP}| = 0.7\text{ V}$ .

- b) What is the necessity of MOS diode/active resistor? Draw the MOS diode/active resistor circuits for NMOS and PMOS transistors. Is there any difference in gain of the following amplifier circuits, [4]
- Common source amplifier with NMOS diode connected load
  - Common source amplifier with PMOS diode connected load

Justify your answer with the suitable circuit diagrams.

- c) With the help of detailed equivalent circuit diagram explain the parasitic capacitances and resistances involved in a MOSFET. [2]

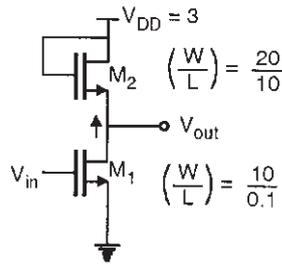
- Q5) a)** What is the principle of operation of Current mirrors? Explain in short nonideal effects of current mirrors. What is the use of current mirrors? [4]

- b) What is difference between active mixer and passive mixers. Draw and explain the architectures of both the mixers. [4]

- c) A 1 V peak-to-peak sinusoidal signal is applied to an 10-bit DAC which has a  $V_{ref}$  of 5 V. Find the maximum SNR of the digitized analog output signal. [2]

- Q6) a)** Draw the small signal model MOS transistor including all the parasitic capacitances and derive the equation for its transconductance ( $g_m$ ) and transition frequency ( $f_T$ ). [4]

- b) Determine the voltage gain of the circuit shown in Figure If  $I_{D1} = I_{D2} = 1$  mA,  $\lambda = 0.1$ ,  $\mu_n C_{ox} = 100 \mu\text{A}/\text{V}^2$ . Neglect body effect. [4]



- c) For an ideal n channel MOSFET with parameters  $L = 1.25 \mu\text{m}$ ,  $\mu_n = 650 \text{ cm}^2/\text{Vs}$ ,  $C_{ox} = 6.9 \times 10^{-8} \text{ F}/\text{cm}^2$ ,  $V_{THn} = 0.65 \text{ V}$ . Design the channel width  $W$  such that  $I_{DSSAT} = 4 \text{ mA}$  with  $V_{GS} = 5\text{V}$ . [2]

**Q7) a)** Write Short notes on following(Any Two) : [4]

- i) DAC Topologies in CMOS ICs
- ii) Techniques used in Micro power opamp
- iii) Non-Idealities in MOSFET

- b) Design an NMOS cascode current source for an output impedance of  $500 \text{ k}\Omega$  and a current of  $0.5 \text{ mA}$ . Assume  $M_1$  and  $M_2$  are identical

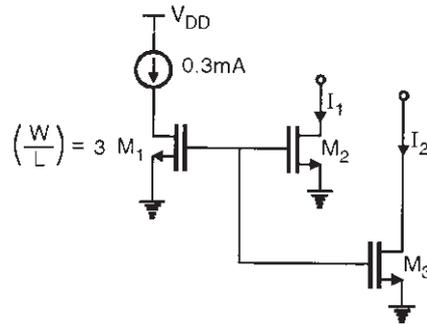
$$\mu_n C_{ox} = 100 \mu\text{A} \text{ and } \lambda = 0.1 \text{ V}^{-1}. \quad [4]$$

- c) If the sampled analog input applied to an 8 bit SAR converter is  $0.7 V_{ref}$ . Find the output digital word. [2]

**Q8) a)** Write Short notes on following(Any Two) : [4]

- i) High Speed Opamp
- ii) Bandgap Reference Source
- iii) CMOS Inverter as an amplifier

- b) Design a current mirror circuit that produces a currents  $I_1 = 0.2 \text{ mA}$  and  $I_2 = 0.5 \text{ mA}$  from a reference current source of  $0.3 \text{ mA}$  connected to transistor with aspect ratio 3. [4]



- c) Define and derive expressions for, [2]
- i)  $g_m$ ,
  - ii)  $g_{mb}$ .



Total No. of Questions : 8]

SEAT No. :

**P4175**

[Total No. of Pages : 2

**[4760] - 1143**

**M.E. (ETC) (VLSI and Embedded System)**

**SYSTEM ON CHIP**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 05 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *All questions carry equal marks.*
- 4) *Your answers will be valued as a whole*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) Explain simulation and RTL synthesis of FSM.

b) What are the limitations of Data flow models?

**Q2)** a) How pipeline stall occur in RISC Architecture?

b) Explain the need of concurrent models.

**Q3)** a) What are pipeline hazards? How pipeline hazards can be handled.

b) Explain various synchronization schemes adopted by Hardware/Software interface.

**Q4)** a) Explain in detail SoC modeling in GEZEL.

b) What is Clock - Domain - Crossing (CDC)? Explain CDC friendly RTL.

**Q5)** a) Explain different architectural techniques that can be used to optimize the performance of the coprocessor.

b) Explain the Limitations of Simulation?

**P.T.O.**

**Q6)** a) What are the limitations of static timing Analysis?

b) Explain the Implication on synthesis.

**Q7)** a) Draw and explain RTL to GDS II design flow.

b) Draw and Explain Generic three - stage pipelined context - based adaptive arithmetic coder architecture?

**Q8)** a) What is Hybrid Power Management Technique?

b) What are the Factors Affecting delay and slew?



Total No. of Questions : 8]

SEAT No. :

**P4176**

**[4760]-1144**

[Total No. of Pages : 3

**M.E. (E & TC) VLSI and Embedded Systems  
EMBEDDED SIGNAL PROCESSOR  
(2013 Credit Pattern) (Semester-II) (504209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) State the important issues in selecting hardware components and interfacing external hardware devices to the DSP processor. [3]
- b) Draw and Explain block diagram of software development tools for designing DSP system. [3]
- c) Given a second order transfer function

$$H(z) = \frac{0.5(1 - z^{-1})}{1 + 1.3z^{-1} + 0.36z^{-2}}$$

Perform the filter realization and write difference equation using direct form-I and direct form II, cascade via first order section, parallel via first order section. [4]

- Q2)** a) Compare the Computational Complexity of the DFT and FFT with the help of suitable example and equations. [3]
- b) Consider a digital sequence sampled at the rate of 44.1 kHz. If we use 1024 data point and apply 1024 point DFT to compute the spectrum,
- i) Determine the frequency resolution.
  - ii) Determine the highest frequency in the spectrum. [3]
- c) Draw 8 point decimation in time FFT butterfly algorithm and explain. [4]

**P.T.O.**

- Q3)** a) A filter is described by the following equation. Draw the Structure using Direct form-I and Direct form-II.  $y(n) - 3/4y(n - 1) + 1/4y(n - 2) = x(n) + 1/2x(n - 1)$ . [3]
- b) What is the need of Code Optimization? Explain different code optimization methods for developing DSP system. [3]
- c) Explain the different addressing modes of TMS 320C54XX processor. [4]
- Q4)** a) Compare TMS 320C54XX and TMS 320C67XX with respect to architecture MIPS/Flops accumulator, memory on-chip peripherals and addressing modes. [3]
- b) Justify the necessity of MAC and Barrel shifter in DSP processor. [3]
- c) Explain the different on chip Peripherals of TMS 320C54xx series. [4]
- Q5)** a) Explain the use of DSP algorithms in developing digital image filtering applications. [3]
- b) Explain adaptive filter algorithm used for noise cancellation and inverse modeling. [3]
- c) Explain DTMF generation and detection application using DSP techniques. [4]
- Q6)** a) Compare FIR and IIR digital filters. [3]
- b) What is wavelet transform? How it is different from Fourier Transform and Short Time Fourier Transform? [3]
- c) What is the need of Image enhancement? Explain the different methods of image enhancement. [4]

- Q7)** a) What are the advantages of using DSP processors? How DSP processors compared with application specific circuits (ASICs), general purpose microprocessor, and microcontrollers? Also, explain the meaning of “real time” in DSP applications. [5]
- b) Write short note on audio coding and audio effects application using DSP techniques. [5]
- Q8)** a) Explain the steps for designing IIR digital filter using Bilinear Transformation Techniques (BLT). [5]
- b) Draw and explain the architecture of Blackfin processor. How it is suitable for developing real time DSP applications. [5]



Total No. of Questions : 8]

SEAT No. :

P4177

[Total No. of Pages : 3

[4760]- 1145

M.E. (E & TC) (VLSI & Embedded System)

FAULT TOLERANT SYSTEMS

(2013 Pattern)

Time : 3 Hours]

[Max Marks :50

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Assume suitable data, if necessary.
- 3) Solve any five questions.

Q1) a) Construct binary decision diagram for a given function: [4]

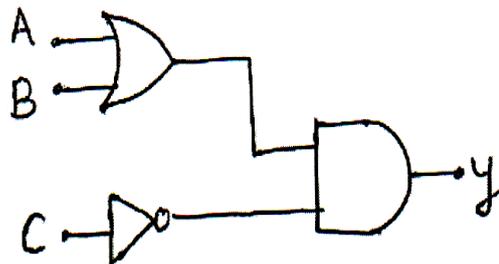
i)  $Y = A\bar{B}C + AC$

ii)  $Y = \bar{A}\bar{B} + AB$

b) Explain Structural model of RTL. Write on RTL model for a positive edge triggered D-Flip-Flop. [4]

c) Write a short note on errors and faults. [2]

Q2) a) Construct a primitive cube table for the circuit shown in Fig.1. [4]

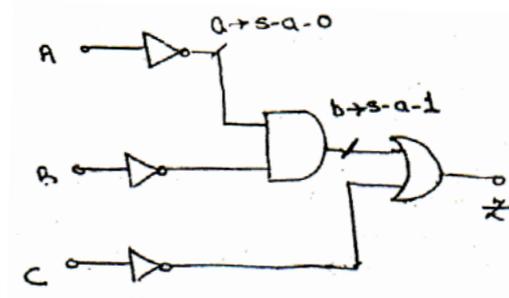


b) Define unknown logic value. Construct AND truth table of 6-valued logic for static hazard analysis. [4]

c) Write a short note on Delay Models. [2]

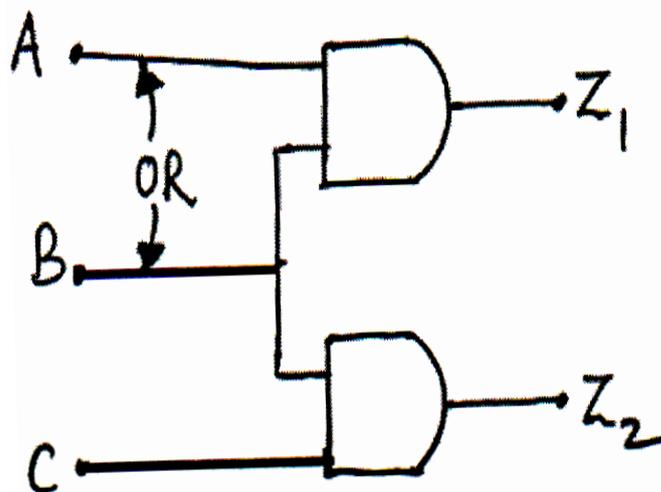
P.T.O.

- Q3) a)** Find the set of all tests that detects the multiple stuck fault for fault 'a's-a-0 and fault 'b's-a-1 for the circuit shown in fig.2. [4]



- b) Explain event driven logic simulation method with an example. [4]  
 c) Explain the Fault Sampling theorem. [2]

- Q4) a)** Explain Parallel Fault simulation in detail with appropriate example. [5]  
 b) Define Detectability. Find test vectors that determine the OR bridging fault between input A&B in fig.3 shown below. [5]



- Q5) a)** Explain single input signature analyzer with suitable example. [5]  
 b) Classify different compression techniques. Explain Transition count compression technique. [5]
- Q6) a)** What is Boundary Scan? Show a design for the boundary-scan cell circuitry for a Bidirectional I/O pin in the IEEE 1149.1 methodology. [5]  
 b) Explain self-checking Berger code checkers. [5]

- Q7)** a) Explain with block diagram the self-checking system for fault detection. **[5]**  
b) Differentiate between On-line and OFF-line BIST. Explain in detail the generic. Off-line BIST architecture at the board level. **[5]**
- Q8)** a) Explain following test pattern generation methods for BIST: **[5]**  
i) Exhaustive Testing.  
ii) Pseudorandom Testing.
- b) Explain in brief the concepts with respect to DFT (Any2): **[5]**  
i) Test points  
ii) Partitioning large combinational circuits  
iii) Initialization  
iv) Partitioning counters and Shift Registers.



Total No. of Questions : 8]

SEAT No. :

**P4178**

**[4760] - 1146**

[Total No. of Pages :2

**M.E. (E & TC - VLSI and Embedded Systems)**

**ASIC Design**

**(2013 Credit Pattern) (Semester - III) (604202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Draw the design flow for an ASIC design process and explain each step. **[5]**

b) What do you mean by ASIC cell library? What should it contain. **[2]**

c) Compare different ASIC technologies. **[3]**

**Q2) a)** Explain in detail Gate array based ASICs. **[5]**

b) Differentiate static and dynamic timing analysis. Which is better? and why? **[2]**

c) Explain Logic synthesis with an example. **[3]**

**Q3) a)** What is crosstalk delay and crosstalk noise in context to ASIC design? Which parameter it will severely affect. **[4]**

b) Explain Gate level mixed mode simulation and synthesis. **[4]**

c) Write a note on testing of mixed mode ASIC. **[2]**

**Q4) a)** Explain noise coupling and element matching with respect to practical aspects of mixed signal analog digital design. **[5]**

b) Explain signal integrity effects in ASIC design. **[5]**

**P.T.O.**

- Q5)** a) What are the different objectives of system partitioning and explain algorithm for the same. [4]  
b) What are the factors contributes to test floor planning? Explain in detail. [3]  
c) What is parameter extraction pertaining to ASIC design? [3]
- Q6)** a) Differentiate pre layout and post layout simulation with respect to ASIC. [4]  
b) What are the approaches to global routing? Explain in detail one algorithm to find shortest path. [4]  
c) Define channel density and Elmore's delay. [2]
- Q7)** a) Explain in detail about ATPG algorithm using test vectors with neat diagram. [4]  
b) Explain types features of any two EDA tools. [4]  
c) Define the term controllability and observability. [2]
- Q8)** a) Briefly describe about Boundary Scan Test with suitable example. [5]  
b) Explain LFSR and BIST. [5]



Total No. of Questions : 8]

SEAT No. :

**P4179**

[Total No. of Pages : 2

**[4760] - 1147**

**M.E. (Electronics and Telecommunications) (Signal Processing)**

**IMAGE PROCESSING AND ANALYSIS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of eight.*
- 2) *Figures to the right indicate full marks.*
- 3) *Make suitable assumptions where ever necessary.*

- Q1)** a) What are Spatial and Gray level resolutions? What are false contours? Explain in brief interpolation techniques used during image resizing. [5]
- b) What is MTR of Human Visual System (HVS) and how it is measured? [5]

- Q2)** a) Explain procedure of image filtering in frequency domain. [5]
- b) Gray level histogram of an image is given below. [5]

|            |     |     |      |      |      |      |     |   |
|------------|-----|-----|------|------|------|------|-----|---|
| Gray Level | 0   | 1   | 2    | 3    | 4    | 5    | 6   | 7 |
| Frequency  | 400 | 700 | 1350 | 2500 | 3000 | 1500 | 550 | 0 |

Perform Histogram equalization and write gray histogram of equalized image.

- Q3)** a) What are order statistics filters? Explain median filter with suitable example. [4]
- b) Explain in brief different techniques used in estimation of the degradation function in image restoration. [4]
- c) An 8 bit input image has to be enhanced by stretching gray level range [96,169] by a factor of 2. The remaining gray levels observe identity transformation. Draw the gray level transformation function. [2]

- Q4)** a) Explain with example following properties of Discrete Cosine Transform (DCT). [4]
- i) Energy Compaction
  - ii) Decorrelation
- b) What are the different redundancies observed in an image? How these redundancies are exploited in Image Compression. [4]
- c) What is Peak Signal to Noise Ratio (PSNR) ? How this is used in quality assessment of Images? [2]

**P.T.O.**

**Q5) a)**

|    |    |    |    |
|----|----|----|----|
| 20 | 40 | 40 | 50 |
| 10 | 40 | 50 | 50 |
| 30 | 40 | 50 | 50 |
| 40 | 40 | 50 | 10 |

For the image above, Generate Huffman Code for the image. Find the compression ratio? **[4]**

- b) Compare RGB and HSI colour models with their applications. **[4]**  
 c) Explain in brief different approaches used in Image Segmentation. **[2]**

**Q6) a)** Explain with suitable example following operations used in morphological image processing. **[4]**

- i) Erosion  
 ii) Opening  
 iii) Closing  
 iv) Boundary Extraction

- b) Explain Sobel Edge operator. Compare gradient and Laplacian based edge operators. **[4]**  
 c) Draw different Structuring elements. **[2]**

**Q7) a)** What is Representation and Description? Explain following boundary representation and description techniques. **[4]**

- i) Polygonal Approximations using Minimum Perimeter Polygons.  
 ii) Signatures

- b) Apply DCT to the following image **[4]**

$$A = \begin{pmatrix} 4 & 2 \\ 2 & 1 \end{pmatrix}$$

- c) What are the drawbacks of pseudo colouring? **[2]**

**Q8) a)** What is Wavelet transform. How Image compression is achieved using wavelet transform. **[4]**

- b) Explain an additive and subtractive color models. What are the applications of these models? **[4]**  
 c) List the different types of noises? What is periodic noise? **[2]**



Total No. of Questions : 8]

SEAT No. :

P4403

[Total No. of Pages : 3

[4760] - 1148

M.E.(E & TC) (Signal Processing) (Semester - I)

SIGNAL PROCESSING TECHNIQUES

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Solve any five questions.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data, if necessary.

Q1) a) Design the bandpass linear phase FSR filter having cut-off frequency, one at 1 rad/sample and another at 2 rad/sample obtain unit sample response through following window. [5]

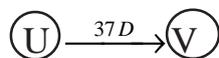
$$w(n) = \begin{cases} 1 & \text{for } 0 \leq n \leq 6 \\ 0 & \text{otherwise} \end{cases}$$

Also obtain magnitude and phase Response.

b) Starting with Steepest descent algorithm  $W_{k+1} = W_k - \mu \Delta_k$  derive window-Hopf LMS algorithm stating any reasonable assumption made. Where  $W_k$  is filter weight vector at discrete time k.  $\mu$  controls stability and rate of convergence.

$\Delta_k$  True Gradient Vector of the error performance surface at time k. [5]

Q2) a) Explain unfolding Algorithm used for Data flow graph. Unfold the given data flow graph by a 4 - factor. [5]



P.T.O.

- b) Implement a 2-stage decimator for the following specifications. [5]

Sampling rate of the Input signal = 20KHz

Decimation factor = 100

Passband = 0 to 40 Hz

Transition band = 40 to 50 Hz

Passband ripple = 0.01

Stopband ripple = 0.002

- Q3) a) Explain design procedure for optimal ripple FIR filter. [4]

- b) Find the order and locations of poles of digital IIR filter with the specifications: Passband magnitude is constant within 1db for frequencies below  $0.2\pi$  and stopband attenuation is greater than 15db for frequencies between  $0.3\pi$  to  $\pi$ . Use bilinear transformation. Sampling time = 1sec.[4]

- c) Compare Type I and Type II Chebyshev filter. [2]

- Q4) a) Design low-pass filter with the following specification, using type-1

frequency sampling Technique. 
$$H_d(e^{jw}) = \begin{cases} e^{-j3w} & 0 \leq w \leq \frac{\pi}{2} \\ 0 & \text{otherwise} \end{cases} \quad [4]$$

- b) Explain: i) MAC unit

ii) Barrel shifter

with respect to DSP processor. [4]

- c) Explain locations of poles in FIR filter. [2]

- Q5)** a) Explain how noise introduced in the signal is minimised using adaptive filter. [4]
- b) Given a signal whose first six values are  
 $X = [1, 1.5, 0.65, 0.37, 0.187, 0.0938]^T$   
 Find a second order all pole model using pade approximation. [4]
- c) What is need of anti-imaging filter in interpolator, explain with spectrum. [2]
- Q6)** a) Explain Booth's multiplication algorithm in signal processing. [4]
- b) What are the advantages of polyphase decomposition ? Explain polyphase decomposition for IIR filter structure. [4]
- c) Explain any one of the application of multirate DSP. [2]
- Q7)** a) Draw the block diagram for sampling rate conversion by rational factor. Also derive input-output signal relationship & draw the spectrum. [4]
- b) What are the advantages of Kaiser window over other windows. Also explain the specifications. [4]
- c) What is frequency Warping ? What is effect of it in filter design. [2]
- Q8)** a) How to use retiming for clock period minimization, explain with example. [4]
- b) Compare type I, type II, type III and type IV FIR filter. [4]
- c) The transfer function of analog filter is  $H(s) = \frac{3}{(s+2)(s+3)}$ . Design digital filter using impulse invariance method with  $T = 0.1\text{sec}$ . [2]



**M.E. (E & T/C) (Signal Processing)**  
**MIXED SIGNAL PROCESSING SYSTEMS AND DESIGN**  
**(2013 Credit Pattern) (Semester-I)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions out of eight questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Design a switched capacitor summing amplifier that gives the output voltage during the  $\Phi_2$  phase period that is equal to  $10V_1 - 5V_2$ . [5]
- b) The switched capacitor circuit in Fig. 1 is an amplifier that avoids shorting the output of the op amp ground during the  $\Phi_1$  phase period. Use the clock scheme shown along with the timing and find the z-domain transfer function,  $H^{oo}(z)$ . Sketch the magnitude and phase shift of this amplifier from zero frequency to the clock frequency,  $f_c$ . [5]

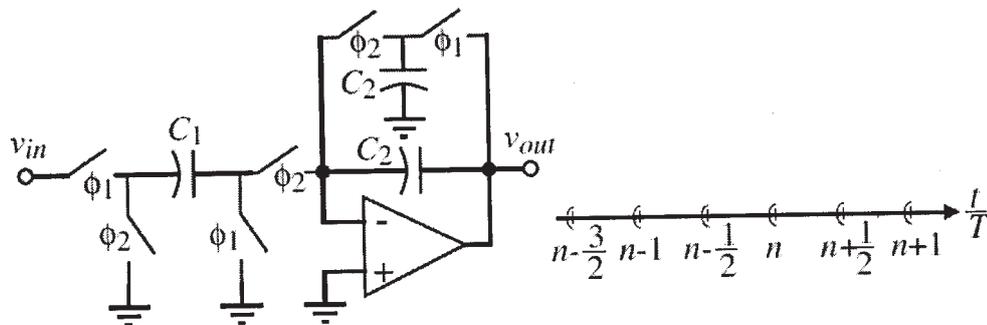


Fig. 1

- Q2)** a) What are the advantages of Switched Capacitor (SC) circuits on Continuous Time circuits? What are the demerits of Switched Capacitor circuits? [4]
- b) For the Non-Inverting charge amplifier in the Fig. 2, find the transfer function in s-domain and evaluate the influence of finite gain and gain bandwidth. Assume  $A_{vd}(0) = 10,000$  and unity gain bandwidth to be 1 MHz and  $C_1/C_2 = 9$ . [3]

P.T.O.

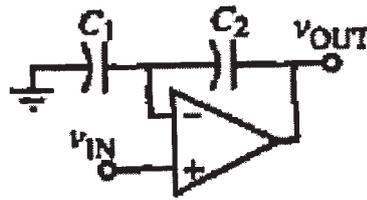


Fig.2

- c) Derive the value of resistance emulated by a series-parallel Switched Capacitor. [3]
- Q3)** a) Draw the schematic of switched capacitor first-order high pass circuit and derive the expression for Z-domain transfer function. [5]
- b) If the clock frequency of parallel switched capacitor equivalent resistor is 100 kHz, find the value of the capacitor C that will emulate a  $1\text{M}\Omega$  resistor. [2]
- c) List any four advantages of Switched Capacitor circuits. [3]
- Q4)** a) Explain the architecture of Charge Scaling DAC with the help of neat figure. [4]
- b) Find the values for 1 LSB, the percentage accuracy and the full-scale voltage generated for a 3-bit and 8-bit DAC. Assume that  $V_{\text{REF}} = 5\text{ V}$ . [3]
- c) Design a 3-bit voltage scaling (resistor string) DAC. Assume that  $V_{\text{REF}} = 5\text{ V}$  and maximum power dissipation is 5 mW. Find the value of the output voltage for  $D_2D_1D_0 = 001$  and 111. [3]
- Q5)** a) Determine the DNL for 3-bit nonideal DAC whose transfer curve is shown in Fig. 3. Assume that  $V_{\text{REF}} = 5\text{ V}$ . Also draw the quantization error curve and DNL curve. [4]

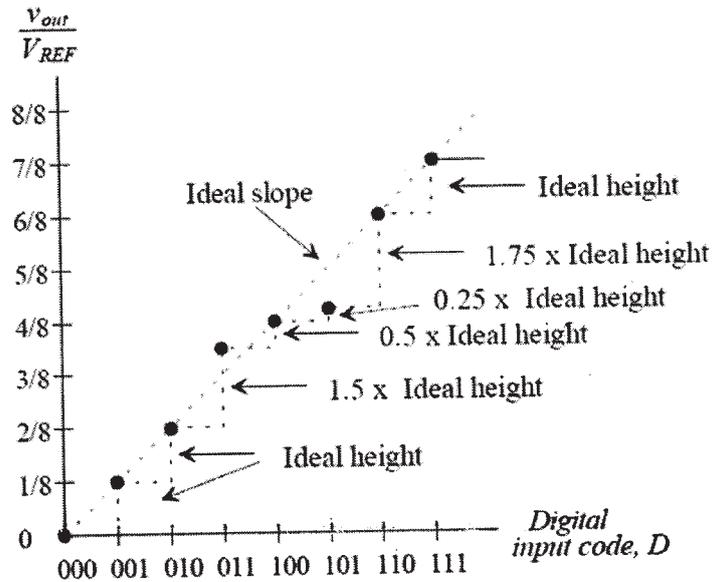


Fig.3

- b) Find the digital output of an ideal four-stage, algorithmic pipeline ADC. Assume  $V_{in} = 0.1 V_{ref}$  and  $V_{ref} = 5$  V. Find the same if the comparators of each stage have a dc voltage offset of 0.1V. [4]
- c) List one advantage and disadvantage of flash ADC over other type of ADCs. [2]
- Q6)** a) Explain in detail the Delta-Sigma ADCs. What is the trade-off between signal bandwidth and accuracy of Delta-Sigma ADCs? [4]
- b) Explain the following terms related to Data converters: ENOB, SFDR, SNR and SNDR. [3]
- c) Find the digital output word to a 8-bit successive approximation converter, if the analog input applied is  $0.7 V_{ref}$ . [3]
- Q7)** a) Draw the block diagram of digital PLL and explain its working in detail. [4]
- b) Explain in brief, the following performance evaluation parameters with respect to direct digital synthesis: [4]
- i) Switching speed.
  - ii) Phase noise.
- c) List four applications of Phase- locked loop. [2]

- Q8)** a) What is the need of locked in Amplifier? Draw the block diagram of typical locked in amplifier. What is phase sensitive detection and narrow band detection? [5]
- b) Compare Direct Digital Synthesizers and PLL synthesizers. [3]
- c) List performance parameters of Direct Digital Synthesizers. [2]



Total No. of Questions : 8]

SEAT No. :

P4180

[Total No. of Pages : 2

[4760]-1150

M.E. (E & TC) (Signal Processing) (Semester - II)

SPEECH SIGNAL PROCESSING

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1)** a) Explain how the human speech production system can be digitally modelled. [5]

b) Use Levinson Durbin algorithm to compute third order all pole model for a signal  $s(n)$  with autocorrelation sequence [5]

$$\gamma_x(0)=1 \quad \gamma_x(1)=0.5 \quad \gamma_x(2)=0.5 \quad \gamma_x(3)=0.25$$

**Q2)** a) Signal samples are given by 1.8, 2.4, 3.5, 5.1, 6.2, 9.7, 11.2, 13.2, 12.6, 10.2, 7.3, 5.9, 8, 7.4, 5.2, 3.1, 1.8. Find step size and quantization noise power for a signal and for a difference of signal if four bit quantizer is used. [5]

b) How Formants and pitch can be extracted from cepstrum? [5]

**Q3)** a) How human auditory system can be modelled by Filter bank? [4]

b) Explain Burg's algorithm in detail. [4]

c) Comment on time & frequency trade off for Wavelet transform. [2]

**Q4)** a) Explain the steps in obtaining MFCC coefficients. [4]

b) What are different means for speech quality assessment. [4]

c) Describe LPC-10 standard. [2]

P.T.O.

- Q5)** a) Explain the spectral subtraction method used for speech enhancement. [4]
- b) Compare PCM ADPCM & DM. [4]
- c) Explain how formants are related to Linear prediction coefficients. [2]
- Q6)** a) Explain Autocorrelation method & AMDF method for pitch period estimation. [4]
- b) How a discrimination between voiced & unvoiced speech is done using [4]
- i) Autocorrelation method
- ii) Spectrum Tilt
- c) A speech signal has rms amplitude of 3V and is to be coded using six bits find step size and quantization noise power? [2]
- Q7)** a) Explain different short term features used in speech signal processing with relevant application. [4]
- b) What do you mean by homomorphic signal processing system? Explain with the block diagram. [4]
- c) How Mel scale differs from Bark scale? [2]
- Q8)** a) What is PLP? Compare the procedure to obtain MFCC with that of PLP. [4]
- b) Explain with block schematic how speaker recognition system works. [4]
- c) Is it possible to obtain original signal from its real cepstrum? If yes how? If not why? [2]



Total No. of Questions : 8]

SEAT No. :

**P4615**

[Total No. of Pages : 3

**[4760] - 1151**

**M.E. (E & TC) (Signal Processing) (Semester - II)**

**ARCHITECTURES FOR SIGNAL PROCESSING ALGORITHMS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator Is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Prove that the multiplication of two DFTs of two sequences is equivalent to circular convolution of two sequences in time domain. **[5]**

b) Using graphical method calculate the circular convolution of the following sequences **[5]**

$$x_1(n) = \delta(n) + \delta(n-1) - \delta(n-2) - \delta(n-3)$$

$$x_2(n) = \delta(n) - \delta(n-2) - \delta(n-4).$$

**Q2) a)** Explain the following properties of Discrete Fourier Transform. **[5]**

i) Circular Time Shift

ii) Circular Frequency Shift

b) Construct a 2x3 convolution algorithm using modified Winograd algorithm with  $m(p) = p(p - 1)(p + 1)$ . **[5]**

**Q3) a)** Explain how to construct SRDFG for MRDFG with example. **[5]**

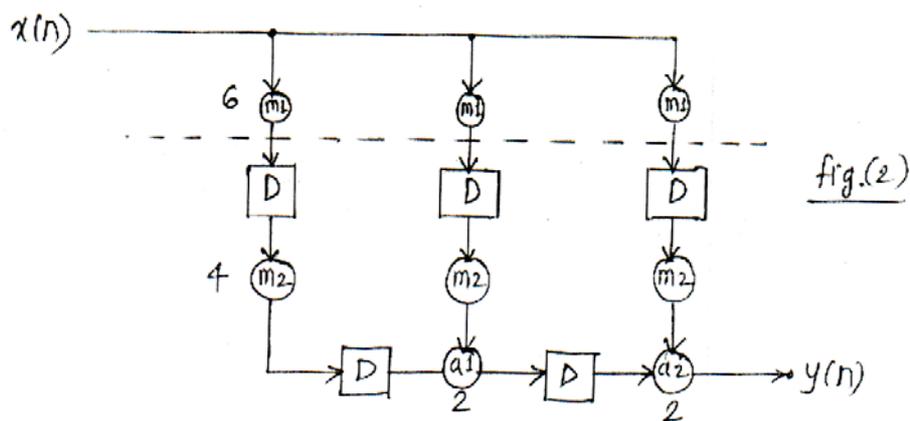
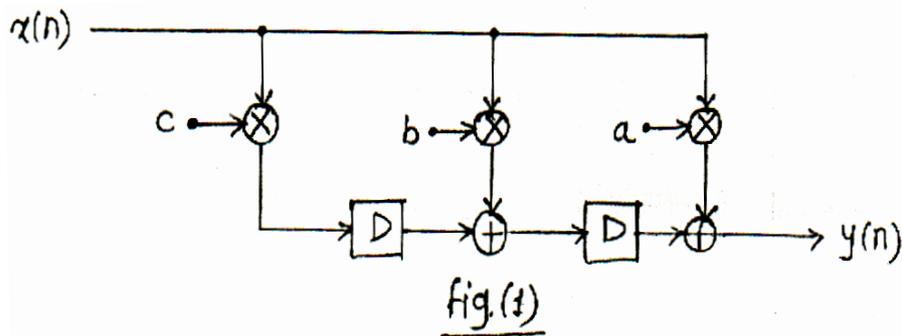
b) Explain iterated convolution algorithm. **[2]**

c) Explain Cook - Toom algorithm. **[3]**

**P.T.O.**

**Q4) a)** Consider the 3 tap FIR filter shown in fig. 1 and its finegrain pipelined version in fig. 2. Assume that the multiplication operation takes 10 u.t. and the addition operation takes 2 u.t. For power estimation purposes, assume that the capacitance of the multiplier is 5 times that of an adder. In the fine-grain pipelined filter the multiplier is broken into 2 parts,  $m_1$  and  $m_2$ . with computation time of 6 u.t. and 4 u.t. respectively, with capacitance 3 times and 2 times that of an adder, respectively. Assume the device threshold voltage to be 0.6 V. also assume the nonpipelined filter to be operated at the supply voltage 5 V. [4]

- i) What is the supply voltage of the pipelined filter if the clock period remains unchanged?
- ii) What is the power consumption of the pipelined filter as a percentage of the original filter?



- b) Explain properties of retiming. [4]
- c) Explain properties of unfolding. [2]

- Q5)** a) Explain mathematically how pipelining can achieve high speed and low power. [5]  
b) Explain systolic array design with an example. [5]
- Q6)** a) Explain parallel multipliers. Also state the types of it. [5]  
b) Explain with neat schematic 4x4 carry save baugh Wooley multiplier. [5]
- Q7)** a) Explain implementable bit serial multipliers using systolic mappings. [3]  
b) Briefly explain CSD representation. [2]  
c) Explain bit serial FIR filter. [5]
- Q8)** Write short note on any two of the following : [10]  
a) Carry save array multipliers.  
b) Booth - Wallace tree multiplier  
c) Integrated convolution algorithm with the merit and demerit of it.



Total No. of Questions : 8]

SEAT No. :

**P4181**

**[4760]-1152**

[Total No. of Pages : 2

**M.E. (E & TC-Signal Processing)**  
**BIOMEDICAL SIGNAL PROCESSING**  
**(2013 Credit Pattern) (Semester-II) (504409)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answers any five questions out of 8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1)** a) Describe a generalized bio-instrumentation system with a neat block diagram. **[5]**

b) Write a note on Blood flow. **[5]**

**Q2)** a) Discuss the Cardiovascular system in details. **[5]**

b) Describe the cell bio-electric phenomenon with a neat figure. **[5]**

**Q3)** a) Explain the origin of Bio-Potential. **[4]**

b) Explain biomedical application of Laplace Transform. **[4]**

c) Discuss Transient Protection. **[2]**

**Q4)** a) What is the technique used to study fetal electro-cardiography. Explain the technique used. **[4]**

b) Explain the movement of Artifact circuit. **[4]**

c) Explain Eigen functions of LSI system and Z-transform. **[2]**

**P.T.O.**

- Q5)** a) Write a note on CT scan. [4]  
b) Draw Autocorrelation function for  
 $X(n) = [0, -1, 0.25, -1, 0.75, 0.25, -1, 0, 0.32]$  [4]  
c) Define Z-transform. [2]
- Q6)** a) Explain biomedical application of Fourier Transform. [4]  
b) Write a note on ECG. [4]  
c) Draw & explain Cell structure. [2]
- Q7)** a) Explain operating principle and specification of transducer. [4]  
b) Discuss Phonocardiography technique. [4]  
c) What is characterization of signal in frequency domain. [2]
- Q8)** a) Discuss Weiner filter in detail. [4]  
b) Explain power spectral density. [4]  
c) What is the application of wavelet transform. [2]



Total No. of Questions : 8]

SEAT No. :

P4182

[Total No. of Pages : 3

[4760]- 1153

M.E. (Electronics and Telecommunications) (Signal Processing)

STATISTICAL SIGNAL PROCESSING

(2013 Pattern)

Time : 3 Hours]

[Max Marks :50

Instructions to the candidates:

- 1) Attempt any five questions out of eight.
- 2) All questions carry equal marks.
- 3) Figures to the right indicate full marks.
- 4) Make suitable assumptions wherever necessary.

Q1) a) A third order all pole Pade's approximation to a signal  $x(n)$  has been

found to be  $H(z) = \frac{1}{1 + 2z^{-1} + z^{-2} + 3z^{-3}}$  [5]

What information about  $x(n)$  can be obtained from this model?

b) Derive first and second order all pole Model using Prony's Method for following sequences. [5]

$$\begin{aligned}x(n) &= \delta(n) - \delta(n-1) \\r_x(k) &= 2 \quad k=0 \\&= -1 \quad k=1 \\&= 0 \text{ otherwise}\end{aligned}$$

Q2) a) Develop the Levinson order update equation using all pole Prony's method of modeling. [5]

b) For the given the autocorrelation sequence  $r_x(k)$  compute the reflection Coefficient  $\Gamma_1, \Gamma_2, \Gamma_3$ , using scur's recursion. The autocorrelation sequence is as follows. [5]

$$r_x(k) = [2, -1, -1/4, 1/8]^T$$

P.T.O.

- Q3)** a) State CR lower bound theorem with its regularity condition. [5]  
 b) From measurement of a process  $x(n)$ , the autocorrelation sequence is found to be as follows, [5]

$$r_x(k) = \alpha^{|k|}; |k| \leq M \text{ \& } |\alpha| < 1.$$

Estimate the power spectrum using

- i) The Blackman-Tukey method with a rectangular window.  
 ii) The minimum variance method.

- Q4)** a) Explain steepest descent algorithm in brief. Also derive equation for updating its weights. [5]  
 b) Consider the single weight adaptive filter shown in **fig. a**. Find its system function  $H(z)$  relating  $d(n)$  to  $e(n)$  using LMS algorithm. Also determine range of values for  $\mu$  for which  $H(z)$  is stable. [5]

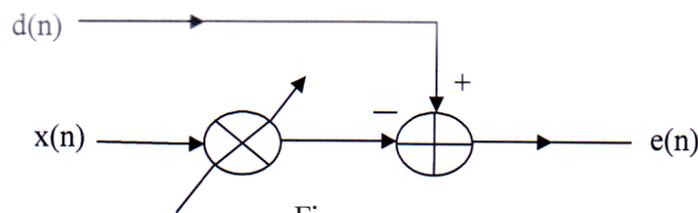


Fig.a

- Q5)** a) Explain in brief how power spectrum can be estimated by stochastic signal modeling? [3]  
 b) What are special types of random processes? Enlist expression for their power spectrum estimation in terms of  $\omega$ . [3]  
 c) Compare parametric and Nonparametric methods for power spectrum estimation. [4]
- Q6)** a) Define a regular process with its properties in brief. [3]  
 b) What is an asymptotically unbiased and asymptotically efficient Estimator. [3]  
 c) The autocorrelation sequence of a process  $x(n)$  is as follows, [4]

$$r_x(k) = [1, 0.5, 0.5]$$

Design a two coefficient LMS adaptive linear predictor for  $x(n)$  that has a misadjustment  $M=0.05$ , and find the steady state mean square error.

- Q7)** a) Enlist properties which a generalized adaptive filter should possess. [3]  
 b) Explain modified covariance method of parametric spectrum estimation. [3]  
 c) Given a signal whose first six values are as follows, [4]

$$x = [1, 1.500, 0.750, 0.375, 0.1875, 0.0938]^T$$

Using Padé's approximations find a second order all pole model. Comment on its stability.

- Q8)** a) Explain leaky LMS algorithm in brief. [3]  
 b) Discuss properties and limitations of Padé's approximation technique. [3]  
 c) Implement third order FIR filter  $H(z) = 1 + 0.5z^{-1} - 0.1z^{-2} + 0.5z^{-3}$  using lattice structure and step down recursion having the vector coefficients

$$a_3 = [1, 0.5, -0.1, -0.5]^T \quad [4]$$



Total No. of Questions : 8]

SEAT No. :

**P4404**

**[4760] - 1154**

[Total No. of Pages :2

**M.E. (E & TC -Signal Processing)**  
**STILL IMAGE AND MOVING PICTURE COMPRESSION**  
**STANDARDS**  
**(2013 Credit Pattern) (Semester -III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if required.*

- Q1)** a) Explain color transforms used in JPEG 2000 for lossy and lossless compression. **[5]**
- b) Give advantages of JPEG2000 over baseline JPEG. **[5]**
- Q2)** a) What is SNR scalability? How it is achieved in JPEG 2000? **[5]**
- b) Which entropy coding method is used in JPEG 2000? Explain in short. **[5]**
- Q3)** a) What is temporal redundancy? How it is reduced by inter-frame coding? **[5]**
- b) Explain need of motion estimation in video coding. **[5]**
- Q4)** a) Explain telescopic motion search technique in MPEG-1. Give its advantages. **[5]**
- b) In coding of SIF-625 video at 1.2 Mbit/s, with a GOP structure  $N \times 12$ ,  $M \times 3$ , the ratios of complexity indices of I, P and B are 20:10:7, respectively. Calculate the target bit rate for coding of each frame in the next GOP. **[5]**

**P.T.O.**

- Q5)** a) Explain MPEG-1 decoder with block diagram. [5]  
b) Explain picture types in MPEG-1. [5]
- Q6)** a) How MPEG-2 provides temporal scalability? Explain. [5]  
b) Give additional features of MPEG 2 over MPEG-1. [5]
- Q7)** a) Explain motion vector prediction in H.263. [5]  
b) Explain how error detection by post processing is achieved in H.263. [5]
- Q8)** a) Compare MPEG-4 with MPEG-1. [5]  
b) Explain VOP encoder structure in MPEG 4. [5]



Total No. of Questions : 8]

SEAT No. :

**P4183**

**[4760] - 1155**

[Total No. of Pages : 2

**M.E. (E & TC) (Communication Networks) (Semester - I)**  
**MODELING & SIMULATION OF COMMUNICATION NETWORK**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Describe the various simulation methodologies and the factors affecting the modeling of functional block. **[5]**  
b) Explain the selection criteria for the parameters used for the evaluation of performance of any communication system. **[5]**
- Q2)** a) Derive the mathematical framework for the estimation model of bandpass filter. **[5]**  
b) Explain the importance of uplink and downlink frequency in the modeling of a communication system. **[5]**
- Q3)** a) Explain the utility of PDF for the analysis of random process. Also describe the polar method for the generation of a pair Gaussian random vector. **[5]**  
b) Describe the utility of correlated and uncorrelated Gaussian random numbers in the modeling of a stochastic process. **[5]**
- Q4)** a) Explain the characteristics of PN sequence and its importance in communication systems with examples. **[5]**  
b) Describe the various methods used for testing the random numbers. **[5]**
- Q5)** a) Discuss Monte Carlo simulation with an example of BER calculation with QPSK modulation taking suitable assumptions. **[5]**  
b) Compare the semi-analytic method of simulation in contrast with Monte Carlo method. **[5]**

**P.T.O.**

- Q6)** a) What is queuing model? How it is useful for Simulation? Explain all different kind of Queuing Model in detail. [5]
- b) Discuss Poissonian and Non-Poissonian modeling of network traffic with suitable example. [5]
- Q7)** a) Explain the impact of nonlinearities on the modeling and simulation of any system. Also describe the methods of dealing with the functional nonlinearities. [5]
- b) Derive the mathematical model for the diffused multipath fading channels using tapped delay line model. [5]
- Q8)** a) Illustrate various aspects of modeling and simulation of time varying systems in detail. [5]
- b) Derive and demonstrate two state Markov model for discrete channel with memory. [5]



Total No. of Questions : 8]

SEAT No. :

**P4616**

[Total No. of Pages : 2

**[4760] - 1156**

**M.E. (Communication Networks)**

**SPREAD SPECTRUM AND CDMA SYSTEMS**

**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Use of calculator is allowed.*

**Q1) a)** What is Galois field? What are the properties of Galois field. **[5]**

b) Calculate the discrete period cross-correlation function for the pair of m- sequences defined by

$$g_1(D) = 1 + D^2 + D^5 \text{ and } g_2(D) = 1 + D^2 + D^3 + D^4 + D^5 \quad \mathbf{[5]}$$

**Q2) a)** List the different strategies for synchronization techniques in spread spectrum systems. Explain any one technique in detail. **[5]**

b) Explain the multiple-dwell detector function with a flow chart or a state transition diagram. **[5]**

**Q3) a)** With the help of an example, explain concept of shadowing. **[5]**

b) Explain the performance of SS in single tone jamming using a generalized receiver model. **[5]**

**Q4) a)** Discuss the fundamental concepts of convolution codes. **[5]**

b) Explain different methods of diversity in radio systems. **[5]**

**P.T.O.**

- Q5)** a) Explain the concept of cell splitting and cell sectoring. [4]  
b) Explain the typical applications of CDMA. [2]  
c) Discuss the performance of CDMA in multipath fading environment. [4]
- Q6)** a) Explain CDMA IS 95 A Architecture with suitable diagram. [5]  
b) Explain the conceptual block diagram of IS-95 for forward and reverse link channels. [5]
- Q7)** a) Explain RAKE receiver with suitable block schematic. [5]  
b) Discuss adaptive power control mechanism in CDMA. [5]
- Q8)** a) Explain the Physical and logical channels in WCDMA. [5]  
b) Discuss GPS receiver technology. [5]



Total No. of Questions : 8]

SEAT No. :

**P4617**

**[4760]-1157**

[Total No. of Pages : 2

**M.E. (E & TC) (Communication Networks)  
DETECTION AND ESTIMATION THEORY  
(2013 Credit Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of calculator is allowed.*

**Q1) a)** What is Bayes' Criteria for Binary Hypothesis testing? Explain with suitable mathematical representations. **[5]**

b) In what situation Neyman-Pearson (NP) Criteria useful? Derive the NP Criteria. **[5]**

**Q2) a)** What is M Hypothesis test? Write and explain Bayes' Criteria for M Hypotheses. **[5]**

b) Define Gaussian random vector and general Gaussian problem. Explain the general Gaussian problem when the covariance matrices on two hypotheses test are equal. **[5]**

**Q3) a)** Explain the orthogonal representation of deterministic signal. **[5]**

b) Explain the conventional characterization of Random Process. **[5]**

**Q4) a)** Define Gaussian Process State and prove any one property of Gaussian Process. **[5]**

b) Explain any one example of multidimensional problems for estimation of continuous waveform. **[5]**

**P.T.O.**

- Q5)** a) State the problem binary detection in AWGN. [5]  
b) Explain the terms: [5]  
i) Unbiased Estimate  
ii) Bias of Estimate  
iii) Minimum Variance Unbiased Estimator.
- Q6)** a) Explain Bayes' Estimator. [5]  
b) What is Weiner Filter? How it is useful in estimation of non-stationary process? [5]
- Q7)** a) Explain any one property of optimum process. [4]  
b) What is Kalman Filtering? Explain it with block schematic. [4]  
c) Write expression for ARMA process. [2]
- Q8)** a) Discuss range detection in RADAR. [4]  
b) Explain realization of AR filter. [4]  
c) What is discrete time random process? [2]



Total No. of Questions : 8]

SEAT No. :

P4184

[Total No. of Pages : 2

**[4760]-1158**  
**M.E. (E & TC) (Semester - II)**  
**COMMUNICATION NETWORK**  
**Traffic Analysis & QoS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of Calculator is allowed.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Explain in detail functional model with neat digram? [4]  
b) Write short note on broadband network services? [4]  
c) Prepare a chart for functional roll of management tools? [2]
- Q2)** a) Explain SNMP & Organization model? [4]  
b) What is network management system explain in detail? [4]  
c) Explain in detail the network management standards? [2]
- Q3)** a) Explain TMN Conceptual Model? [4]  
b) What is the TMN Service architecture? [4]  
c) Explain OAM management? [2]
- Q4)** a) Explain optical & MAN feeder networks? [4]  
b) What are the system utilities for management? [4]  
c) Write integrated view of TMN? [2]

**P.T.O.**

- Q5)** a) Explain high speed network in terms of performance modeling & estimation? [4]  
b) Explain the RSVP operation by using filtering q sub stream? [4]  
c) What is the requirement of Fiber channel? [2]
- Q6)** a) Explain Differential services? [4]  
b) Explain mechanism for congestion control? [4]  
c) What are Services categories define by ATM forum? [2]
- Q7)** a) Explain control Traffic & congestion control in ATM networks? [4]  
b) Explain Link control mechanism (Stop and Wait ARQ)? [4]  
c) Explain Cell Delay Variation? [2]
- Q8)** a) Define MPLS & Explain it in detail? [4]  
b) Explain performance requirement & metrics? [4]  
c) Define ATM & Explain QoS parameters define by ATM forum? [2]



Total No. of Questions : 8]

SEAT No. :

**P4185**

[Total No. of Pages : 2

**[4760] - 1159**

**M.E. (E & TC) (Communication Network)**

**Broadband Wireless Technologies**

**(Semester - II) (2013 Pattern)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain the steps involved in designing the receiver in orthogonal frequency Division Multiplexing. [5]

b) Compare and contrast interleaved FDMA and single carrier FDMA. [5]

**Q2) a)** Explain the steps involved in Multiple Input Multiple Output (MIMO) transceiver design. [5]

b) Derive channel capacity for Single Input Single Output (SISO) channels.[5]

**Q3) a)** Compare and contrast between Time hopping ultra wideband and Direct sequence ultra wideband systems. [5]

b) What do you mean by Energy efficient Medium Access Control? Explain it's working principle briefly. [5]

**Q4) a)** Explain the different types of schemes used in directional antenna MAC.[5]

b) Explain the Multichannel Medium Access control system. [5]

**Q5) a)** Classify the routing protocols on basis of their path selection criteria.[5]

b) Explain the concept of outage probability for video services in a multirate DS - CDMA system. [5]

**P.T.O.**

- Q6)** a) What are the issues related to mobility in Wi - MAX networks? [5]  
b) Explain the bandwidth scheduling used in WiMAX Mesh network. [5]
- Q7)** a) What is grant scheduling and grant sizing in bandwidth management for multichannel Ethernet Passive Optical Network? [5]  
b) Explain QoS protection and Admission control in Ethernet Passive Optical Network. [5]
- Q8)** a) Explain basic steps involved in WOBAN routing. [5]  
b) Explain & draw the Integrated architecture for Ethernet Passive Optical Network and WiMAX Network. [5]



Total No. of Questions : 10]

SEAT No. :

**P4311**

**[4760] - 116**

[Total No. of Pages : 3

**M.E. (Mech.) (Design Engg. & Automotive Engg.)**

**MATHEMATICAL MODELING AND ANALYSIS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from section - I and any three questions from section - II.*
- 2) *Answers to each section should be written in separate answer book.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data wherever necessary but mention it clearly.*
- 5) *Use of scientific calculator is allowed.*

**SECTION - I**

**Q1) a)** Linearize the differential equation given below for a small excursion about

$$x = \pi/4. \quad \frac{d^2x}{dt^2} + 2\frac{dx}{dt} + \cos x = 0 \quad [12]$$

- b) Explain the followings : [6]
- i) Time invariant system
  - ii) Discrete time system

**Q2) a)** State the physical laws governing a fluid system. [4]

b) Derive the differential form of the momentum equation for a fluid system. [12]

**Q3)** For an electrical circuit shown in Figure 1, obtain a mathematical model and an equation for the current  $i(t)$ . Assume that the switch S is open for  $t < 0$ , closed at  $t = 0$  and is opened again at  $t = t_1 > 0$ . [16]

**Q4) a)** Draw linear graphs for the systems shown in Figure 2. [6]

b) Explain explicit and implicit numerical techniques. [10]

**P.T.O.**

**Q5)** Figure 3 shows an input  $x[n]$  to a linear time invariant system and its impulse response  $h[n]$ . Determine the convolution of  $x[k]$  and  $h[n]$ . [16]

## SECTION II

**Q6)** Solve the following initial value problem using Laplace transform technique.  
 $y''(t) - 3y'(t) + 2y(t) = 4e^{2t}$  when  $y(0) = -3$  and  $y'(0) = 5$  [16]

**Q7)** Determine z transforms of the following signals : [16]

- a)  $x(m) = 1$  for  $m = 0$  and  $x(m) = 0$  for  $m \neq 0$ .
- b)  $x(m) = 1$  for  $m = k$  and  $x(m) = 0$  for  $m \neq k$ .
- c)  $x(m) = 1$  for  $m = -k$  and  $x(m) = 0$  for  $m \neq -k$ .
- d)  $x(m) = 1$  for  $m = \pm k$  and  $x(m) = 0$  for  $m \neq \pm k$ .

**Q8)** Construct a wavelet set for a map defined by  $T(x) = x/2$  for all  $x \in Q = [-\pi, \pi)$ . [16]

**Q9)** Write short notes : [16]

- a) Deterministic simulation
- b) Monte Carlo Simulation

**Q10)** Compare the followings : [18]

- a) Analytical and monte Carlo simulations
- b) Deterministic model and stochastic model

Figures :

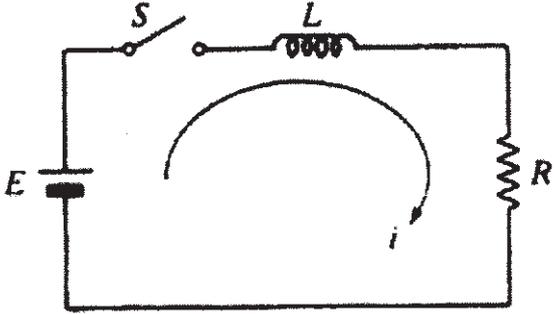


Figure 1

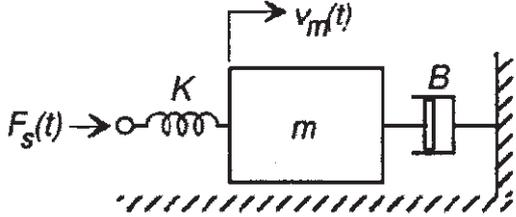


Figure 2

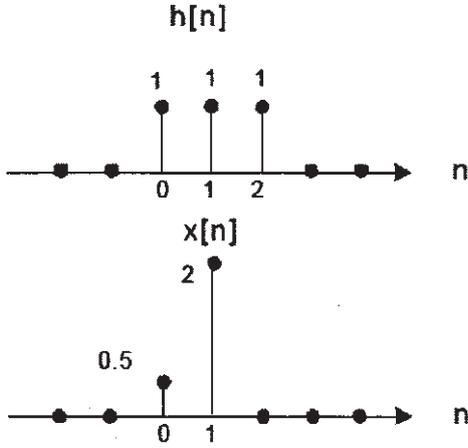


Figure 3



Total No. of Questions : 8]

SEAT No. :

**P4618**

**[4760]-1160**

[Total No. of Pages : 2

**M.E. (E & TC) (Communication Networks)**

**OPTICAL NETWORKS**

**(2013 Credit Pattern) (Semester - II) (504509)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of Calculator is allowed.*

- Q1)** a) Explain the optical layer hierarchy with neat diagram. [4]
- b) Explain in brief the propagation in a nonlinear medium. [3]
- c) Write a note on couplers. Explain 3 dB coupler in detail. [3]
- Q2)** a) What are solitons? State its advantages and applications. [4]
- b) Compare transparent and nontransparent network. [3]
- c) Write short note on MZI. [3]
- Q3)** a) State the overall system design parameters of optical network and explain in brief. [4]
- b) State and explain design parameters of optical transmitter in brief. [3]
- c) Explain the operating principle of Fabry-Perot filters. State the power transfer function for the same. [3]

**P.T.O.**

- Q4)** a) Explain second-generation optical networks along with key network elements that enable optical networking. [4]
- b) Write short notes on the following (Any two): [6]
- i) Protocol stack alternatives.
  - ii) Wavelength Stabilization.
  - iii) Lasing Loops.
- Q5)** a) Describe optical networks layered architecture in detail. Mention significance of each layer. [5]
- b) Describe the basic transmission unit for SONET. Comment on overhead and user areas in the envelope. [5]
- Q6)** a) With neat block schematic explain the OTN layered model. State the advantages of the recent optical network layered architecture. [4]
- b) Write a note on Transparency and All-Optical Networks. [4]
- c) What is Erbium-doped Fiber? [2]
- Q7)** a) What is label switching? Explain FEC. [4]
- b) What is WDM? Explain WDM link in detail. [4]
- c) Calculate link loss  $\gamma$  in dB unit, if transmitted power is 1 mW and received power is 1  $\mu$ W. [2]
- Q8)** a) What is MPLS traffic engineering? [4]
- b) Write short notes on the following (Any Two): [6]
- i) Virtual Tributaries.
  - ii) Generic Framing Procedure.
  - iii) Control plane and Data plane.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4186**

[Total No. of Pages : 2

**[4760]- 1161**

**M.E. (E&Tc) (Communication Networks) (Semester - III)**

**MOBILE COMPUTING**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) *Answers any Five Questions out of Q.1 to Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain various types of mobilities in mobile communication environment. **[5]**

b) Explain various access methods in wireless communication along with their application areas. **[5]**

**Q2)** a) Explain various features, architecture and security algorithm used in GSM. **[5]**

b) Write a note on MIMO. **[5]**

**Q3)** a) Discuss WML in details. **[4]**

b) Explain how GSM system can be enhanced to use a GPRS system. **[4]**

c) Discuss 2-G mobile telephone technology. **[2]**

**Q4)** a) Explain the authentication process in 802.11 frame work. **[4]**

b) Discuss the three tier architecture of mobile computing. **[4]**

c) Discuss 3-G mobile telephone technology. **[2]**

**P.T.O.**

- Q5)** a) Explain in details about voice over internet protocol architecture. [4]  
b) Explain GPRS architecture in details. [4]  
c) Discuss 4-G mobile telephone technology. [2]
- Q6)** a) Explain dynamic channel allocation. [4]  
b) What are the various issues to be considered in designing the WLAN environment. [4]  
c) What is H.323? Explain in detail. [2]
- Q7)** a) Write a note on VOIP [4]  
b) Explain various security models used in mobile computing. [4]  
c) Explain logical and physical channels in GSM system. [2]
- Q8)** a) Write a note on CDMA [4]  
b) Explain multipath propagation with an example. [4]  
c) What is handoff? What is roaming? [2]



Total No. of Questions : 8]

SEAT No. :

**P4187**

**[4760] - 1162**

[Total No. of Pages :2

**M.E. (E & TC) (Communication Networks)  
DIGITAL COMMUNICATION RECEIVERS  
(2013 Credit Pattern) (Semester - III) (604502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams and waveforms must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** With the help of block diagram explain duobinary signaling. Demonstrate duobinary coding and decoding for the following sequence 0010110. Consider the first bit of the sequence to be a start up digit, not part of the data. **[5]**

b) What are the different pulse modulation techniques? Explain M-ary pulse modulation. What is the advantage of multilevel signaling? **[5]**

**Q2) a)** Explain BPSK Modulation Technique. Give the derivation for probability of error for coherent detection. **[5]**

b) Draw the vectorial representation for values of M= 2,4,8 and 16 for MPSK signal. **[5]**

**Q3) a)** With the help of Spectral diagrams explain Matched-filter demodulator for signal corrupted with AWGN. **[5]**

b) Derive the probability of error of M-ary Orthogonal signals. **[5]**

**Q4) a)** Explain optimum Receiver for CPM signals. **[5]**

b) Explain detection of signals with memory using max-likelihood sequence detection algorithm. **[5]**

**P.T.O.**

- Q5)** a) What are the characteristics of Fading Multipath Channel. [4]  
 b) With the help of a model, explain diversity for Binary signals. [4]  
 c) Compare the performance of two, four & eight phase DPSK with diversity. [2]
- Q6)** a) Define the following: [5]  
 i) Doppler power spectrum of the channel  
 ii) Doppler spread of the channel  
 iii) Coherence Time  
 iv) Spaced time correlation function  
 v) Scatter function of the channel
- b) The scattering function  $S(\tau, \lambda)$  for a fading multipath channel is non zero for the range of values  $0 \leq \tau \leq 1 \text{ms}$  and  $-0.1 \text{Hz} \leq \lambda \leq 0.1 \text{Hz}$ . Assume that the scattering function is approximately uniform in the two variables Find: [5]  
 i) The multipath spread of the channel  
 ii) The doppler spread of the channel  
 iii) The Coherence Time  
 iv) The Coherence bandwidth of the channel  
 v) The spread factor of the channel
- Q7)** a) Discuss the algorithm for Adaptive Decision Feedback Amplifier. [5]  
 b) What is the need for carrier and symbol synchronization? Enlist the techniques for the same. [5]
- Q8)** a) Explain Max-likelihood Timing Estimator for baseband PAM. [4]  
 b) What are decision directed loops for carrier phase estimation? [4]  
 c) Give the need for recursive LMS Algorithm. [2]



Total No. of Questions : 8]

SEAT No. :

**P4188**

[Total No. of Pages : 3

[4760] - 1163

**M.E. (Electronics) (Digital Systems) (Semester - I)**

**MICROELECTRONICS**

**(2013 Pattern) (Credit System)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** What do you mean by pull up and pull down networks in static CMOS logic? Design static CMOS logic circuit for the following boolean expressions. **[5]**

i)  $F = \bar{A} + (\bar{B} + \bar{C})\bar{D}$

ii)  $f = \overline{x \cdot (y + z)} + y$

**b)** Draw the stick diagram and layout of the following functions. **[5]**

i) Two input OR gate

ii) Two input NOR gate

**Q2) a)** What are the various parasitic components in a CMOS circuit? With reference to CMOS inverter circuit, explain the term parasitic delay. **[5]**

**b)** List various Lithography techniques used in fabrication process. Explain photolithography process in detail. **[5]**

**Q3) a)** Why is NAND a preferred gate? How does mobility of electrons and holes affect size of gates in CMOS logic? **[4]**

**b)** Write short notes on (Any two) : **[4]**

i) Dynamic CMOS logic

ii) Power dissipation in CMOS

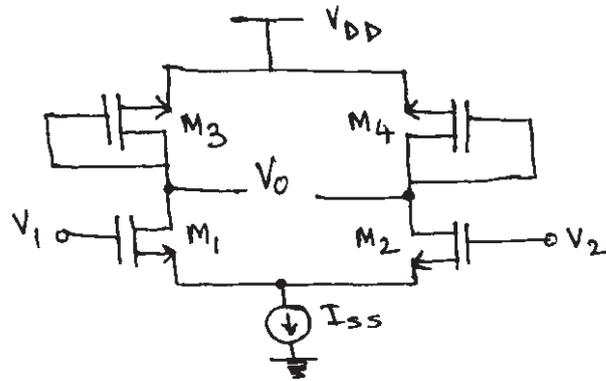
iii) CMOS RF circuits

**c)** Explain how CMOS inverter can be used as amplifier. **[2]**

**P.T.O.**

- Q4)** a) With reference to CMOS inverter explain the meaning of following terms :[4]
- i)  $(w/L)$  ratio
  - ii) Switching energy
  - iii) Propagation delay
  - iv) Noise margin
- b) Design a full Adder using : [4]
- i) Static CMOS logic
  - ii) Dynamic CMOS logic
- c) Explain MOS gate capacitance model and MOS diffusion capacitance model.[2]
- 
- Q5)** a) Draw and explain fabrication steps for following processes : [4]
- i) n-well process
  - ii) p-well process
- b) Draw the VTC of CMOS inverter and explain the different regions of operation. [4]
- c) What are the merits and demerits of CMOS transmission gate? [2]
- 
- Q6)** a) What are the components to be consider for the power dissipation in a CMOS VLSI circuit. Calculate approximate dynamic power dissipation in a chip operating with  $V_{DD}$  of 4.5V at 200 MHz with an internal switched capacitance of 300PF. [4]
- b) Design 2:1 MUX using transmission gate and conventional static CMOS logic. Compare the two circuits with respect to speed, area and power.[4]
- c) Explain in brief Micron design rules. [2]
- 
- Q7)** a) Compare BiCMOS and CMOS technologies with respect to following parameters. [4]
- i) Speed
  - ii) Power dissipation
  - iii) Noise margin
  - iv) Input impedance
- b) Write short notes on (any two) [4]
- i) Impact of transistor sizing on VTC of CMOS inverter.
  - ii) Layout design rules
  - iii) Low power design techniques.
- c) Draw CMOS inverter circuit and describe its switch level RC delay model.[2]

- Q8) a)** What is the effect of CMOS sizing on **[4]**
- i) Propagation delay
  - ii)  $C_{gs}$
  - iii)  $R_{DS(on)}$  and
  - iv) Current sink/source capabilities
- b) Determine the voltage gain of the circuit shown below. Assume  $M_1$  is identical to  $M_2$  and  $M_3$  is identical to  $M_4$  and  $\lambda \neq 0$ . **[4]**



- c) Implement two input AND gate in pass transistor logic. List drawbacks of pass transistor logic. **[2]**



Total No. of Questions : 8]

SEAT No. :

P4189

[Total No. of Pages :2

[4760]-1164

M.E. (Electronics) (Digital Systems)

DIGITAL SIGNAL PROCESSING ARCHITECTURES

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data if required.*

**Q1)** a) Compute the 4-point DFT of the following sequence:  $x[n] = \{3, 0, 1, 2\}$ . From this determine the DFT of the sequence  $\{0, 1, 2, 3\}$  using DFT property. [5]

b) Explain along with example overlap-save method for filtering long length sequence. [5]

**Q2)** a) Explain the spectral analysis of ECG and speech signal. [4]

b) Explain the DTMF signal detection using Goertzel algorithm. [4]

c) In short, explain the difference between DFT and DTFT. [2]

**Q3)** a) Explain the concept of designing FIR filter using windows. Which window gives the best performance. [4]

b) Explain the steps in the design of Digital FIR filter using Frequency sampling method. How this method is different than the Fourier series expansion method. [4]

c) Compare FIR and IIR filter design methods in short. [2]

**P.T.O.**

- Q4)** a) Explain with a block schematic a sampling rate converter with a factor of I/D. [5]
- b) Design a single stage decimator to reduce the sampling frequency of the signal from 512 KHz to 128 KHz. The band of interest is 0-60 KHz. Find the filter order and state the pass band and stop band edge frequency. The pass band ripple is 1 dB and stop band attenuation is 40 dB. [5]
- Q5)** a) Calculate the wavelet decomposition for the impulse response  $h(n) = \{1, 2, 4, 7\}$  [4]
- b) What is multiresolution analysis? How wavelets are useful in it? [4]
- c) Draw and explain Radix-2 DIT FFT butterfly structure. [2]
- Q6)** a) Draw and explain the architecture of Texas TMS320C6713 floating point DSP processor. [4]
- b) What is Code Composer Studio? Explain the use of CCS in developing signal processing application. [4]
- c) Explain the difference between fixed and floating point processor. [2]
- Q7)** a) Draw & explain the architecture of 'Blackfin' digital signal processor. [4]
- b) Find the product of -5 and 7 using Booth's multiplication algorithm? [4]
- c) State time scaling property of DFT. [2]
- Q8)** Write short notes on:
- a) Write a short note on mapping between S domain and Z domain for BZT technique of IIT filter Design. [4]
- b) Software defined radio architecture. [3]
- c) STFT over DFT. [3]



Total No. of Questions : 8]

SEAT No. :

**P4190**

**[4760] - 1165**

[Total No. of Pages :2

**M.E. Electronics (Digital System)**

**EMBEDDED SYSTEM DESIGN**

**(2013 Credit Pattern) (Semester - I) (504103)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any FIVE questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*
- 5) *Figure to the right indicate full marks.*

- Q1)** a) Explain SOC with suitable block diagram. [4]  
b) Explain any two life cycle models of embedded system. [4]  
c) Explain role and importance of formulation of requirement specification. [2]
- Q2)** a) State and give importance of following design metrics of embedded system. [4]  
i) NRE cost  
ii) Power  
iii) Size  
iv) Performance
- b) What is necessity of following development tools. [4]  
i) Emulator  
ii) Compiler and Assembler  
iii) Linker  
iv) Simulator
- c) Explain why prototyping of an embedded system is essential. [2]

*P.T.O.*

- Q3)** a) List the different features of ARM processor and Explain 5 stage pipeline of ARM processor. [5]  
b) What is Advanced Microprocessor Bus Architecture (AMBA) in ARM.[5]
- Q4)** a) What is ARM floating point architecture. [4]  
b) Explain ARM debug architecture. [3]  
c) How memory can be interfaced with ARM processor. [3]
- Q5)** a) Explain the file system in Embedded Linux. [4]  
b) What is device driver? Explain with an example of LED. [3]  
c) Explain the setup for the development of an embedded Linux application. [3]
- Q6)** a) What is Boot loader? Which important tasks are performed by boot loader in an embedded system. [4]  
b) Explain the Linux Kernel build system. [3]  
c) Explain different steps involved in porting linux on ARM 9 platform.[3]
- Q7)** a) Explain the structure of Android Application. [5]  
b) What is Android manifest, Explain manifest file structure. [5]
- Q8)** a) What are the steps involved in android application development. [4]  
b) What is an Intent in Android OS, explain the term Intent filters. [3]  
c) Explain telephony and SMS using Android OS. [3]



[4760]-1166

**M.E. (Electronics) (Digital Systems)**  
**DESIGN FOR TESTABILITY**  
**(2013 Pattern) (Semester - I)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data if necessary.

**Q1)** a) Derive the state diagram and write VHDL code that has an input W and an output Z. The machine has to generate Z=1 when the previous four values of W were 1001 or 1111; otherwise Z=0. Overlapping input patterns are allowed. The desired behavior is as follows: [5]

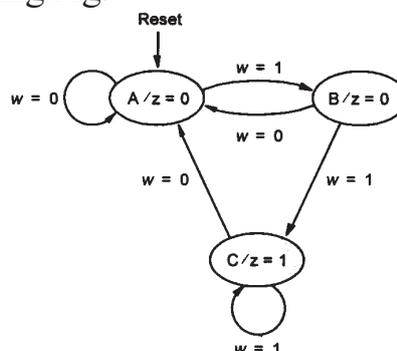
W: 010111100110011111

Z: 000000100100010011

b) For the function  $f(w_1, w_2, w_3) = \sum m(0, 2, 3, 6)$ , use Shannon's expansion to derive an implementation using 2-to-1 multiplexer and any other necessary gates. [5]

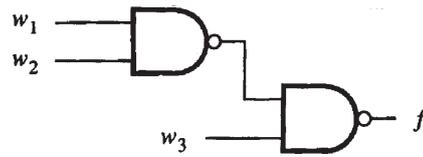
**Q2)** a) Design a single-input and single-output Moore-type FSM that produces an output of 1 if in the input sequence it detects either 110 or 101 patterns. Overlapping sequences should be detected. [5]

b) Give the state table, ASM Chart and VHDL program for the state diagram shown in following Fig. [5]



P.T.O.

- Q3)** a) Derive a table to show the coverage of various stuck-at-0 and stuck-at-1 faults by the eight possible tests. Find a minimal test set for this circuit. [5]



- b) Derive a Mealy-type FSM that can act as a sequence detector that produces  $z = 1$  when the previous two values of  $w$  were 00 or 11; otherwise  $z = 0$ . [5]

- Q4)** a) Consider the Function  $f = \bar{w}_1 \bar{w}_2 + \bar{w}_2 \bar{w}_3 + w_1 w_2 w_3$ . Give a circuit that implements  $f$  using the minimal number of two input LUTs. Show the truth table implemented inside each LUT. [5]

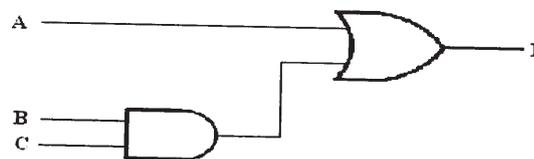
- b) Write VHDL code to expand 8-to-1 multiplexer using component 2-to-1 multiplexer. [5]

- Q5)** a) Give the Pseudo-Code for the bit counter. Draw and explain the ASM chart and data path for ASM chart for a bit-counting circuit. [5]

- b) Explain the BIST architecture for sequential circuit. [5]

- Q6)** a) Explain the working of SRAM Cell. [5]

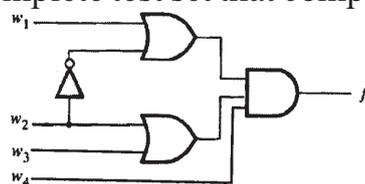
- b) Find test set that will detect all possible faults in the circuit shown in following Fig. [5]



- Q7)** a) Implement the function  $f = w_1 w_3 + w_1 w_2 + w_1 w_3$  using Shanon's expansion method with 4:1 multiplexer. [5]

- b) Explain the steps involved in Scan Path Technique. [5]

- Q8)** a) For the circuit shown in following Fig. sensitize each path in this circuit to obtain complete test set that comprises a minimum number of tests. [5]



- b) Explain the various types of fault models. [5]



Total No. of Questions : 8]

SEAT No. :

**P4192**

[Total No. of Pages : 2

**[4760] - 1167**

**M.E. (Electronics - Digital Systems)**

**PLDs AND ASIC DESIGN**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain how FSM can be used for optimal digital design? [4]  
b) Explain with suitable example, state assignment and state diagram optimization. [4]  
c) Write a note on hardware and software codesign. [2]
- Q2)** a) Explain the principle of operation of pipelining and resource sharing in a system design. [4]  
b) What are the top down approaches to design a system. [2]  
c) Explain the significance of fault tolerance in PLDs and ASIC design. [4]
- Q3)** a) Explain the architecture and functional block of CPLD XC95 XX series. [5]  
b) Explain the behavioral, data flow, structural VHDL modelling techniques with example. What are the relevant advantages of each. [5]
- Q4)** a) Write VHDL code for four bit UP/DOWN synchronous counter with parallel load facility. [4]  
b) Classify and explain different types of test benches. [4]  
c) What are the different types of delays associated with VHDL. [2]
- Q5)** a) Write logic implementation block in FPGA architecture. Explain sparten - II CLB. [5]

**P.T.O.**

- b) Is routing a critical issue in FPGA architecture? Explain why. What are the techniques used in typical FPGA to handle routing issues. [5]
- Q6)** a) Draw and describe Xilinx vertex - II architecture. [4]  
b) Explain the difference between simulation and synthesis in relation to EDA. [4]  
c) Explain the different libraries associated with STD \_ LOGIC package of VHDL. [2]
- Q7)** a) Classify and explain Gate array based ASICs. [4]  
b) Explain the features of Mentorgraphics EDA tool. [2]  
c) Write a note on IP core. [4]
- Q8)** a) Explain the ASIC design flow with neat diagram. [4]  
b) Explain RTL to GDS - II flow in detail. [4]  
c) What are ASIC cell libraries and what should it contain? [2]



Total No. of Questions : 8]

SEAT No. :

**P4193**

**[4760]-1168**

[Total No. of Pages : 3

**M.E. (Electronics) (Digital Systems)  
RANDOM SIGNALS AND PROCESSES  
(2013 Revised Course) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions out of 8 questions.*
- 2) *Answers to all the questions must be written in detail to its fullest length.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Assume suitable data wherever required.*
- 5) *Figures to the right indicate full marks.*

**Q1)** a) The pdf for a random variable is given by

$$f_x(x) = \left\{ \frac{1}{6} \delta(x-2) + 2\delta(x-3) + 2\delta(x-4) + \delta(x-5) \right\}$$

Draw the pdf and its corresponding CDF. **[5]**

b) A process is given by  $x(t) = 5 \cos(\omega t + \theta)$  where  $\omega$  is constant and  $\theta$  is a uniformly distributed random variable between 0 to  $\pi$ . Find the autocorrelation and its power spectral density. **[5]**

**Q2)** a) Two random variables X and Y have a joint probability density function

given by  $f_{xy}(x, y) = \left\{ \begin{array}{l} x^2 + \frac{xy}{3} \quad 0 \leq x \leq 1, 0 \leq y \leq 2 \\ 0 \quad \text{elsewhere} \end{array} \right\}$ . Check that it is a valid

density function. Find marginal density functions. **[5]**

b) Explain the Neyman Pearson criteria. What is the probability of miss and probability of hit? **[5]**

**P.T.O.**

**Q3)** a) A fair six sided die is thrown. Find the probability of throwing a sum of 7 and probability of one face showing even number and one face showing an odd number. [4]

b) Define a wide sense stationary process. What is ensemble autocorrelation? [3]

c) Consider the joint density function given by

$$f_{xy}(x, y) = kxy \quad 1 \leq x \leq 3, 1 \leq y \leq 2$$

$$= 0 \quad \text{elsewhere}$$

find value of k, prove that X and Y are statistically independent. [3]

**Q4)** a) Consider a random variable X with mean value of 3 and variance of 2. A second random variable Y is defined as  $Y = 2X - 5$ . Find the mean and variance of Y. Find correlation between X and Y. [3]

b) Consider a random variable 'x' with a pdf having a constant value of 1/8 between -3 to -1 and also between 1 and 3. The pdf is equal to 1/4 from -1 to 1. Draw the pdf, find the mean and the variance of the process. [4]

c) Define an ergodic process. Define the skew and Kurtosis for a process. [3]

**Q5)** a) Describe the K-S square test for fitting a distribution function for a continuous random variable. [3]

b) Find the characteristic function of the random variable X having density function given by  $f_x(x) = \left\{ e^{-\frac{1}{2}|x|} \text{ for all } x \right\}$ . [4]

c) State the central limit theorem. How will you use it? [3]

- Q6)** a) Define an exponential and Rayleigh random variable. [3]
- b) Consider a binary symmetric channel with a priori probabilities  $P(B_1) = 0.6$ ,  $P(B_2) = 0.4$ . A priori probabilities indicate the probability of transmission of symbols 0 and 1 before the experiment is performed i.e. before transmission takes place. The conditional probabilities are given by  $P(A_1 | B_1) = 0.9$ ,  $P(A_2 | B_1) = 0.1$  and  $P(A_2 | B_2) = 0.1$ ,  $P(A_1 | B_2) = 0.9$ . Find received symbol probabilities. [4]
- c) How will you find power spectral density of a process? Can you use autocorrelation function for finding power spectral density? [3]
- Q7)** a) A box contains five red, three green, four blue, and two white balls. What is the probability of selecting a sample size of six balls containing two red, one green, two blue, and one white ball? [4]
- b) Explain Bayes theorem. Explain use of Bayes theorem. [3]
- c) Consider a random process given by  $x(t) = A \cos(\omega_0 t + \vartheta)$  where  $A$  and  $\omega_0$  are constants. The variable  $\vartheta$  is uniformly distributed between 0 to  $2\pi$ . Find the autocorrelation and find the mean square value of the process. [3]
- Q8)** a) Explain the Hypothesis testing for taking a decision for Hypothesis  $H_1$ . [3]
- b) A random process has function of the form  $x(t) = A \sin(2\pi ft + \vartheta)$  where  $A$  and  $\omega$  are constants and  $\vartheta$  is uniformly distributed between 0 to  $2\pi$ . Find the mean and decide if the process is wide sense stationary. Find power spectral density of the process. [4]
- c) Describe Bayes estimator used in estimation theory. [3]



Total No. of Questions : 8]

SEAT No. :

P4543

[Total No. of Pages : 3

[4760] - 1169

M.E. (Electronics) (Digital System)

IMAGE PROCESSING AND COMPUTER VISION

(2013 Pattern) (Semester - III)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of given eight questions.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain Laplacian edge detector. Also explain why log mask is preferred over laplacian for edge detection. [4]

b) Explain 4-connectivity, 8-connectivity and m-connectivity with reference to relation between pixels. [3]

c) What is the main difference between brightness correction and gray scale transform. [3]

**Q2)** a) What is image thresholding? Explain local, global and adaptive thresholding. [4]

b) Describe Gaussian low pass filtering for images. [3]

c) Give convolution mask for following edge detectors : [3]

i) Sobel

ii) Prewitt

iii) Laplace

**P.T.O.**

- Q3)** a) Explain importance of hysteresis thresholding and non-maximal suppression in canny edge detection process. [4]
- b) What is histogram of an image? Explain in detail histogram equalisation. [3]
- c) Explain why histogram of discrete image is not flat after histogram equalisation. [3]
- Q4)** a) With reference to 2-D transform, explain the following :- [4]
- i) Basis image
- ii) Separability
- iii) Symmetry
- iv) Energy compaction
- b) What is DCT? Explain different properties of DCT. [3]
- c) Differentiate between lossy and lossless compression. [3]
- Q5)** a) Explain basic idea of active vision and with example explain how this approach eases vision tasks. [5]
- b) Describe the application of epipolar geometry in computer vision. [5]
- Q6)** a) Describe the intrinsic and extrinsic calibration parameter of single perspective camera. [5]
- b) Explain main contribution of epipolar geometry in stereopsis. [5]
- Q7)** a) Explain the difference between fundamental and essential matrices in stereopsis. [4]
- b) Explain the stereo correspondence algorithm. How depth acquisition will be made possible. [3]
- c) Describe the principle of 2-D view based representation of 3-D scene.[3]

- Q8)* a) How the mismatches in correspondences treated in stereopsis. [4]
- b) Explain the basics of photometric stereo in 3-D, Vision. [3]
- c) Explain Trifocal tensor in three camera. [3]



Total No. of Questions : 10]

SEAT No. :

P3786

[Total No. of Pages : 4

[4760] - 117

M.E. (Mechanical) (Design Engineering)

ADVANCED STRESS ANALYSIS

(2008 Pattern) (Semester - I)

Time :3 Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Derive the compatibility equation in Cartesian co-ordinate system. [8]
- b) Investigate what problem of plane stress is represented by the function.

$$\phi = m \left[ \frac{x^2}{2} + \frac{y^2}{2} - 1 \right]$$
$$\phi = \frac{3F}{4h} \left( xy - \frac{2Ry^3}{3h^2} \right) + \frac{P}{2} y^2$$

Where,  $h$  is half depth of the beam, and  $F$  as the concentrated load. [8]

**Q2)** Show that

Solves the torsional problem for the solid elliptical shaft. Determine 'm' in terms of  $G$ , where  $G$  is modulus of torsional rigidity of shaft and is angle of twist. Find the maximum shearing stress and the wrapping function. [16]

**P.T.O.**

**Q3)** State the assumptions made in solutions of problems in contact stresses. Derive from fundamentals the expression for the contact stresses between two rollers (with parallel axis) under compressive load. How this relation is used to find contact stresses between two spur gears. [16]

**Q4)** Circular disc of uniform thickness with 800 mm diameter has a central hole of 70 mm diameter. Determine the radial & circumferential stress distribution in the disc when it is rotating at 3000 r.p.m. about its own axis if Material density ( $\rho$ ) = 8000 kg/m<sup>3</sup> and Poisson's ratio = 0.3. Plot the stress distribution and comment on it. Derive the expression used. [16]

**Q5)** Write short notes on any three: [18]

- a) Theorem of virtual work.
- b) Torsion of non circular shaft.
- c) Stress in beams subjected to unsymmetrical bending.
- d) Concept of plain stress & strain with suitable example.

## SECTION - II

**Q6)** a) Explain following terms used in photo elastic analysis: [10]

- i) Isoclinics.
- ii) Stress and strain fringe value.
- iii) Dark field Polari scope.
- iv) Birefringement material.

b) How strain gauges are arranged to obtain various strain rosettes. [6]

- Q7) a) Locate the position of shear centre for following cross section as shown in Fig. 1 of the beam. All dimensions are in mm. Derive the expression if any, you use. [12]

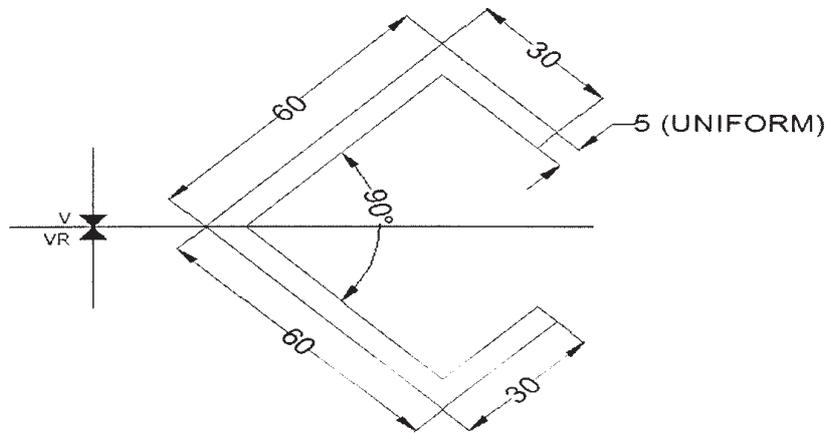


Fig.1

- b) Explain the term shear centre and its importance. [4]

- Q8) a) Prove that the differential equation for radial equilibrium in cylindrical coordinates of an element in a uniform thin disc rotating at  $\omega$  rad/sec and subjected to principal direct stresses is given by [8]

$$\sigma_t - \sigma_r - r \frac{\partial \sigma_r}{\partial r} = \rho \omega^2 r^2$$

- b) How you will increase the strength of a thick cylinder? [4]  
 c) Explain the term disk of uniform strength. [4]

- Q9) a) Determine the shape factor for I section shown in fig.2

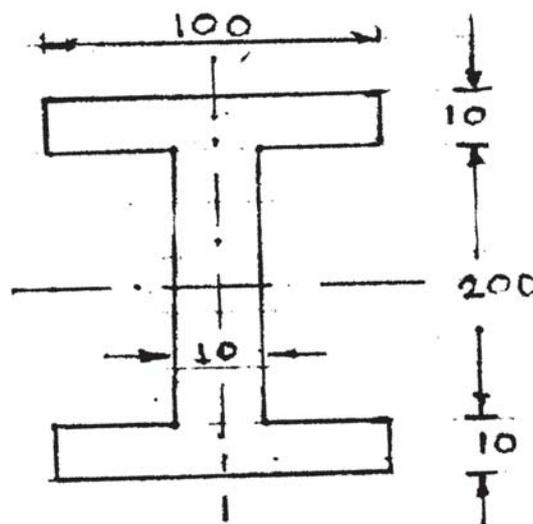


Fig.2

[10]

- b) Explain the fracture mechanics approach for estimation of residual life of component. What is critical stress intensity factor? How it is useful in design of cracked components? [6]

*Q10*) Write short notes on any three [18]

- a) Contact Stresses for gears
- b) Brittle coating method & Coating Materials
- c) Crack initiation and Crack opening phenomenon
- d) Spring back effect in plastic bending.



Total No. of Questions : 8]

SEAT No. :

**P4619**

**[4760] - 1170**

[Total No. of Pages : 2

**M.E. (Electronic) (Digital System)**  
**WIRELESS AND MOBILE TECHNOLOGIES**  
**(2013 Credit Pattern) (Semester - III) (604102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Explain log normal shadowing path loss model. How it is different from long distance path loss model? **[5]**

b) Compare Time diversity and frequency diversity. **[5]**

**Q2) a)** Explain handoff concept and Mobile assisted handoff in GSM. **[5]**

b) Explain P-Persistence and non Persistence CSMA for MAC protocol. **[5]**

**Q3) a)** Explain with example the demand assignment multiple access with implicit reservation. **[5]**

b) Explain polling scheme MAC algorithm. State its advantages and disadvantages. **[5]**

**Q4) a)** Define **[4]**

i) Home network

ii) Foreign network

iii) Home agent

iv) Care off address

b) Compare DSDV and DSR routing algorithm. **[6]**

**P.T.O.**

- Q5)** a) Name the inefficiencies of mobile IP regarding data forwarding from correspondent node to mobile node. Explain optimization of Mobile IP. [6]
- b) Explain the concept of Hierarchical routing algorithm. [4]
- Q6)** a) Describe system architecture of 802.11 LAN. [4]
- b) Explain power saving mechanisms in IEEE 802.11 and HIPERLAN. [6]
- Q7)** a) Explain snooping TCP and Mobile TCP. [5]
- b) Compare flat fading and frequency selective fading. [5]
- Q8)** a) Explain demand assigned multiple access scheme for satellite system. [5]
- b) Explain localization and calling in GSM. [5]



Total No. of Questions : 8]

SEAT No. :

P4530

[Total No. of Pages : 2

[4760]-1171

M.E. (Production) (CAD/CAM)

COMPUTER AIDED DESIGN

(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.
- 2) Q7 and Q8 are compulsory.
- 3) Figures to the right indicate full marks.
- 4) Draw neat self-explanatory sketches wherever necessary.
- 5) Use of calculator is allowed.
- 6) Assume suitable data, if necessary.

Q1) Discuss applications of computers for design. [5]

OR

Q2) Discuss Grover's Model of Product life Cycle for Selection of CAD/CAM. [5]

Q3) Why parametric representation of geometrical entities are preferred in CAD software? Explain your answer with non-parametric and parametric equations of appropriate geometric entity. [5]

OR

Q4) What is Homogeneous Co-ordinate system? Explain the necessity of Homogeneous co-ordinate system for transformation of geometric entities using suitable examples. [5]

Q5) What is blending of curves? Explain how two Bezier segments can be blended with suitable numeric example. [7]

OR

Q6) Explain the procedure of mass property calculations in CAD software. [7]

P.T.O.

- Q7)** a) What sweep representation scheme used for representation of a solid. **[8]**  
b) What is Z-buffer algorithm for B-REP and CSG model? **[7]**

**Q8)** Write short note on any three : **[18]**

- a) Shading algorithms.
- b) Virtual Realism.
- c) Parametric programming.
- d) Features based segmentation.



Total No. of Questions : 6]

SEAT No. :

P4194

[Total No. of Pages :2

[4760]-1172

**M.E. Production (CAD/CAM)**  
**COMPUTER AIDED MANUFACTURING**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Question No. 5 and Question No. 6 are compulsory.*
- 2) *Solve Q. 1 or Q. 2 and Q. 3 or Q. 4 .*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1) a) What is Direct Numeric Control (DNC) system? Explain it. [5]**

**b) Explain rolling guide ways used in CNC. [5]**

OR

**Q2) a) Explain the meaning of following code. [5]**

- i) M09
- ii) G03
- iii) M30
- iv) G70
- v) G00

**b) Prepare canned cycle for work piece shown in Fig.1. [5]**

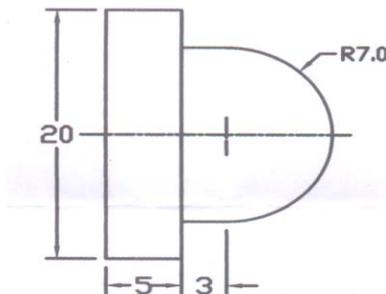


Fig.1: Raw material size  
Ø 20 X 15 mm lg  
All Dimensions are in mm

**P.T.O.**

- Q3)** Write short note on: **[10]**
- a) CNC-CMM.
  - b) Material handling System.

OR

- Q4)** a) Explain CNC Molding Machines. **[5]**
- b) Explain elements of AGV's. **[5]**
- Q5)** a) Explain automated inspection's principle. Explain Contact & Non-Contact inspection methods. **[8]**
- b) Explain machine vision. **[7]**

- Q6)** Write short note on any three: **[15]**
- a) Role of human workers in future automated factory.
  - b) Bar code technique for factory data collection.
  - c) Computer for local area network.
  - d) Impact of automated factory on society.



Total No. of Questions : 8]

SEAT No. :

**P4195**

[4760] - 1173

[Total No. of Pages :2

**M.E. (Production) (CAD/CAM)**  
**ADVANCED MATHEMATICS AND STATISTICS**  
**(2013 Credit Pattern) (511303) (Semester - I)**

*Time : 2Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer 3 questions from Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1) a)** Find the curve on which the functional  $\int_0^1 [(y')^2 + 12xy] dx$ , with  $y(0) = 0$  and  $y(1) = 0$  can be extremised. **[8]**
- b) Reduce the quadratic form  $2x_1x_2 + 2x_1x_3 - 2x_2x_3$  to the canonical form by an orthogonal reduction and discuss its nature. Also find the modal matrix. **[8]**

OR

- Q2) a)** Solve the boundary value problem  $y'' + y + x = 0$  ( $0 \leq x \leq 1$ ),  $y(0) = y(1) = 0$  by Galerkin's method. Compare your solution with the exact solution. **[8]**
- b) If  $A = \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$  show that  $(I - A)(I + A)^{-1}$  is a unitary matrix. **[8]**

- Q3) a)** Solve the integral equation: **[4]**

$$\int_0^{\infty} f(x) \cos \lambda x dx = e^{-\lambda}.$$

- b) Solve  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  for, **[8]**

$0 < x < \pi$ ,  $0 < y < \pi$ , given that

$$u(0, y) = u(\pi, y) = u(x, \pi) = 0, u(x, 0) = \sin^2 x$$

**P.T.O.**

- c) Solve by the method of Laplace transform the equation  $y''' + 2y'' - y' - 2y = 0$  with  $y(0) = y'(0) = 0$  and  $y'(0) = 6$ . [5]

OR

- Q4)** a) Apply Convolution theorem to evaluate [4]

$$L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$$

- b) Find the Fourier transform of  $e^{-x^2}$ . [5]
- c) A tightly stretched Flexible string has its ends fixed at  $x = 0$  and  $x = l$ . At a time  $t = 0$ , the string is given a shape defined by  $f(x) = \mu x(l - x)$ , where  $\mu$  is a constant and then released, find the displacement of any point  $x$  of the string at any time  $t > 0$ . [8]

- Q5)** a) Discuss the state variable model and its advantages over differential equation model. [8]

- b) For a chi-square distribution with n.d.f. establish the following recurrence relation between the moments. [9]

$$\mu_{r+1} = 2r(\mu_r + n\mu_{r-1}), r \geq 1. \text{ Hence find } \beta_1 \text{ \& } \beta_2.$$

OR

- Q6)** a) Describe in brief types of simulation approaches. [8]

- b) The height of six randomly chosen sailors are (in inch) : 63, 65, 68, 69, 71, 72. Those of 10 randomly chosen soldier's are 61, 62, 65, 66, 69, 69, 70, 71, 72, 73. Discuss the light that these data thrown the suggestions that sailors are on the average taller than soldier's. [9]



Total No. of Questions : 6]

SEAT No. :

**P4196**

**[4760]-1174**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)**

**DESIGN OF EXPERIMENTS AND RESEARCH METHODOLOGY**

**(2013 Credit Pattern) (Semester - I) (511304)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Question No. 5 and question No. 6 are compulsory.*
- 2) *Solve Q.1 or Q.2 and Q.3 or Q.4.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1) a)** Explain different types of research proposals. **[5]**

b) Explain meaning, need, concepts related to research design. **[5]**

OR

**Q2)** Write short notes on following (any two): **[10]**

- a) Creative problem solving process.
- b) Group problem solving techniques.
- c) Logical approach for problem solving.

**Q3) a)** Explain the stages in model building. **[5]**

b) Explain Steps and Features of simulation experiments. **[5]**

OR

**P.T.O.**

- Q4)** a) What is experimental design? Explain applications of experimental design. [5]  
b) Explain guidelines for designing experiments? [5]
- Q5)** a) Explain Taguchi approach to parameter design. [8]  
b) What is Robust Design? Explain it. [7]
- Q6)** Write short notes on following (any three): [15]  
a) Uni-variate and Bi-variate analysis  
b) Parametric and Non-Parametric Tests.  
c) Principles of Thesis Writing.  
d) Oral Presentations (Briefing).

EEE

Total No. of Questions : 8]

SEAT No. :

P4535

[Total No. of Pages : 2

[4760]-1175

M.E. (Production) (CAD/CAM)

COMPUTER INTEGRATED MANUFACTURING

(2013 Pattern) (Semester - II)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.*
- 2) *Q7 and Q8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self - explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** What are the different levels of Integration against evolution of CIM?

Explain.

[5]

OR

**Q2)** What are the components of PLM software? Explain.

[5]

**Q3)** What is a relational database? Describe the architecture of database management system.

[5]

OR

**Q4)** What are the benefits of GT to the manufacturing industry?

[5]

**Q5)** What is a FMC? How does FMC ensure flexibility in manufacturing?

[7]

OR

**Q6)** Which are the typical sensors that are normally used in robot? Explain.

[7]

**Q7) a)** What are the components of small local area network in CIM setup? Explain.

[8]

- b) What are the communication interfaces used in computer - to - computer communication? Explain in brief. What are the commonly used interface cards?

[7]

**P.T.O.**

**Q8)** Write short notes on any three

**[18]**

- a) GKS implementation in a CAD workstation
- b) ESPRIT - CIM OSA model
- c) Data associated with FMC
- d) ASRS



Total No. of Questions : 6]

SEAT No. :

P4197

[Total No. of Pages : 2

[4760] - 1176

M.E. (Production-CAD/CAM Engineering)

FINITE ELEMENT ANALYSIS

(2013 Pattern) (Semester - II)

Time : 2 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) Q. No. 5 and Q. No.6 are compulsory.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of non programmable calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Explain the concept of functional. State the convergence requirement of shape function. [5]

b) Enumerate the basic steps in finite element problems formulation? [5]

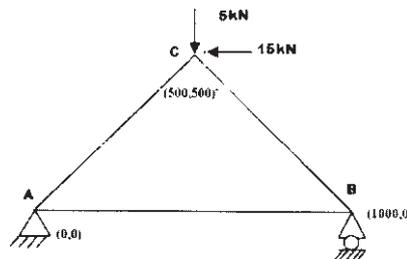
OR

Q2) a) Explain in brief the skyline matrix. Also, properties of global stiffness matrix. [5]

b) Explain the influence of node numbering on the assembled stiffness matrix?[5]

Q3) a) Explain in brief different types of elements used in finite element formulation. [4]

b) For the three-bar truss shown in figure below. Determine the nodal displacement and stress in each member. Find the support reactions also. Take  $E = 200\text{GPa}$ ,  $\text{Area} = 350\text{mm}^2$ . [6]

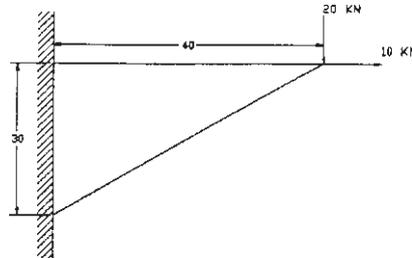


OR

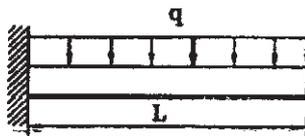
P.T.O.

**Q4) a)** Determine shape function in for CST element in terms of Cartesian co-ordinate systems. [4]

b) A 2D plate loaded is shown in figure. Determine the displacements of nodes using the plane stress condition. Ignore body forces. Determine the reaction forces also stress in the elements. Assume thickness as 10 mm,  $E = 100 \text{ GPa}$  &  $\mu = 0.25$  [6]



**Q5) a)** Using Reyleight - Ritz method, determine the expression for deformation of cantilever beam subjected UDL. Take  $E =$  modulus of Elasticity,  $I =$  moment of area. [8]



b) Derive expression for consistent load which varies linearly from  $P_1$  at node 1 to  $P_2$  at node 2 on a beam element of length  $l_e$ . [7]

**Q6) a)** Explain Hamilton's principle along with derivation for equilibrium. [7]

b) Using two equal length finite elements, determine the natural circular frequencies of the solid circular shaft fixed at end as shown in figure below. [8]



Total No. of Questions : 8]

SEAT No. :

**P4198**

**[4760]-1177**

[Total No. of Pages : 3

**M.E. (Production) (CAD/CAM)  
OPTIMIZATION TECHNIQUES  
(2013 Credit Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Formulate an optimization problem for minimum weight design of a power screw subjected to an axial load  $F$ . Pitch ( $p$ ), major diameter ( $d$ ), nut height ( $h$ ) and screw length ( $s$ ) are design variables. Constraints are to ensure that screw should be self locking and shear stress in screw should not exceed shear yield strength of the material. **[4]**
- b) Solve the non-linear programming problem using Lagrange multiplier method: Optimize  $4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$  Subject to:  $x_1 + x_2 + x_3 = 15$ ;  $2x_1 - x_2 + 2x_3 = 20$  and  $x_1, x_2, x_3 \geq 0$ . **[4]**
- c) State Kuhn-Tucker necessary and sufficient conditions in non-linear programming. **[2]**
- Q2)** a) Minimize the function  $f(x) = \frac{x}{\log x}$  using Newton-Raphson method. Assume starting point as  $x = 1$ . **[4]**
- b) Explain steps for golden section method for one dimensional minimization problems. **[4]**
- c) What are Fibonacci numbers? How they are obtained? **[2]**

**P.T.O.**

- Q3)** a) Minimize the function  $f(x) = 4x_1^2 - 5x_1 \cdot x_2 + 3x_2^2 - 8x_1$  such that  $0 \leq x_1, x_2 \leq 4$ . Use steepest descent method. Perform one iteration. Assume initial point as (0, 0). [4]
- b) Explain Newton's method for multi-variable optimization. [4]
- c) Define saddle point. [2]

**Q4)** Write short notes on:

- a) Pattern search method. [5]
- b) Multi-objective optimization. [5]

- Q5)** a) Calculate function 'ϕ' at point (10, 20) for optimization problem given below using interior penalty method. Consider penalty parameter 'r' = 1000. [4]

$$\text{Min } f(x) = \frac{1}{3}(x_1 + 1)^3 + x_2$$

$$\text{Subject to: } g_1(x) = -x_1 + 1 \leq 0$$

$$g_2(x) = -x_2 \leq 0$$

- b) Discuss the algorithm for exterior penalty function method. [4]
- c) Define mixed penalty method. [2]
- Q6)** a) Explain two point crossover method in genetic algorithm. [4]
- b) What is the probability of accepting new solution (3.6, 4.8) over current solution of (5.2, 1.7) at temperature 300°C for minimizing the function  $3x_1^2 + x_1^2 \cdot x_2^2 - 5x_1x_2$  with  $0 \leq x_1, x_2 \leq 6$  using simulated annealing? [4]
- c) What are termination criteria in simulated annealing algorithm? [2]

- Q7)** a) Explain five focusing steps of theory of constraints. [4]  
b) Write internal constraints in theory of constraints. [2]  
c) Explain application of theory of constraints in logistics management. [4]

**Q8)** Write short notes on:

- a) Artificial neural network. [5]  
b) Real coded genetic algorithm. [5]



Total No. of Questions : 6]

SEAT No. :

**P4620**

[4760] - 1178

[Total No. of Pages : 2

**M.E. (Production)**

**ADVANCED STRESS ANALYSIS**

**(2013 Pattern) (Semester - III)**

*Time : 2 Hours]*

*[Max. Marks : 50*

**Instructions to the candidates:**

- 1) *All Questions are compulsory.*
- 2) *Figures to the right side indicate full marks*

**Q1) a)** Determine the principal direction and principal values of the second order cartesian tensor (stress tensor)  $T$  as given below. **[6]**

$$[\delta_{ij}] = \begin{bmatrix} 3 & -1 & 0 \\ -1 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

b) Show that the airy stress function  $\Phi = 2x_1^4 + 12x_1^2x_2^2 - 6x_2^4$  Satisfies the biharmonic equation.  $\nabla^4 = 0$  **[4]**

OR

**Q2) a)** Stress tensor at a point is given by

$$[\delta_{ij}] = \begin{bmatrix} 5 & 0 & 0 \\ 0 & -6 & -12 \\ 0 & 12 & 1 \end{bmatrix}$$

Determine maximum shear stress at the point and show that it acts in plane which bisects the maximum and minimum stress planes **[6]**

b) Explain Generalized Hook's law. **[4]**

**Q3)** Explain mohr's circle for the 3D stresses and castigliano's theorem. **[10]**

OR

**Q4)** Determine complex formulation of the plane elasticity problem. **[10]**

**P.T.O.**

- Q5)** a) Describe stages in crack growth. [7]  
b) Explain the terms isoclinics and isochromatics in photoelasticity. What is there physical significance in measurement of stresses? [8]
- Q6)** a) Write note on Investigation and analysis of failures. [7]  
b) Write note on CTOD. [8]



Total No. of Questions : 8]

SEAT No. :

P4716

[Total No. of Pages : 2

**[4760] - 1179**  
**M.E. (Production) (CAD/CAM)**  
**COMPUTER AIDED PRODUCTION PLANNING**  
**(2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q.6*
- 2) *Q7 and Q8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self - explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

*Q1)* Explain ALDEP use in facility planning. [5]

OR

*Q2)* Discuss different measures of forecast errors. [5]

*Q3)* Discuss GT benefits and limitations. [5]

OR

*Q4)* Discuss use of quadratic assignment model adding new machines to existing facility. [5]

*Q5)* Discuss ERP implementation issues. [7]

OR

*Q6)* Discuss evaluation of heuristics in view of production scheduling. [7]

*Q7) a)* Four jobs are to be processed using three machines. The time required on machine 'j' for job 'i' is given in the table below :

| Job | Time required on |           |           |
|-----|------------------|-----------|-----------|
| i   | Machine A        | Machine B | Machine C |
| 1   | 5                | 8         | 20        |
| 2   | 6                | 30        | 6         |
| 3   | 30               | 4         | 5         |
| 4   | 2                | 5         | 3         |

How should the jobs be scheduled so as to minimize the total time required to complete all the jobs? [8]

**P.T.O.**

b) The weekly demand for the product has the following distribution :

|             |      |      |      |      |      |      |
|-------------|------|------|------|------|------|------|
| Demand      | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
| Probability | 0.03 | 0.17 | 0.27 | 0.28 | 0.18 | 0.07 |

Simulate for 10 weeks and find expected demand. (Use random numbers from calculator) [7]

**Q8)** Write short notes (Any THREE) : [18]

- a) Random number generation.
- b) CDS algorithm for sequencing.
- c) Software for ERP.
- d) Gantt chart
- e) MRP II



Total No. of Questions : 8]

SEAT No. :

**P4563**

**[4760]-118**

[Total No. of Pages : 2

**M.E.(Mech.) (Design Engineering)  
INSTRUMENTATION & AUTOMATIC CONTROL  
(2008 Pattern) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*

**SECTION-I**

- Q1)** a) Explain the significance of Parameter Estimation. [8]  
b) Discuss the significance of statistical methods used in experimentation. [8]
- Q2)** a) Compare RTD with thermocouples with respect to principle, sensor output, type and one application each. [8]  
b) Explain electromagnetic flow meter with respect to principle, schematic, sensor output and applications. [8]
- Q3)** a) Explain a suitable transducer to measure pressure with an electrical output signal. State applications of the transducer you discuss. [8]  
b) Explain a suitable method to measure mass flow rate. [8]
- Q4)** Write short notes on (any two): [18]  
a) Primary and secondary transducers.  
b) Accuracy, precision and hysteresis.  
c) Thermopiles.

***P.T.O.***

## SECTION-II

- Q5)** a) With respect to principle, construction and working explain reluctance type magnetic pick up used for angular velocity measurement. [8]
- b) Explain the Op-Amp used to implement PI controller. Discuss the role of such controller used in temperature control system. [8]
- Q6)** Discuss in brief with respect to principle, construction, range, precision, cost the sensors used to measure flow measuring transducer/ transmitter. [16]
- Q7)** a) Define proportional, Integral and derivative control with mathematical equations. Discuss in brief the advantage of adding Integral control to proportional controller. [8]
- b) Explain why in Integral controllers are not used alone. Discuss the controller output in case of proportional plus Integral controller. [8]
- Q8)** Write short notes on (any three): [18]
- a) Pneumatic proportional controller using flapper valve.
- b) Op-Amp used as voltage to current converter.
- c) Humidity measurement.
- d) Sensors to measure displacement.



Total No. of Questions : 8]

SEAT No. :

**P4405**

[Total No. of Pages : 3

**[4760] - 1180**

**M.E. (Production)**

**MATHEMATICAL AND STATISTICAL METHODS  
(2013 Pattern) (Credit System) (Theory) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer total 5 questions from following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Obtain the solution of differential equation in terms of Bessel function  
 $x^2 y'' - xy' + x^2 y = 0$ . **[5]**

b) Express  $f(x) = x^3 + 2x^2 - x - 3$  in terms of Legendre polynomials. **[3]**

c) Solve in Series the equation  $\frac{d^2 y}{dx^2} + xy = 0$ . **[2]**

**Q2) a)** Solve the Differential equation  $u_t = ku_{xx}$  such that **[5]**

i)  $U$  is not infinite when  $t \rightarrow \infty$

ii)  $U_x = 0$  when  $x=0$  and  $u=0$  when  $x=1$  for all values of  $t$ .

iii)  $U = u_0$  when  $t = 0$  for all values of  $x$  between  $0$  to  $1$ .

b) Write a note on Heat equation. **[3]**

c) Solve the equation by the method of separation of variables  $py^3 + qx^2 = 0$ . **[2]**

**Q3) a)** Expand the function in Laurent Series  $1 - \frac{\cos z}{z^3}$  about  $z = 0$ . **[5]**

b) Find Taylor's Expansion of  $(z - 1)(z + 1)$  about the point  $z = 1$ . **[3]**

c) Write a note on complex function. **[2]**

**P.T.O.**

**Q4) a)** In a bolt factory, machines A, B & C produce 25, 35, & 40 % of the total output, respectively. Of a bolt is chosen at random from the combined output, what is the probability that it is defective? If a bolt chosen at random is found to be defective, what is the probability that it was produced by B or C? [5]

b) A random variable X has the following probability distribution [3]

|      |   |     |    |     |    |     |    |
|------|---|-----|----|-----|----|-----|----|
| X    | : | -2  | -1 | 0   | 1  | 2   | 3  |
| P(x) | : | 0.1 | K  | 0.2 | 2K | 0.3 | 3K |

i) Find K.

ii) Calculate mean & variance.

c) Write a note on - mean & variance distribution. [2]

**Q5) a)** Compute the coefficient of correlation between X & Y using the following data [5]

|     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| X : | 78  | 89  | 97  | 69  | 59  | 79  | 68  | 57  |
| Y : | 125 | 137 | 156 | 112 | 107 | 138 | 123 | 108 |

b) Find the rank correlation for the following data : [3]

|     |   |   |    |   |   |    |   |   |   |   |
|-----|---|---|----|---|---|----|---|---|---|---|
| X : | 3 | 8 | 9  | 2 | 7 | 10 | 4 | 6 | 1 | 5 |
| Y : | 5 | 9 | 10 | 1 | 8 | 7  | 3 | 4 | 2 | 6 |

c) The Regression equations of two variables x & y are  $x=0.7y+5.2$ ,  $y=0.3x+2.8$ , Find the means of the variables. [2]

**Q6) a)** The following data resulted from an experiment compare three burners  $B_1, B_2$  &  $B_3$ . A Latin square design was used as the tests were made on 3 Engines & were spread over 3 days.  $[F_{5\%}(v_1 = 2, v_2 = 2) = 19]$  [5]

|       | Engine 1   | Engine 2   | Engine 3   |
|-------|------------|------------|------------|
| Day 1 | $B_1 - 16$ | $B_2 - 17$ | $B_3 - 20$ |
| Day 2 | $B_2 - 16$ | $B_3 - 21$ | $B_1 - 15$ |
| Day 3 | $B_3 - 15$ | $B_1 - 12$ | $B_2 - 13$ |

Test the hypothesis that there is no difference between the burners.

b) Name the basic principles of experimental design. [3]

c) Compare RBD and LSD. [2]

**Q7) a)** In a random sample size 500, the mean is found to be 20. In another independent sample of size 400, the mean is 15. Could the samples have been drawn from the same population with SD 4? (LOS-1%,  $Z_{\alpha} = 2.58$ ) [5]

b) In a large city A 20% of a random sample of 900 school boys had a slight physical defect. In another large city B, 18.5% a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant? (LOS – 5%,  $Z_{\alpha} = 1.96$ ). [5]

**Q8) a)** The Regression equations of two variables  $x$  &  $y$  are  $7X - 16Y + 9 = 0$ ,  $5Y - 4X - 3 = 0$ . Find the coefficient of correlation between them. [5]

b) Fit a second degree parabola to the following data. [5]

|     |   |   |   |   |    |    |    |    |   |
|-----|---|---|---|---|----|----|----|----|---|
| X : | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9 |
| Y : | 2 | 6 | 7 | 8 | 10 | 11 | 11 | 10 | 9 |



Total No. of Questions : 8]

SEAT No. :

**P4199**

[Total No. of Pages :2

**[4760]-1181**

**M.E. (Production) (Manufacturing and Automation)**

**INDUSTRIAL AUTOMATION**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions .*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket Calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) A hydraulic system requires 300 l/min at 25 bar pressure for 10 seconds and 60 l/min at 350 bar pressure for 12 seconds. Calculate % energy saved due to intensifier circuit. **[4]**
- b) Explain with neat sketch proportional control valve and state their applications. **[4]**
- c) An external gear pump having gears with pitch circle diameter 120 mm, number of teeth 40 and face width 30 mm delivers 60 lpm at 1000 rpm. Calculate volumetric efficiency of pump. **[2]**
- Q2)** a) Draw a suitable pneumatic circuit for a driven by a single acting cylinder with actuation of at least two (of three) manually operated valves. **[4]**
- b) Briefly explain the principles of step counter method with a suitable example. **[4]**
- c) Draw a neat sketch of hydro-pneumatic circuit. **[2]**
- Q3)** a) Discuss the advantages of microcontrollers over microprocessors in control operations. **[4]**
- b) Draw ladder diagram that can be used to start a motor and then after a delay of 120 second start a pump. When the motor is switched off there should be a delay of 15 second before the pump is switched off. **[4]**

**P.T.O.**

- c) A sensor has transfer function of  $2.5 \text{ mV}/^\circ\text{C}$ . Find the required voltage resolution of the signal conditioning if temperature resolution of  $0.15^\circ\text{C}$  is required. [2]

**Q4)** Write short notes on:

- a) Explain formulation of linear quadratic optimal control problem. [5]  
b) Variable displacement pump control for constant flow. [5]

- Q5)** a) Explain with neat sketch any one type of rotary feeder. [4]  
b) Explain performance analysis of material handling system. [4]  
c) Draw neat sketch of rotary indexing machine. [2]

- Q6)** a) Explain important functions of work cell controller in an industrial robot. [4]  
b) The linear joint of the industrial robot is actuated by the piston mechanism. The length of the joint when fully retracted is 600 mm, and when fully extended is 975 mm. If the robot controller has 8 bit storage capacity, determine the control resolution of this robot. [4]  
c) List any four criteria for selection of robot. [2]

- Q7)** a) Explain applications of multi-scale modeling in supply chain management. [4]  
b) What is need of fuzzification in decision making? [4]  
c) What is adaptive neuro-fuzzy interface system? [2]

**Q8)** Write notes on:

- a) Robot programming for welding [5]  
b) Guiding technologies in AGV [5]



Total No. of Questions : 8]

SEAT No. :

**P4200**

**[4760] - 1182**

[Total No. of Pages :2

**M.E. (Production Engineering)**  
**ADVANCED MANUFACTURING PROCESSES**  
**(2013 Credit Pattern) (511103) (Semester - I)**

*Time : 2Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of electronic pocket calculator and logarithmic tables is allowed.*

- Q1)** a) Explain important steps followed in sand casting. [4]  
b) Explain briefly injection blow molding process with neat sketch. [4]  
c) List out the advantages of non-conventional machining processes. [2]
- Q2)** a) Explain with neat sketch working principle of laser beam machining. [4]  
b) Describe important characteristics of heat affected zone in EDM. [4]  
c) List out important sand casting defects with their remedies. [2]
- Q3)** a) Explain with neat sketch working principle of Electro Chemical machining. [4]  
b) Explain any four welding defects with their causes and remedies. [4]  
c) Differentiate between destructive and Non-destructive testing of castings. [2]
- Q4)** a) Describe principle of material removal, advantages and limitations of Electro Discharge Machining (EDM). [5]  
b) Explain various welding defects with their causes and remedies. [5]

*P.T.O.*

- Q5)** a) A wire of 10 mm diameter is to be reduced to 5 mm diameter. The die angle is  $10^\circ$  and the coefficient of friction at dies and wire interface is 0.5. The flow stress of wire material is  $340 \text{ N/mm}^2$ . Determine drawing stress and drawing load if the drawing speed is 0.7 m/s. [4]
- b) Explain metal high speed blanking with neat sketch. [4]
- c) Classify the non-conventional forming processes. [2]
- Q6)** a) Explain metal spinning with neat sketch. [4]
- b) Explain high energy rate forming with neat sketch. [4]
- c) Differentiate between hot forming and cold forming. [2]
- Q7)** a) Explain important process parameters of electro-hydraulic forming. [4]
- b) A tube of 22 mm external diameter and 1 mm thickness is to be reduced to 19 mm external diameter and 0.5 mm thickness. The die angle is  $24^\circ$  and plug angle is  $16^\circ$ . The coefficients of friction at die and tube interface and tube and plug (mandrel) interface is 0.5. The flow stress of tube material is  $340 \text{ N/mm}^2$ . The tube drawing is carried at a speed of 0.4m/s. Calculate the fixed plug. [4]
- c) What is ironing? [2]
- Q8)** a) Explain forming limit diagram. [5]
- b) Explain various rolling problems. [5]



Total No. of Questions : 8]

SEAT No. :

**P4201**

**[4760]-1183**

[Total No. of Pages : 3

**M.E. (Production-Manufacturing & Automation)**

**RESEARCH METHODOLOGY**

**(2013 Credit Pattern) (Semester - I) (511104)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicates full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain various steps in research process. **[4]**

b) Explain significance of research in solving real life problems in engineering. **[4]**

c) Write names of any four techniques in defining a research problem. **[2]**

**Q2) a)** Explain and illustrate Latin square design. **[4]**

b) Explain principle of replication, principle of randomization, and principle of local control related to experimental design. **[4]**

c) With any suitable example explain 4 x 3 factorial design? **[2]**

**Q3) a)** Explain Holtzman Inkblot test used in data collection? **[4]**

b) Explain various criteria for appropriate selection of data collection method. **[4]**

c) What are important aspects of a questionnaire? **[2]**

**P.T.O.**

**Q4)** Write short notes on the following

- a) Analytical and synthetic research. **[5]**
- b) Benefits of digital data collection. **[5]**

**Q5)** a) The weights of packages received have the mean weight of 300 Kg. and a standard deviation of 50Kg. What is the probability that the 25 packages received at random and loaded on elevator will exceed the specified limit of 7800 Kg. The areas under standard normal curve are as shown in Table 1: **[4]**

Table 1

|                  |        |        |        |        |        |        |
|------------------|--------|--------|--------|--------|--------|--------|
| z                | 1.1    | 1.2    | 1.3    | 1.4    | 1.5    | 1.6    |
| Area under curve | 0.3643 | 0.3849 | 0.4032 | 0.4192 | 0.4332 | 0.4452 |

Assume linear interpolation for values in between.

- b) Certain manufacturing company wants to manufacture 3 products based on their customer demand. Product demands for previous year were 30% for product 1, 25% for product 2, 45% for product 3, the survey of current year conducted for 500 customer shows that 180 customers preferred product 1, 120 customers preferred product 2, and 200 customers preferred product 3. Calculate chi-square value. **[4]**
- c) What do you mean by skewness and Kurtosis? **[2]**

**Q6)** a) Select the most suitable material using TOPSIS method for cryogenic storage tank to transport liquid nitrogen. Material selection attributes are: Toughness index (TI), Yield strength (YS), Young's modulus (YM), and density (D). Weightages for TI, YS, YM and D are 0.35, 0.20, 0.12, and 0.33 respectively. The attribute data for four materials is presented in Table 2. **[4]**

Table 2

| MTRL | Material selection attributes |       |      |      |
|------|-------------------------------|-------|------|------|
|      | TI                            | YS    | YM   | D    |
| 1    | 75.5                          | 420   | 74.2 | 2.8  |
| 2    | 95                            | 91    | 70   | 2.68 |
| 3    | 770                           | 1,365 | 189  | 7.9  |
| 4    | 187                           | 1,120 | 210  | 7.9  |

b) Calculate the initial temperature for simulated annealing algorithm to minimize the function  $f(x) = 2x_1^2 - 4x_1 + x_2^2 - 6x_2 - 8$  for the bounds  $3 \leq x_1, x_2 \leq 8$ . [4]

c) What is elite count in genetic algorithm? How it affect the performance of algorithm? [2]

**Q7)** a) Explain in brief various aspects to be considered by research student in written and oral presentation of research report. [4]

b) Discuss the individual research proposal and institutional research proposal. [4]

c) Mention the steps involved in data interpretation. [2]

**Q8)** Write short notes on:

a) Artificial Neural networks. [5]

b) Data envelopment analysis. [5]



[4760]-1184

**M.E. (Production) (Manufacturing & Automation)**  
**COMPUTER INTEGRATED MANUFACTURING**  
**(2013 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates :*

- 1) Attempt any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data if necessary.

- Q1)** a) Given  $B_0(1,1)$ ,  $B_1(2,3)$ ,  $B_2(4,3)$ ,  $B_3(3,1)$  the vertices of a Bezier polygon, determine point on Bezier curve for parameter value ' $t$ ' = 0.4 [4]
- b) A line joining points (0 0 0) and (0 10 0) is used to generate a sweep surface by simultaneously translating it 15 unit along  $x$  axis and rotating through  $2\pi$  about  $x$ -axis. Determine the point at parameter value ' $t$ ' = 0.6 and at  $120^\circ$  on this surface. [4]
- c) What is Gourand shading? [2]

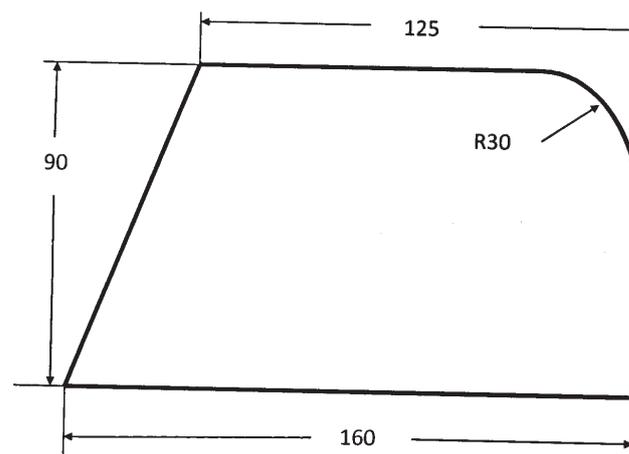
**Q2)**

Fig. 1

- a) Write APT geometry statements to mill the part shown in Fig. 1 [4]
- b) Write APT cutter motion statements to mill the part shown in Fig. 1 [4]
- c) Explain with suitable example the ‘cutter radius compensation’? [2]

**Q3)** a) Obtain the global stiffness matrix for the problem described by the following equation considering uniform mesh of two elements: [4]

$$-\frac{d^2u}{dx^2} + 3u - x^3 = 0 \quad \text{for } 0 < x < 1. u(0)=0, u(1)=0.$$

b) Obtain the deflections in global co-ordinate systems for the truss shown in Fig.2 [4]

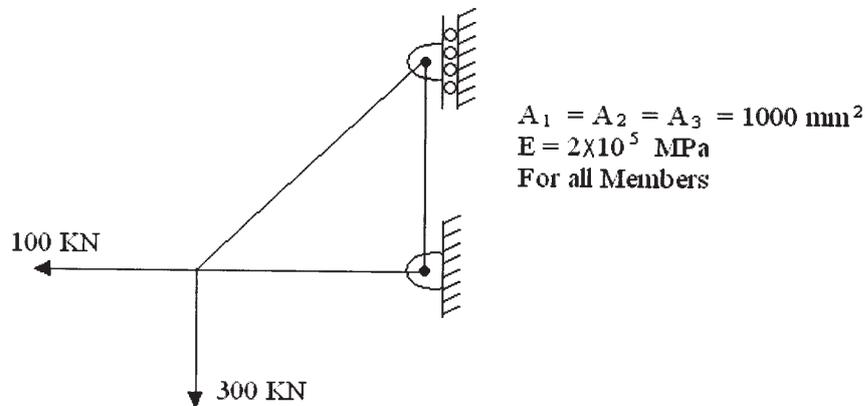


Fig. 2

c) What do you mean by Iso-parametric element? [2]

**Q4)** a) Write short note on “Cubic Hermite Spline”. [5]

b) Explain the difference between subroutine and macro. [5]

**Q5)** a) Describe in brief two logical types of database architecture. [4]

b) Explain the main features of ODMBS (object database management system). [4]

c) State any four machine readable media used in shop floor data collection. [2]

- Q6)** a) What are the advantages of computer aided PPC over traditional PPC system? [4]  
b) Describe the four steps that can be identified in evolution of MRP. [4]  
c) List any four components of a DDC system. [2]
- Q7)** a) What are the components of a physical subsystem in a FMS? [4]  
b) Explain in brief the Optiz classification system used in Group Technology. [4]  
c) Enumerate any four applications of ultrasonic in inspection work. [2]
- Q8)** a) Write a short note on “Photogrammetry”. [5]  
b) Describe the functioning of NIST-AMRF Model of CIM. [5]



Total No. of Questions : 8]

SEAT No. :

P4203

[Total No. of Pages : 2

**[4760] - 1185**  
**M.E. (Production)**  
**MANUFACTURING AND AUTOMATION**  
**Tool and die design**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) A simple cutting tool has  $0^\circ$  rake angle and  $3^\circ$  clearance angle. The maximum length of the flank wear allowed before regrinding is 1mm. Assuming the volume rate of wear of the tool to be constant, what will be the percentage increase in the tool life if the clearance angle is increased to  $7^\circ$ ? [4]
- b) Explain effect of abrasive type, grain size, bonding material and structure on the performance of grinding wheel. [4]
- c) Define: [2]
- i) crater wear
  - ii) Machinability
- Q2)** a) Explain the effect of tolerance of diameter of cylindrical workpiece on V-block location [4]
- b) What is foolproof location? Give one example. [2]
- c) Explain analysis to determine width of diamond pin. [4]
- Q3)** a) Explain methods of reducing cutting forces in press tool operations. [4]
- b) Determine the spring back angle and hence punch angle to obtain  $90^\circ$  bend if thickness of part is 4 mm, modulus of elasticity of work material  $2 \times 10^5$  MPa, punch radius is 10 mm, and part is subjected to a bending moment of 3000 N. [4]
- c) With neat sketch show various element of progressive die. [2]

**P.T.O.**

**Q4)** Write short notes on :

- a) 3: 2: 1 principle of location [5]
- b) ASA system of tool nomenclature [5]

**Q5)** a) Explain edging impression in forging die design [4]

- b) Explain with suitable example the effect parting line selection on the grain flow in forging. [4]
- c) Explain function of flash in forging operation. [2]

**Q6)** For the component shown in Fig. 1 an injection mold is to be designed,

- a) Determine ejector force. [4]
- b) Calculate the mold opening force. [4]
- c) Determine the diameter of the runner. [2]

**Given that :** Shrinkage = 0.96%, Coefficient of friction = 0.15, Material constant for PVC= 0.9, Poisson ratio and Modulus of elasticity for mold material are 3.33 and  $2 \times 10^5$  respectively, Injection pressure= 50 MPa. Modulus of elasticity for PVC is  $3 \times 10^3$  MPa, thickness=2 mm.

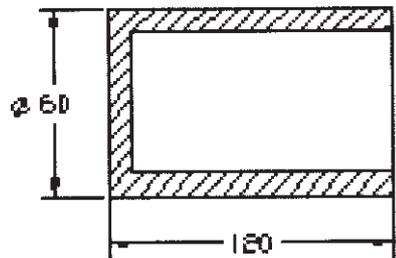


Fig. 1

**Q7)** a) Explain general steps in die casting die design. [4]

- b) Discuss design of feeding system in die casting die design. [4]
- c) Define following defects in die casting : [2]
  - i) misruns
  - ii) cold shuts

**Q8)** Write short notes on :

- a) Determination of mold opening force in injection molding [5]
- b) Selection of forging die material. [5]



Total No. of Questions : 8]

SEAT No. :

**P4204**

**[4760] - 1186**

[Total No. of Pages :2

**M.E.(Production) (Manufacturing and Automation)  
ADVANCED JOINING PROCESSES  
( 2013 Credit pattern) (Semester- II) (511109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of non-programmable electronic pocket calculator and statistical tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Give a brief review of conventional welding processes employed in the industries. [4]
- b) Discuss the factors which are considered in choosing a welding process for a specific application. [4]
- c) Why shielded metal arc welding process is most commonly used. [2]
- Q2)** a) Describe the working principle of Electron Beam Welding with a neat sketch. [4]
- b) Enumerate the important features of High Energy Density Welding processes. [4]
- c) State the various applications of Ultrasonic Welding. [2]
- Q3)** a) List down the different factors that causes the Arc Blow during welding? [4]
- b) Briefly discuss the necessity of conducting destructive testing of welds. Why standard specimens are used for testing? State the basic considerations in choosing a test of mechanical properties. [4]
- c) With neat sketches describe the faulty weld profiles on a butt and fillet welds. [2]

**P.T.O.**

- Q4)** a) Explain Angular Distortion and Longitudinal Bowing in welding with neat sketches. [5]
- b) Describe the stovepipe technique in pipeline welding. [5]
- Q5)** a) Calculate the melting efficiency in the case of arc welding of steel with a current of 200 A at 20 V. The travel speed is 5 mm/s, and the cross-sectional area of the joint is 20 mm<sup>2</sup>. Heat required to melt steel may be taken as 10 J/mm<sup>3</sup> and heat transfer efficiency is 0.85. [4]
- b) How residual stresses occur in welds? Briefly explain stress relieving treatment of welds. [4]
- c) What makes spray metal transfer superior to globular metal transfer? [2]
- Q6)** a) Discuss thermal and mechanical treatments of welds. What common thermal treatments are carried out on welds? [4]
- b) Briefly discuss the isothermal transformations, Time Temperature Transformations in steel. [4]
- c) What is HAZ in welding? Why a weld usually fails in HAZ area? [2]
- Q7)** a) Explain in a brief the hot air welding technique for welding of PVC plastics. [4]
- b) Describe with an example the use of friction welding technique for welding plastic components of circular cross section. [4]
- c) Draw a neat sketch of a test specimen with a butt joint to find out the strength of plastic sheets. [2]
- Q8)** a) Name the methods used to control contamination of welds and describe them in basic terms. [5]
- b) Why cast irons are more difficult to weld than steels? [5]



Total No. of Questions : 8]

SEAT No. :

**P4205**

[Total No. of Pages : 2

**[4760]- 1187**

**M.E. (Production) (Manufacturing & Automation)**

**ADVANCED ROBOTICS**

**(2013 Pattern)**

*Time : 2 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Your are advised to attempt not more than Five questions.*

- Q1)** a) Explain the six degrees of freedom associated with the manipulator. [4]  
b) What is the basic structure of Industrial Robot? What are the advantages of this structure for its application? [4]  
c) Explain the terms compliance and resolution. [2]
- Q2)** a) Mention useful properties of rotation matrices. [4]  
b) Explain homogeneous coordinates and homogeneous transformation matrix. [4]  
c) What is forward kinematics problem? [2]
- Q3)** a) Give classification of grippers and explain with sketch magnetic gripper. [4]  
b) Explain open and closed loop control systems in robotics. [4]  
c) What do you mean by end effectors? Explain. [2]
- Q4)** a) Discuss considerations in gripper selection and design. [5]  
b) List the steps involved in DH convention. [5]

**P.T.O.**

- Q5)** a) Explain lead through programming in detail. [4]  
b) Discuss various interpolation schemes used in motion interpolation. [4]  
c) Explain the meaning of robot textual languages. [2]
- Q6)** a) Explain optical and non optical position sensors. [4]  
b) Explain object recognition techniques in machine vision. [4]  
c) Enlist the applications of machine vision. [2]
- Q7)** a) What are singularities of a manipulator? How are they classified and Determined. [4]  
b) Determine Jacobian and joint velocities for a 3 DOF planar arm with revolute joints. [4]  
c) What is a Jacobian? [2]
- Q8)** a) Describe monitor commands in VAL II. [5]  
b) Explain the concept of low vision and high vision associated with Robot vision system. [5]



Total No. of Questions : 8]

SEAT No. :

**P4206**

**[4760] - 1188**

[Total No. of Pages :2

**M.E.**

**Production Engineering**

**SURFACE ENGINEERING**

**(2013 Credit Pattern) (Semester - III) (611102)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*
- 5) Use of electronic pocket calculator and logarithmic tables is allowed.*

**Q1) a)** What is Surface Engineering? Explain contributions of surface engineering to key industry sectors. **[6]**

b) Write short note on metal corrosion prevention. **[4]**

**Q2) a)** Explain various mechanical and chemical cleaning, techniques of industrial parts. **[6]**

b) Describe various factors to be considered while selecting the cleaning method of industrial parts. **[4]**

**Q3) Write short notes on:**

a) Hot Dipping **[5]**

b) Metal cladding. **[5]**

**Q4) a)** Describe mechanism of surface degradation. **[5]**

b) What you mean by fatigue life of industrial part? List out the factors which affect the fatigue life. **[5]**

**P.T.O.**

**Q5)** Explain following processes with their applications:

- a) Physical Vapor Deposition (PVD) [5]
- b) Chemical Vapor Deposition (CVD). [5]

**Q6)** a) Describe laboratory and special techniques of measuring coating thickness. [8]

- b) Suggest suitable coating hardness testing method for following? [2]
  - i) Steel, Cu, Al, Zn & Mg
  - ii) Hard rubber & Plastics

**Q7)** a) Describe any two methods of measuring coating hardness. [5]

- b) Write note on: 'Thermal degradation of metallic coatings during oxidation'. [5]

OR

**Q8)** a) Write short note on: high temperature metallic coatings. [5]

- b) State the basic difference between oxidation/corrosion resistant coating and thermal barrier coating. [5]



Total No. of Questions : 7]

SEAT No. :

**P4207**

[Total No. of Pages : 2

**[4760] - 1189**

**M.E. (Computer Engineering) (Semester - I)**

**APPLIED ALGORITHMS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q. No. 1 is compulsory. Solve any 5 from Q.No.2 to Q.No. 7.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Solve following recurrence by iteration: **[5]**  
$$T(n) = T(n - 1) + n^4$$
- b) Explain with examples Time and space trade-offs in algorithms. **[5]**
- Q2)** a) Write pseudo code algorithm for quick sort also give its time analysis using recurrence. **[4]**
- b) Write Kruskal's minimum spanning tree algorithm and determine its time complexity. **[4]**
- Q3)** a) Write approximation algorithm to store programs and also Prove that the absolute approximate knapsack problem is NP-hard. **[4]**
- b) Write Heuristic algorithm for knapsack problem and also subalgorithm for function EpsilonApprox. **[4]**
- Q4)** a) Explain with examples segment Intersection and Orientation. **[4]**
- b) Explain convex hull problem- formulation using graham scan algorithm. What is its time complexity? **[4]**

**P.T.O.**

**Q5) a)** Solve the given problem by simplex method **[4]**

$$\text{Max } Z = 107x_1 + x_2 + 2x_3$$

STC

$$14x_1 + x_2 - 6x_3 + 3x_4 = 7$$

$$16x_1 + 1/2x_2 - 6x_3 \leq 5$$

$$16x_1 - 8x_2 - x_3 \leq 0$$

$$x_1, x_2, x_3, x_4 \geq 0$$

b) Explain problem formulation for single source shortest path. Also write algorithm. **[4]**

**Q6) a)** Explain moments and transforms of distributions with examples. **[4]**

b) Explain with examples expectations of functions of more than one random variable. **[4]**

**Q7) a)** Give and explain inequalities and limit theorems. **[4]**

b) Explain random variable with suitable example. **[4]**



Total No. of Questions : 10]

SEAT No. :

**P3936**

**[4760]-119**

[Total No. of Pages : 2

**M.E. (Mechanical- Design Engineering)**

**ADVANCED MATERIAL SCIENCE**

**(2008 Course) (Semester - I) (Elective-I) (502204-B)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in detail the binary equilibrium eutectic phase diagram. [8]
- b) Explain the method of plotting an equilibrium diagram and derive the lever rule as applied to the equilibrium diagram. [8]
- Q2)** a) Determine the relation between the lattice parameter (a) and the atomic radius (r) for monotonic, SC, BCC and FCC structure. [8]
- b) List and sketch five possible Bravais lattices in two dimensions. What is Schottky and Frenkel defect? [8]
- Q3)** a) List important micro-constituents of Fe-C system and explain their mechanical properties. [8]
- b) What is co-ordination number? How it is useful to decide lattice structure? What is physical significance in metallic structure? [8]
- Q4)** a) Explain the heat treatment of tool steel. [8]
- b) Explain the various methods to achieve high strength in HSLA steels. [8]

***P.T.O.***

**Q5) Write a note on following (Any Three):** **[18]**

- a) Materials for high temperature applications.
- b) Heat Treatment of non ferrous alloys.
- c) Cu-Zn equilibrium diagram.
- d) Titanium alloys.

**SECTION - II**

**Q6) a) Explain commonly used materials in orthodontal applications.** **[8]**

- b) Define biomaterials and explain broadly their purpose. How they are differ from conventional materials? **[8]**

**Q7) a) What is carbon nanotubes? Mention important technological applications.** **[8]**

- b) Determine the use of cermets in cutting tools for machining. **[8]**

**Q8) a) What is shape memory alloy? What is mechanism of change of shape with temperature? What is ferromagnetic shape memory alloy?** **[8]**

- b) Explain in detail the characteristics of sintered ceramics. **[8]**

**Q9) a) Classify composites in details, and explain the characteristics of fibre Reinforced composites.** **[8]**

- b) Explain the surface coatings and their tribological aspects. **[8]**

**Q10) Write a note on (Any Three):** **[18]**

- a) Manufacturing techniques of shape memory alloys.
- b) Super conducting materials.
- c) Particulate composites.
- d) PVD.

*EEE*

Total No. of Questions : 6]

SEAT No. :

**P4208**

[Total No. of Pages :3

**[4760]-1190**

**M.E. (Computer Engineering) (Semester - I)**

**HIGH PERFORMANCE DATABASES**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All six questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Why is automatic index tuning a hard problem? Give an example. **[4]**

b) If you were about to create an index on a relation, what considerations would guide your Choice? Discuss: **[5]**

- i) Clustered versus unclustered indexes.
- ii) Hash versus tree indexes.

**Q2) a)** Describe different transformations of global queries into fragment queries in distributed database. **[4]**

b) Explain any two concurrency protocols in distributed databases to ensure consistency. **[4]**

**Q3) a)** Explain how a TP monitor manages memory and processor resources more effective than a typical operating system. **[4]**

b) Write a short note on (Any One) **[4]**

- i) Long duration transaction
- ii) Main memory databases

**Q4) Solve Any Two.**

a) Consider following DTD **[4]**

```
<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT report (section*)>
```

**P.T.O.**

```

<!ELEMENT section (section.title, section.content)>
<!ELEMENT section.title (#PCDATA)>
<!ELEMENT section.content (#PCDATA | anesthesia | prep | incision
| action | observation)*>
<!ELEMENT anesthesia (#PCDATA)>
<!ELEMENT prep (#PCDATA | action)*>
<!ELEMENT incision (#PCDATA | geography | instrument)*>
<!ELEMENT action (#PCDATA | instrument)*>
<!ELEMENT observation (#PCDATA)>
<!ELEMENT geography (#PCDATA)>
<!ELEMENT instrument (#PCDATA)>

```

Create XML document and solve the following queries in XQuery on XML

- i) In the Procedure section of Report 1, what Instruments were used in the second Incision?
  - ii) In Report 1, what Instruments were used in the first two Actions after the second Incision?
- b) Consider following DTD for bid [4]

```

<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT bids (bid_tuple*)>
<!ELEMENT bid_tuple (userid, itemno, bid, bid_date)>
<!ELEMENT userid (#PCDATA)>
<!ELEMENT itemno (#PCDATA)>
<!ELEMENT bid (#PCDATA)>
<!ELEMENT bid_date (#PCDATA)>

```

Create XML document and solve the following queries in XQuery on the bibliography fragment

- i) List the item number and description of the item(s) that received the largest number of bids, and the number of bids it (or they) received.
  - ii) List item numbers and average bids for items that have received three or more bids, in descending order by average bid
- c) Explain SOAP architecture in web databases [4]

- Q5)** a) Explain Time series analysis in Temporal Databases. [4]  
b) Explain Mobile databases with suitable example. [4]
- Q6)** a) Explain Database Connectivity Standards and Object Database Standards. [5]  
b) Solve any One [4]  
i) Explain CouchDB building blocks for large systems, self data contain and Replication  
ii) Explain Performance tuning using Materialized View and Schemas



Total No. of Questions : 6]

SEAT No. :

**P4209**

**[4760] - 1191**

[Total No. of Pages :3

**M.E. (Computer)**

**ADVANCED COMPUTER ARCHITECTURE**

**(2013 Credit Course) (510103) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All Questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Compare with features different shared memory multiprocessor models. **[5]**
- b) State the following terms w.r.t. various interconnect architectures: **[4]**
- i) Network diameter
  - ii) Bisection Bandwidth
  - iii) Routing function
  - iv) Multistage Network

OR

- a) Draw the dependence graph and analyze the various dependencies among the following statements in a given program. **[5]**
- S1 : Load R1, M(100)
- S2 : Move R2, R1
- S3 : Inc R1
- S4 : ADD R2, R1
- S5 : Store M(100), R1
- b) State and compare Interconnection Networks used in multiprocessor systems. **[4]**

*P.T.O.*

- Q2)** a) Define the term Degree of Parallelism (DOP). Describe Average Parallelism in terms of DOP. [4]
- b) With example, illustrate the mismatch between software and hardware parallelism. How can we match the software and hardware parallelism?[4]

OR

- a) What is Scalability? Define the term Speedup and Efficiency w.r.t. scalability? How these parameters reflects the performance of parallel computer systems? [4]
- b) Derive the Amdahl's law for speedup performance. Comment on the major observations and conclusions drawn w.r.t. the speedup obtained.[4]

- Q3)** a) Compare the features and performance of CISC and RISC processor architectures. [4]
- b) How arithmetic and instruction pipelines are designed? What is the use of Reservation Table? [4]

OR

- a) State the 4-level memory hierarchy defined for a computer system. How the data transfer takes place between adjacent levels of a memory hierarchy? [4]
- b) Discuss in brief the different mechanisms implemented in superscalar processor architectures to enhance the performance of Instruction and Arithmetic pipeline. [4]

- Q4)** a) With example state the advantages of vector processing over scalar processing. What is Vectorizing Compiler? State any 2 Vector optimizing functions. [4]
- b) What is cache coherency? What are the cache write policies used for cache updating? State the 4 states of MESI protocol. [4]

OR

- a) Discuss and compare between store-and-forward routing and wormhole message routing schemes. [4]
- b) With example explain the use of Compound Vector Function (CVF) to perform the vector operations. [4]

- Q5)** a) With example explain message passing parallel programming. What is SPMD Programming? [4]
- b) Explain with example the use of synchronization primitives in parallel programming. [4]

OR

- a) State and discuss different collective communication functions designed for MPI. [4]
- b) Explain the support provided by an OS for parallel program execution. Comment on thread and process level parallelism. [4]

- Q6)** a) Explain different services offered by Cloud. What is the difference between public and private cloud? [5]
- b) Discuss important features of Quantum computing. How these architectures can be used for distributed parallel processing? [4]

OR

- a) Compare between grid and cloud computing. What is cloud middleware? [5]
- b) How Neural Networks can be used for distributed parallel computing? Discuss in brief. [4]



Total No. of Questions : 6]

SEAT No. :

**P4210**

**[4760]-1192**

[Total No. of Pages : 2

**M.E. (Computer Engineering)  
RESEARCH METHODOLOGY  
(2013 Pattern) (Semester-I) (510104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** What is difference between research methods and methodology? Compare research methods, research techniques and explain with suitable examples. **[9]**

OR

b) Enlist and explain different objectives of research and explain ethical considerations in the research. **[9]**

**Q2) a)** What is research problem? Explain the importance of problem identification, and different technique involved in defining a research problem. **[8]**

OR

b) What is hypothesis and hypothesis formulation? Explain different characteristics the hypothesis must process in order to be a good research hypothesis. **[8]**

**Q3) a)** What is research design? Explain the meaning of the following in context of research design. **[8]**

- i) Extraneous variables;
- ii) Experimental and Control Groups,
- iii) Treatments.

OR

**P.T.O.**

- b) Explain and illustrate the following research designs: [8]
- i) Two group simple randomized design;
  - ii) Latin Square design,
  - iii) Random replications design; and
  - iv) Simple factorial design.

- Q4)** a) Calculate coefficient of correlation, coefficient of determination, and probable error from the following data. [8]

|    |     |     |     |     |     |     |     |
|----|-----|-----|-----|-----|-----|-----|-----|
| x: | 100 | 200 | 300 | 400 | 500 | 600 | 700 |
| y: | 30  | 50  | 60  | 80  | 100 | 110 | 130 |

OR

- b) What do you mean by multivariate analysis? Explain how it differs from bivariate analysis. [8]

- Q5)** a) Point out the important limitations of tests of hypotheses. What precaution the researcher must take while drawing inferences as per the results of the said tests? [8]

OR

- b) The procedure of testing hypothesis requires a researcher to adopt several steps. Describe in brief all such steps. [8]

- Q6)** a) What is an optimum service level with respect to queuing theory? Explain the characteristic properties of the Poisson input process and discuss their limitations by giving examples from practical queuing systems. [9]

OR

- b) Describe in brief the layout of a research report. Enlist and explain different types of research reports. [9]



Total No. of Questions : 8]

SEAT No. :

**P4406**

[Total No. of Pages : 2

**[4760] - 1193**

**M.E. (Computer Engineering) (Semester - II)**

**OPERATING SYSTEM DESIGN**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any four from Q. No. 1 to 6, Q. No. 7 & 8 compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Design a connection protocol for using a random number generator package. **[4]**

b) Explain why kernel mode processes are really the same thing as threads in the operating system? **[4]**

**Q2)** a) Why hardware instructions are removed from the virtual processor? Why they are removed? How they are removed? What are they replaced with? **[4]**

b) Describe the interaction between the CreateProcess, Wait and Exit system calls. **[4]**

**Q3)** a) Demonstrate how rendezvous pattern consists of two signaling pattern. **[5]**

b) Explain the system calls for interrupt handling. **[3]**

**Q4)** a) Why the space allocated to a stack automatically increased when the stack overflow it? Why is there a limit to how much it can be increased altogether? **[4]**

b) Explain the memory management design problem. What are the solutions available to memory management design problem? **[4]**

**P.T.O.**

- Q5)** a) Suppose you have 16 M bytes of main memory. Using the list method, you have an overhead of eight bytes per memory block. Using the bitmap method, you use an allocation granularity of 126 bytes. How many blocks are there when the space overhead of both methods is the same? What is the average block size for this many blocks? [5]
- b) Show the code to read disk block 100 into address 0X2000. [3]
- Q6)** a) The commands to a terminal to print an ASCII character contain only the characters, and do not say where to place the character on the screen. Why did design it like this. [4]
- b) Explain the mechanism for protecting hardware and software resources. [2]
- c) Explain two levels of index blocks with examples. [2]
- Q7)** a) With the help of mathematical model demonstrate the working of IPC pattern for mutual exclusion and singling. [5]
- b) Implement the following change to the simple operating system. When a process makes a system call the time it has remaining is recorded. The next time it executes it gets that time plus 100 more milliseconds. But no process can get more than 300 milliseconds. [4]
- Q8)** a) What makes the caching work?. How does dynamic programming use caching? [3]
- b) Give the advantages of a DMA device controller over a non-DMA device controller. [3]
- c) Write short notes on micro-kernel operating system. [3]



Total No. of Questions : 6]

SEAT No. :

**P4211**

**[4760] - 1194**

[Total No. of Pages : 2

**M.E. (Computer Engineering)**  
**SOFTWARE DESIGN AND ARCHITECTURE**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Solve question number 1 or 2, 3 or 4 and 5 or 6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Write in short the applicability, structure and implementation of **[8]**

- i) Builder pattern
- ii) Prototype pattern

b) What are the formal approaches of design pattern and what are the two major components of a software design method? **[8]**

**OR**

**Q2) a)** What is design patterns? How they are documented using a template? Explain the way they are documented with examples to illustrate from Adapter pattern. **[8]**

b) What are the major phases of the software design process. **[8]**

**Q3) a)** What is the role of architecture and what are the Uses of architecture documentation? **[9]**

b) What are the four common styles of the module viewtype? Explain in detail. **[8]**

**P.T.O.**

**OR**

**Q4) a)** What is an architecture implementation framework? How does an architecture implementation framework differ from middleware? [9]

b) What are the concept of systematic reuse and its particular implementation using product lines? [8]

**Q5) a)** Discuss the application domains of interaction - oriented software architectures. [9]

b) What is architectural pattern? Explain any one pattern with example. [8]

**OR**

**Q6) a)** Write short notes on:- [9]

i) Hierarchical Architecture

ii) Component-Based Software Architecture.

b) Explain with an examples stakeholder driven modeling. [8]



Total No. of Questions : 08]

SEAT No. :

**P4212**

**[4760]-1195**

[Total No. of Pages :2

**M.E. (Computer Engineering )**  
**ADVANCED NETWORK COMPUTER NETWORK**  
**(2013Credit Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any three questions from question No. 1,2,3,4, and any three questions from question No.5,6,7,8,.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Make suitable assumptions wherever necessary.*

**Q1) a)** Write short note on principals of network design. **[5]**

b) Explain with example an application of probability theory in network design and analysis. **[4]**

**Q2) a)** Enlist and explain some of the measure issues a network designer must consider. **[5]**

b) Analyse M/M/n queuing system using state transition diagram. **[4]**

**Q3) a)** Message arrives to the system at the rate of 10 per minute. Length of message is exponentially distributed with average of 3600 character on the transmission channel of 9600 bps. Calculate. **[5]**

i) Average service time.

ii) Service rate.

iii) Utilization of server.

iv) Probability of three messages in the system.

v) Average number of messages in the queue.

vi) Average waiting time. vii) Average time in the system.

b) State and explain Little's theorem. **[3]**

**P.T.O.**

- Q4)** a) Explain the centralize network design along with the problems associated with it. [4]  
b) Explain with example ESAU-Williams algorithm to find CMST. [4]
- Q5)** a) What is quality of service in network design? Explain the any three Qos mechanism. [4]  
b) Explain various traffic engineering methods. [4]
- Q6)** a) Explain ubiquitous computing with design issues and challenges. [4]  
b) Differentiate between IPV4 and IPV6 header format. Explain aggregation feature in IPV6. [4]
- Q7)** a) What do you mean by delay in communication subnet? Explain different component to calculate the delay. [5]  
b) Write short note on Internet of Things. [4]
- Q8)** a) Explain the following performance characteristics of network. [5]  
• Throughput,  
• Routing overhead,  
• Capacity,  
• Bandwidth,  
b) Write short note on cyber physical system. [4]



Total No. of Questions : 6]

SEAT No. :

P4213

[Total No. of Pages : 2

[4760]- 1196

**M.E. (Computer Engineering)**

**ADVANCED STORAGE SYSTEMS AND INFRASTRUCTURE  
MANAGEMENT**

**(2013 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

**Q1)** a) Which components constitute the disk service time? Which component contributes the largest percentage of the disk service time in a random I/O operation? [5]

b) Explain the process of data recovery in case of a drive failure in RAID.[5]

**Q2)** a) Explain integrated implementations and Gateway implementations mechanism of NAS? [5]

b) What are the different files sharing protocols used in NAS? Compare NFS and CIFS. [5]

**Q3)** a) What are the basic topologies used in a back-up environment? [5]

b) What is de duplication? Explain in detail. [5]

**Q4)** a) Write short note on the IT systems issues and business demands? [5]

b) What are the various Infrastructure management activities? [5]

**P.T.O.**

- Q5)** a) Write short note on Design of I.T. Infrastructure. [4]  
b) Explain with neat diagram Information Technology Infrastructure Library. [6]
- Q6)** a) Explain various important factors that should be managed in Service delivery process? [5]  
b) Explain the following terms: [5]  
a) Service level Management  
b) Financial Management and Costing  
c) Availability Management  
d) Configuration Management  
e) Tools and thier Integration



Total No. of Questions : 8]

SEAT No. :

**P4214**

**[4760] - 1197**

[Total No. of Pages :2

**M.E.**

**COMPUTER ENGINEERING**

**Advanced Unix Programming**

**(2013 Pattern) (Credit) (Semester - III) (610102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any five questions out of 8 questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1) a)** What are different types of Shell? Explain shell responsibilities in brief. **[4]**

b) Explain the various features of IA-64 architectures in brief. **[4]**

c) Explain input and output redirection with a suitable example. **[2]**

**Q2) a)** Explain 'Signal Set' data type with five functions used to manipulate signals. **[5]**

b) Explain the working of unreliable and reliable signals in Unix. **[3]**

c) How does wait ( ) and waitpid ( ) work? **[2]**

**Q3) a)** Write a note on Memory Mapped I/O. **[5]**

b) What is the basic difference between select ( ) & pselect ( ) functions used in I/O multiplexing? **[5]**

**Q4) a)** Explain the rules that govern the inheritance and release of locks in record locking. **[4]**

b) Write a note on Record Locking. **[4]**

c) How does pipe and FIFO IPC mechanism differ? **[2]**

**P.T.O.**

- Q5)** a) Explain the client-server communication using FIFO in Unix with a suitable diagram. [6]  
b) Write a short note on IPC using Message queue. [4]
- Q6)** a) Explain the importance of unlink ( ) in case of FIFO. [3]  
b) Explain in detail SHM\_LOCK and SHM\_UNLOCK commands. [3]  
c) What is a socket? Explain different types of socket? [4]
- Q7)** a) Write a note on RPC. [3]  
b) What files are generated by rpcgen? List the server specific files. [3]  
c) What are different models of concurrent server design? Explain any one model in detail. [4]
- Q8)** a) Write short notes on the following. [7]  
i) Socket descriptor.  
ii) Socket address structure for IP4.  
b) What type of operations are supported on routing sockets? [3]



Total No. of Questions : 12]

SEAT No. :

**P4215**

[Total No. of Pages : 2

[4760] - 1198

**M.E. (Computer Engineering) (Computer Networks)**

**ADVANCED NETWORK ALGORITHMS**

**(2013 Course) (Credit Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or 2, No. 3 or 4, No. 5 or 6, No. 7 or 8, No. 9 or 10, No. 11 or 12.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain characteristics of network algorithmics. **[4]**  
b) Explain abstract protocol model with a neat diagram. **[4]**

OR

- Q2)** With reference to router architecture, explain **[8]**  
a) Lookup  
b) Switching  
c) Queing  
d) Header validations and checksums

- Q3)** a) Explain the process in Ethernet monitoring using bridge hardware? **[4]**  
b) Explain the process of packet filtering in routers? **[4]**

OR

- Q4)** a) Explain the problem in route computation using Dijkstra's algorithm. **[4]**  
b) For incrementally reading a large database, find a way for the database to efficiently perform incremental queries. Find solution that is less burdensome for the database program. **[4]**

- Q5)** a) Explain the need of timers with suitable examples. **[5]**  
b) Explain various routines in a timer module. **[4]**

**P.T.O.**

OR

- Q6)** a) What are timing wheels? Explain their significance. [5]  
b) Explain timer model and performance measures. [4]

- Q7)** a) Explain the problem of Exact match look-up with examples. [4]  
b) Explain non-algorithmic techniques for prefix matching. [4]

OR

- Q8)** a) Write in brief on : [4]  
i) Packet repeater  
ii) Filtering repeater  
b) Explain implementation of Ethernet to Ethernet bridge. [4]

- Q9)** Explain the following techniques in brief : [8]  
a) Packet classification  
b) Linear Search  
c) Demultiplexing Algorithms  
d) Passing Labels

OR

- Q10)** a) Why packet classification is needed? [4]  
b) List and explain features of decision tree approach to packet classification. [4]

- Q11)** a) Explain : [4]  
i) Internet tomography  
ii) Pre-fix counters  
b) Write a short note on passive measurement and denial of service. [5]

OR

- Q12)** a) Explain sting as an example of passive measurement. [5]  
b) Explain how worms are detected? [4]



Total No. of Questions : 8]

SEAT No. :

P4216

[Total No. of Pages : 2

[4760] - 1199

**M.E. (Computer) (Computer Networks)**

**WIRELESS COMMUNICATION**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Explain the various technical challenges associated with meeting the service requirements for broadband wireless, along with potential solutions. **[6]**

b) Describe Quality of Service aspects of WiMax. **[6]**

OR

**Q2) a)** Discuss following with respect to Advanced Antenna systems. **[6]**

i) Transit Diversity

ii) Beam forming

iii) Spatial Multiplexing

b) Define QoS , discuss about Admission Control mechanism, also explain MPLS network and components development for delivering end-to-end QoS in an IP network with figure. **[6]**

**Q3) a)** Why Broadband wireless link is required to transmit multimedia data? Describe simple call setup using SIP. **[6]**

b) What do you mean by Mobile IP? What are different components of Mobile IP? **[6]**

**P.T.O.**

OR

**Q4)** a) What are the various stages of channel coding? Describe their functionalities. [6]

b) Compared with the current requirements what are the limitations of IS-95? Explain TD-CDMA and TD-SCDMA technologies. [6]

**Q5)** a) Explain Protocol layering across WiMax network using end-to-end WiMax Architecture. [6]

b) What are the tasks performed by WiMax Radio Resource Management? [7]

OR

**Q6)** a) What are WiMax forum specified requirements of Authentication and security Architecture, also explain AAA Architecture Framework and Authentication Protocols and Procedure. [7]

b) What are the basic requirements to design a WiMax Mobility Management architecture. [6]

**Q7)** a) What are the benefits of Multiple Antenna Techniques in WiMax. [6]

b) Discuss Link - Level Simulation Methodology used for Transmitter and Receiver sections of WiMax. [7]

OR

**Q8)** Write Short Notes on (any two): [13]

a) Modelling of Computation for frequency domain MIMO channel.

b) WiMax paging network reference model.

c) Multichannel Multipoint Distribution system.



Total No. of Questions : 8]

SEAT No. :

P4751

[Total No. of Pages : 3

[4760] - 120

M.E. (Mechanical) (Design Engg.)

OPTIMIZATION TECHNIQUES

(2008 Pattern) (Elective - I)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any THREE questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary and mention it clearly.*

**SECTION - I**

**Q1)** a) What is optimization problem? Give the classification of optimization problem with suitable examples. [10]

b) Explain the engineering applications of the optimization. [6]

**Q2)** a) State the necessary and sufficient conditions for the maximization of a multivariable function  $f(X)$ . [6]

b) Find the maximum of the function  $f(X) = 2x_1 + x_2 + 10$ . [10]

Subject to

$$g(X) = x_1^2 + 2x_2^2 = 3$$

using the Lagrange multiplier method.

Also find the effect of changing the right-hand side of the constraint on the optimum value of  $f$ .

**P.T.O.**

**Q3) a)** Find the second order Taylor series approximation of the function. [8]

$$f(x_1, x_2, x_3) = x_2^2 x_3 + x_1 e^{x_3}$$

about the point

$$\mathbf{X}^* = \{1, 0, -2\}^T$$

**b)** Minimize  $f = x_1^2 - 2x_2^2 - 3x_3^2$  [8]

subject to the constraints

$$g_1 = x_1 - x_2 - 2x_3 \leq 12$$

$$g_2 = x_1 + 2x_2 - 3x_3 \leq 8$$

using Kuhn-Tucker conditions

**Q4) a)** With the help of example explain the graphical method of optimization. What are the limitations of this method? [8]

**b)** Explain the simplex algorithm. What is the difference between the simplex algorithm and simplex method? [10]

### SECTION - II

**Q5) a)** What is the difference between Newton & Quasi-Newton method in solving an unconstrained minimization problem? [8]

**b)** Minimize the function. [8]

$$f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65x \tan^{-1}(1/x)$$

using the golden section method with  $n = 6$ .

**Q6) a)** With the help of flowchart explain the steps of Powell's method. [8]

**b)** Compare the gradients of the function. [8]

$$f(\mathbf{X}) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2 \text{ at } \mathbf{X} = \begin{Bmatrix} 0.5 \\ 0.5 \end{Bmatrix}$$

by Forward difference method and backward difference method.

Use a perturbation of 0.005 for  $x_1$  and  $x_2$  in the finite-difference methods.

**Q7) a) Minimize** **[12]**

$$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$$

Take the points in defining the initial simplex as

$$\mathbf{X}_1 = \begin{Bmatrix} 4.0 \\ 4.0 \end{Bmatrix}, \mathbf{X}_2 = \begin{Bmatrix} 5.0 \\ 4.0 \end{Bmatrix} \text{ and } \mathbf{X}_3 = \begin{Bmatrix} 4.0 \\ 5.0 \end{Bmatrix}$$

and  $\alpha = 1.0$ ,  $\beta = 0.5$  and  $\gamma = 2.0$  For convergence, take the value of  $\epsilon$  as 0.2. Perform at least two iterations.

b) What is the reason for possible divergence of Newton's method? **[4]**

**Q8) a) What is the difference between the interior and extended interior penalty function methods?** **[6]**

b) Minimize **[12]**

$$f(\mathbf{X}) = 9x_1^2 + 6x_2^2 + x_3^2 - 18x_1 - 12x_2 - 6x_3 - 8$$

subject to

$$x_1 + 2x_2 + x_3 \leq 4$$

$$x_i \geq 0, \quad i = 1, 2, 3$$

Using starting point

$$\mathbf{X}_1 = \{0, 0, 0\}^T,$$

Complete one step of sequential linear programming method.



Total No. of Questions : 6]

SEAT No. :

**P4217**

[4760] - 1200

[Total No. of Pages :2

**M.E. (Computer Networks)**

**ADVANCED DATABASES**

**(2013 Credit Pattern) (510203) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All Six questions are compulsory.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

**Q1) a)** What are the three broad levels at which database systems can be tuned to improve performance? Explain with examples. **[3]**

b) Consider the following relation. **[4]**

Emp (eid : integer, sal : integer, age : real)

There is a clustered index on eid and unclustered index on age

- i) Now would you use the indexes to enforce the constraint eid is a key.
- ii) Give an example of update i.e. definitely speedup because of available indexes.
- iii) Give an update i.e. definitely closed down because of the indexes.
- iv) Can you give an example of i.e. neither speedup nor slower down by indexes?

**Q2) a)** Consider a distributed system with 2 sites A & B Can site A distinguished among following: **[4]**

- B goes down
- Link between A & B goes down
- B is extremely overloaded & response time is 100 times longer than normal

What implications does your answers have for recovery in distributed systems?

b) Write a short note on availability in distributed databases. **[3]**

*P.T.O.*

- Q3)** a) What are failure-atomicity requirements of a workflow? [4]  
b) In a group-commit technique, how many transaction should be part of group? Explain your answer. [5]
- Q4)** a) Give DTD or XML schema for an XML representation of following nested relational schema, [5]  
Emp (ename, childrenset set of (children) skillset set of (skills))  
Children (name, birthday)  
Birthday (day, month, year)  
Skills (type, Examset set of (Exams))  
Exams (year, city)  
b) Consider schema in G.4-a & write the following queries in Xquery. [4]  
i) Find the names of all employees who have child who has birthday in March.  
ii) Find those employee who took an examination for the skill type “typing” in the city “Dayton”  
iii) List all skill types in Emp.
- Q5)** a) Suppose you have spatial database that support system region queries with the circular regions, but not request neighbour queries. Describe an algorithms to find the nearest neighbour by making use of multiple regions queries. [5]  
b) Write note on multimedia database. [4]
- Q6)** a) Explain in detail anatomy of mapreduce program. [5]  
b) Write short note on HDFS. [4]



Total No. of Questions : 12]

SEAT No. :

**P4218**

**[4760]- 1201**

[Total No. of Pages :2

**M.E. (Computer Networks)  
RESEARCH METHODOLOGY  
( 2013 Credit Pattern) (Semester- I) (510204)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat Diagrams should be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*
- 4) *All questions are compulsory.*

**Q1)** Describe the significance of motivations in research and objectives of research. **[9]**

OR

**Q2)** How do you define a research problem? Give two examples to illustrate your answer. **[9]**

**Q3)** Explain the need for research design from the point of view of Indian researchers. **[8]**

OR

**Q4)** What are different techniques to define a research problem? Explain in brief. **[8]**

**Q5)** Describe important research designs used in experimental research study. **[8]**

OR

**Q6)** Explain Fisher's principles of experimental designs, in detail. **[8]**

**Q7)** Distinguish between systematic and stratified sampling. **[9]**

OR

**Q8)** Explain and illustrate the procedure of selecting a random sample. **[9]**

**P.T.O.**

**Q9)** What is the meaning of measurement in research? Explain with suitable example. [8]

OR

**Q10)** Describe the process of interview as a technique of data collection. [8]

**Q11)** Name the important multivariate techniques and explain the important characteristics of any one of such techniques. [8]

OR

**Q12)** Describe, in brief, the layout of a research report, covering all relevant points. [8]



Total No. of Questions : 8]

SEAT No. :

P4407

[Total No. of Pages : 2

[4760] - 1202

M.E. (Computer Networks)

NETWORK DESIGN, MODELLING AND ANALYSIS

(2013 Pattern)(Semester - II)

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any six questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in detail expectation of random variable with its suitable example? **[4]**
- b) Discuss in detail Success Probability and failure probability in establishing network connection. **[4]**
- Q2)** a) For M/M/1 queuing system, A routers outgoing bandwidth is 100kbps. Arrival packet's number of bits has exponential distribution with mean number of 1 Kbits. **[4]**
- Given: Poisson Arrival Process = 80 packets/sec
- Find:
- i) How many packets in router expected by new arrival?
  - ii) What is the expected waiting time for new arrival?
- b) A public bird bath has a mean arrival rate of 3 birds/min in Poisson distribution. Bath-time is exponentially distributed, the mean bath time being 10 sec/bird. Compute how long a bird wait in a queue? **[4]**

**P.T.O.**

**Q3)** Write a short note on (Any Two) : **[8]**

- a) Little's Theorem.
- b) Modelling Network as a graph.
- c) M/G/1 queues with vacation.

**Q4)** a) Solve Terminal Assignment problem for given data. **[5]**

Weight of node = 01 , Max. capacity of concentrator = 03

|   | G | H | I | K |
|---|---|---|---|---|
| a | 5 | 8 | 2 | 5 |
| b | 7 | 4 | 3 | 2 |
| c | 2 | 1 | 3 | 1 |
| d | 1 | 8 | 2 | 2 |
| e | 2 | 4 | 6 | 0 |
| f | 2 | 2 | 2 | 1 |

b) Explain CMST algorithm with suitable example. **[3]**

**Q5)** a) Explain MENTOR algorithm for router design. **[4]**

b) Describe why adding new sites in the network is a significant problem in network design. **[4]**

**Q6)** a) Describe Algorithm to solve line crossings problem in access design. **[4]**

b) Explain performance metrics for network design. **[4]**

**Q7)** a) Explain with suitable example how degree of node affects fault tolerance. **[4]**

b) Explain simple access design problem in detail. **[4]**

**Q8)** Write a short note on (Any Two): **[8]**

- a) Classful IP addressing scheme.
- b) Router Architecture.
- c) Rerouting Algorithm.



Total No. of Questions : 8]

SEAT No. :

P4219

[Total No. of Pages : 2

[4760]-1203

**M.E. (Computer Engineering) (Computer Networks)**

**DISTRIBUTED SYSTEMS**

**(2013 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Solve any three questions from Q.1,2,3,4 and any three questions from Q.5,6,7,8.*
- 2) *Assume suitable data, if necessary.*

**Q1)** a) Why is computer clock synchronization necessary? Describe the design requirements for a system to synchronize the clocks in a distributed system. **[4]**

b) Explain Suzuki - Kasami's broadcast algorithm. **[5]**

**Q2)** a) Enlist and explain different modules involved in achieving a remote method invocation. **[4]**

b) Explain centralized deadlock detection algorithm. **[4]**

**Q3)** Explain remote procedure call in detail with help of diagram. **[8]**

**Q4)** a) Why is Lamport's logical clock required? Discuss limitations of Lamport's colck. **[4]**

b) Describe ricart Agrawala's algorithm for implementing mutual exclusion in a distributed environment. **[4]**

**P.T.O.**

- Q5)** Explain why UDDI can be described as being both a name service and a directory service, mentioning the types of inquiries that can be made. [8]
- Q6)** a) What are main causes of thrashing in a DSM system? What are commonly used methods to solve thrashing problem in a DSM system? [5]  
b) Discuss classification of failures. What is backward & forward error recovery? [4]
- Q7)** a) Write note on SOAP. [4]  
b) Write receiver initiated algorithm in distributed scheduling. [4]
- Q8)** a) Explain vote reassignment protocol. [4]  
b) Discuss design issues of distributed file systems. [4]



Total No. of Questions : 8]

SEAT No. :

**P4220**

**[4760] - 1204**

[Total No. of Pages :2

**M.E. (Computer Networks)**  
**HIGH PERFORMANCE NETWORKS**  
**(2013 Credit Pattern) (Semester - II) (510209)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any three questions from Question No. 1, 2, 3, 4 and any three questions from Question No. 5, 6, 7, 8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume Suitable data if necessary.*

**Q1)** a) What is 10-gigabit Ethernet? Explain Giga-bit Ethernet Technology in details. **[5]**

b) Explain in details Token Bus Technology and Token Ring Technology. **[4]**

**Q2)** a) Write a short note on X.25, Frame relay. **[4]**

b) Compare Message Switched Network and Circuit Switched Network. **[4]**

**Q3)** a) Explain Adaption layer of ATM in details. **[4]**

b) Draw and explain Ethernet frame format. **[4]**

**Q4)** a) How are ATM cells mapped on the following physical layer interfaces. **[4]**

i) DS 1

ii) DS 3

iii) E 3

iv) STS-3c

b) Draw and explain ATM protocol reference model. **[4]**

*P.T.O.*

- Q5)** a) Draw and explain IP over MPLS architecture. [4]  
b) Write a note on forwarding operation of MPLS. [4]
- Q6)** a) List and explain silent features of Wimax. [4]  
b) Comment on “Will Fixed WiMax Die”. [4]
- Q7)** a) Explain in details Physical and MAC layer of WiMax. [4]  
b) Which are the different scheduling algorithms are used for HSDPA to schedule the transmission for users. [4]
- Q8)** a) Explain in short LTE and Mobile WiMax wireless networks. [5]  
b) List and explain research areas of MPLS and High Performance Wireless Networks. [4]



Total No. of Questions : 6]

SEAT No. :

P4221

[Total No. of Pages : 2

[4760] - 1205

**M.E. Computer Networks (Semester - III)**

**ADVANCED TCP/IP**

**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3,) *Figures to the right side indicate full marks.*

- Q1)** a) Draw and explain TCP state transition diagram. **[5]**
- b) How Stream Control Transmission Protocol is suitable for high reliability applications? Explain. **[5]**
- Q2)** a) Explain the mechanism of TELNET how it forces the remote operation system to respond to control function quickly. **[5]**
- b) Explain any two protocols which are used for implementation of Voice over internet. **[5]**
- Q3)** a) Compare and explain IMAP and POP3 mechanisms. **[5]**
- b) Differentiate between HTTP & HTTPS. Explain under what condition proxy cache web pages, while using HTTPS. **[5]**
- Q4)** a) Explain open loop and closed loop flow control mechanisms in networks. **[5]**
- b) Write short note on TCP congestion avoidance algorithms TCP Tahoe and TCP Vegas. **[5]**

**P.T.O.**

- Q5)** a) Explain AODV with its advantages and limitations. [5]  
b) Explain TCP performance in mixed wired and wireless environment.[5]
- Q6)** a) Explain Key management in Internet Key Exchange Protocol. [5]  
b) Draw SSL architecture and explain. [5]



Total No. of Questions : 12]

SEAT No. :

**P4222**

**[4760] - 1206**

[Total No. of Pages :2

**M.E. (Computer) (Computer Networks)  
SYSTEM OPERATIONS AND MAINTENANCE  
(2013 Credit Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No. 1 or 2, Q.No. 3 or 4, Q.No. 5 or 6, Q.No.7 or 8, Q.No.9 or Q.10, Q.No.11 or 12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Explain Cisco IOS XR System Database. What are the services provided by Sys BD. **[9]**

OR

**Q2)** Draw and explain IOS XR Layered High Availability Architecture. **[9]**

**Q3)** Explain Control plane and data plane configuration management. List the functionalities of Cisco IOS XR Configuration Manager. **[8]**

OR

**Q4)** What is two stage configuration model? Explain with suitable example. **[8]**

**Q5)** What is SNMP? Which different versions of SNMP those are supported by Cisco IOS XR software? Also explain basic steps are needed to configure SNMP on an IOS XR router. **[8]**

OR

**P.T.O.**

**Q6)** What is role of Access Control Lists in forwarding plane? Give key features of Access Control Lists. **[8]**

**Q7)** What are the types of Interior routing protocol? Explain RIP Configuration steps in Detail. **[8]**

OR

**Q8)** Explain in details Enhanced Interior Gateway Routing Protocol. **[8]**

**Q9)** Explain Label Distribution Protocol (LDP) in detail. **[8]**

OR

**Q10)** What is MPLS Traffic Engineering? Also explain TE configuration tasks. **[8]**

**Q11)** Explain Functionalities of Three-Stage Fabric Links. **[9]**

OR

**Q12)** Explain the steps who to create the Secure Domain Router and how to configure them. **[9]**



Total No. of Questions : 8]

SEAT No. :

**P4223**

[Total No. of Pages : 3

**[4760] - 1207**  
**M.E. (Chemical)**  
**MATHEMATICAL AND STATISTICAL METHODS**  
**(2013 Pattern) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer total 5 questions from following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Solve in series the equation **[5]**  
 $xy'' + 2y' + xy = 0.$
- b) Expand the following function in terms of Legendre polynomials in the interval  $-1 < x < 1$  **[3]**  
 $f(x) = x^3 + 2x^2 - x - 3.$
- c) What is mean by Bessel's equation and Bessel functions? **[2]**
- Q2)** a) Find the potential in the interior of a sphere of unit radius when the potential on the surface is  $f(\theta) = \cos^2\theta.$  **[5]**
- b) Find the solution of  $u_t = ku_{xx}$  having given that  $u = u_0 \sin t$  when  $x = 0$  for all values of  $t$  and  $u = 0$  when  $x$  is very large. **[3]**
- c) Explain Laplace equation in cylindrical form. **[2]**
- Q3)** a) Find the Laurent's expansion of  $f(z) = (7z - 2)/[(z + 1)z(z - 2)]$  in the region  $1 < z + 1 < 3.$  **[5]**
- b) Evaluate  $\int_0^{1+i} (x^2 + iy)dz$  along the paths  $y = x$  and  $y = x^2.$  **[3]**
- c) Write a note on series of complex terms. **[2]**
- Q4)** a) In a certain college, 4 % of the boys and 1% of girls are taller than 1.8 m. Further more 60% of the students are girls. If a student is selected at random and is found to be taller than 1.8 m. What is the probability that the student is a girl? **[5]**

**P.T.O.**

- b) Fit a binomial distribution for the following data: [3]
- |   |   |   |    |    |    |    |   |
|---|---|---|----|----|----|----|---|
| x | : | 0 | 1  | 2  | 3  | 4  | 5 |
| f | : | 2 | 14 | 20 | 34 | 22 | 8 |
- c) Compare Discrete Probability Distribution and Continuous Probability Distribution. [2]

- Q5)** a) Compute the coefficient of correlation between X and Y using the following data: [5]

|   |   |    |    |    |    |    |    |    |
|---|---|----|----|----|----|----|----|----|
| X | : | 55 | 56 | 58 | 59 | 60 | 60 | 62 |
| Y | : | 35 | 38 | 38 | 39 | 44 | 43 | 45 |

- b) Find the rank correlation for the following data: [3]
- |   |   |    |    |    |    |    |    |    |    |    |    |
|---|---|----|----|----|----|----|----|----|----|----|----|
| x | : | 78 | 36 | 98 | 25 | 75 | 82 | 90 | 62 | 65 | 39 |
| y | : | 84 | 51 | 91 | 60 | 68 | 62 | 86 | 58 | 63 | 47 |
- c) Explain Correlation and Regression of Analysis. [2]

- Q6)** a) Five breeds of cattle  $B_1, B_2, B_3, B_4, B_5$  were fed on four different rations  $R_1, R_2, R_3, R_4$ . Gains in weight in kg over a given period were recorded and given below.

|       | $B_1$ | $B_2$ | $B_3$ | $B_4$ | $B_5$ |
|-------|-------|-------|-------|-------|-------|
| $R_1$ | 1.9   | 2.2   | 2.6   | 1.8   | 2.1   |
| $R_2$ | 2.5   | 1.9   | 2.3   | 2.6   | 2.2   |
| $R_3$ | 1.7   | 1.9   | 2.2   | 2.0   | 2.1   |
| $R_4$ | 2.1   | 1.8   | 2.5   | 2.3   | 2.4   |

Is there significant difference between i) breeds ii) rations?  
 $[F_{5\%}(v_1=3, v_2=12)=3.49 \text{ and } F_{5\%}(v_1=4, v_2=12)=3.26]$  [5]

- b) Write down the format of ANOVA table for two factors of classification. [3]
- c) Distinguish between experimental and extraneous variables. [2]

- Q7)** a) The average marks scored by 32 boys is 72 with a SD of 8, while that for 36 girls is 70 with SD of 6. Test at 1 % LOS whether the boys perform better than girls. ( $Z_{\alpha} = 2.33$ ) [5]

- b) Tests made on the breaking strength of 10 pieces of a metal gave the following results 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg. (LOS= 5%,  $v = 9, t_{0.05} = 2.26$ ) [5]

**Q8)** a) The regression equations of two variables x and y are  $x = 19.13 - 0.87y$  and  $y = 11.64 - 0.50x$ . Find the **[5]**

- i) coefficient of correlation between them
- ii) mean of x's
- iii) mean of y's.

b) Fit a straight line  $y = a + bx$  to the following data by method of least squares **[5]**

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| x | : | 0 | 1 | 3 | 6 | 8 |
| y | : | 1 | 3 | 2 | 5 | 4 |



Total No. of Questions : 8]

SEAT No. :

**P4408**

[Total No. of Pages : 3

[4760] - 1208

**M.E. (Chemical)**

**PROCESS OPTIMIZATION**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Minimize  $f(x) = x + (2/x) + (1/3x^2)$

- a) Minimize  $f(x) = x + (2/x) + (1/3x^2)$ . Use Fibonacci Search Method. Write complete algorithm for this method. **[4]**
- b) Minimize  $f(x) = x + (2/x) + (1/3x^2)$ . Demonstrate at least 2 steps towards finding optimized solution for the above function, using Fibonacci Search Method. **[4]**
- c) What is the Multivariable optimization? Explain with example. **[2]**

**Q2)** a) Discuss the conditions of convexity of a function using Hessian matrix. **[4]**

- b) Find whether the following function is strictly convex / strictly concave. **[4]**

$$f(x) = x_1^2 + 4x_1x_2 + 8x_1 - 15x_2 - 8x_2^2 + 15, \text{ using Hessian Matrix.}$$

- c) How a maximization problem may be stated on minimization one? **[2]**

**Q3)** a) Explain the Interval Halving Method. **[4]**

- b) Demonstrate for minimization of  $f(x) = 2x_1 + 3x_2 + 4x_1x_2$  starting at  $(x^0)^T = [2 \ 5]$  in the direction  $s^0 = [2 \ 2]^T$  by Simplex method. Perform 2 steps. **[4]**

- c) What are the Constraints of a function? Explain with example. **[2]**

**P.T.O.**

- Q4)** a) Explain the Bounding Phase Method. [4]
- b) Demonstrate for minimization of  $f(x) = 2x^3 + (3/(1+x))$ . Perform 2 steps, Using Bounding Phase Method. [4]
- c) What do you understand by ‘saddle point’? Explain. [2]
- Q5)** a) For a typical batch reactor write model equations based on which an optimization problem can be defined. Also define typical constraints on such a problem [4]
- b) For a typical batch reactor discuss the strategy to get optimized solution out of it. [4]
- c) Example of Quadratic programming. [2]
- Q6)** a) For a typical binary distillation column write model equations based on which an optimization problem can be defined. Also define typical constraints on such a problem. [4]
- b) For a typical binary distillation column discuss the strategy to get optimized solution out of it. [4]
- c) Explain with example ‘Local Optima’. [2]

**Q7)**

|                      | Weight percent composition |               |               | Maximum allowable consumption rate, kg/day |
|----------------------|----------------------------|---------------|---------------|--|
|                      | combination A              | combination B | combination C |  |
| Top distillate(1)    | 20                         | 26            | 16            | 500  |
| Middle distillate(2) | 30                         | 70            | 67            | 800  |
| Residue(3)           | 50                         | 04            | 17            | 350  |

Table No. 1

a) Chemical Products (1,2,3) coming out of a multicomponent distillation tower has three combinations A, B, C as shown in the above table no.1. The maximum quantity of Chemicals 1 to 3 is restricted to the figures as shown in the table 1. The profits on combinations A, B, C are Rs. 125, 135, 160 per 1t respectively. Formulate the complete optimization problem and discuss about it. [5]

b) For the problem in

find the approximate optimum consumption rates of the three grades that can be produced. [5]

**Q8)** a) What are Kuhn Tucker conditions? Discuss. [5]

b) Explain with example. The right direction in any directional search method approaches the ultimate solution much faster. [5]



Total No. of Questions : 8]

SEAT No. :

**P4224**

[4760] - 1209

[Total No. of Pages :3

**M.E. (Chemical)**

**ADVANCED SEPARATION PROCESSES**  
**(2013 Credit Pattern) (Semester - I) (Theory) (509103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume Suitable data, if necessary.*

**Q1) a)** What is cross flow filtration? What are its advantages over dead end filtration? [5]

b) What is the principle and working of CF electro-filtration? Discuss its application? [5]

**Q2) a)** What is the process of surface based solid-liquid separations involving a second liquid? [5]

b) What is reverse osmosis? Explain the process and derive the equations of flux for once through continuous operation mode? [5]

**Q3) a)** Discuss the classification of membrane processes along with its applications compared to conventional separation techniques? [3]

b) What are the different types of membrane modules. [2]

c) What is membrane fouling and its effects? Give various reasons for fouling along with typical schematic diagram? [5]

**Q4) a)** Discuss the reactive absorption for removal of hazardous gases like  $H_2S$  &  $SO_x$ . [5]

b) Discuss principle, working and application of reactive extraction operation? [5]

**P.T.O.**

**Q5) a)** Describe working principle of Ion chromatography techniques along with its applications? [5]

b) Enlist various factors considered for selection of an analytical method? Discuss advantages of HPTLC over TLC? [5]

**Q6) a)** Describe mechanism and applications of supercritical fluid extraction in chemical & biochemical industry? [5]

b) Differentiate between electrophoresis and dielectrophoresis and discuss advantages of dielectrophoresis over electrophoresis techniques? [5]

**Q7) a)** A solution of washed, raw cane sugar, 38% sucrose by weight, is colored by the presence of small quantities of impurities. It is to be decolorized at 70°C by treatment with an adsorptive carbon in a contact filtration plant. The data for equilibrium adsorption isotherms were obtained by adding various amounts of the carbon to separate bathes of original solution and observing the equilibrium colour reached in each case. The data, with the quantity of carbon expressed on the basis of the sugar content of the solution, are as follows: [8]

|                        |   |       |      |       |       |       |
|------------------------|---|-------|------|-------|-------|-------|
| Kg carbon/kg dry sugar | 0 | 0.006 | 0.02 | 0.019 | 0.023 | 0.041 |
| Color removed          | 0 | 45    | 65   | 77    | 80    | 81    |

The original solution has a color concentration of 20, measured on an arbitrary scale, and it is desired to reduce the colour to 2.4% of its original value.

i) Convert the equilibrium data to  $Y^* = \text{color units/kg sugar}$ ,  $X = \text{colour units/kg carbon}$ . Do they follow the Freundlich equation? If so, what are the equation constants?

ii) Calculate the necessary doses of fresh carbon, per 1000kg of solution for single-stage process.

b) Describe oil spill management technique. [2]

**Q8) a)** Ultrafiltration of a well-stirred suspension containing 0.1 vol% yeast suspension gives a flux of 36 gal/ft<sup>2</sup>-day under a pressure difference of 130 psi. **[6]**

i) What is the value of  $L_p$ ?

ii) What is the water velocity through the membrane?

**b)** A chromatographic analysis for the chlorinated pesticide Dieldrin gives a peak with a retention time of 8.68 min and a baseline width of 0.29min. How many theoretical plates are involved in this separation? Given that the column used in this analysis is 2.0 meters long, what is the height of a theoretical plate? **[4]**



Total No. of Questions : 10]

SEAT No. :

**P3937**

**[4760] - 121**

[Total No. of Pages : 2

**M.E. (Mechanical) (Design Engg.)**  
**MATERIAL HANDLING AND EQUIPMENT DESIGN**  
**(2008 Pattern) (Elective - II (A))**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section-I and three questions from section - II.*
- 2) *Question Nos. Q 3 and Q10 are compulsory. Out of the remaining attempt 2 questions from section I and 2 questions from section II.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Assume suitable data, if necessary.*
- 7) *Use of electronic pocket calculator is allowed.*

**SECTION - I**

- Q1)** a) Discuss the Importance of MHE in today's industrial world by giving suitable examples. [8]  
b) Write note on classification of material handling equipments? [8]
- Q2)** a) Write any five principles of MHE? [8]  
b) Explain in brief the activity cost data and economic analysis for design of components of material handling systems. [8]
- Q3)** a) Explain in brief the design of material (mechanical) handling equipments considering hoists. [8]  
b) Explain in detail material handling equation. [10]
- Q4)** a) What are factors affecting on selection material handling equipments? [8]  
b) Discuss in detail travelling mechanism for cantilever crane? [8]
- Q5)** a) Write short note on any two : [10]  
i) Hand propelled overhead Travelling cranes.  
ii) Hoisting mechanism  
iii) Electrically driven EOT  
b) Write in detail application of material handling equipments. [6]

**P.T.O.**

## SECTION - II

- Q6)** a) What are the various types of load chains and ropes used in material handling systems? [8]  
b) Explain in detail Grab buckets. [8]
- Q7)** a) Give in brief design of load lifting attachments with considering forged, standard and Ramshorn Hooks. [8]  
b) Explain in brief the objectives of equipments used for material storage. [8]
- Q8)** a) Explain in brief Gravity flow of solids through slides and chutes, with applications, advantages, and disadvantages. [8]  
b) Discuss the layout factors in designing a new warehouse. [8]
- Q9)** a) Explain in detail objective of storage system. [8]  
b) Explain various points considered while evaluating an existing warehouse system. [8]
- Q10)** Write short notes on any three of the following : [18]  
a) Factors considered in a new warehouse building.  
b) Storage systems for bulk material.  
c) Warehouse automation.  
d) Safety considerations in design of a material handling system.  
e) Different types of ropes used in Material handling system.



Total No. of Questions : 08]

SEAT No. :

**P4225**

**[4760] - 1210**

[Total No. of Pages :2

**M.E.(Chemical)**

**RESEARCH METHODOLOGY**

**(Semester-I) ( 2013 Credit Pattern) (509104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** What is the necessity of defining a research problem? Explain. **[5]**

b) Explain the significance of a Research design. **[5]**

**Q2)** Explain the meaning of the following in context of Research design. **[10]**

- a) Extraneous variables;
- b) Confounded relationship;
- c) Research hypothesis;
- d) Experimental and Control groups;
- e) Treatments.

**Q3) a)** The heights in inches of 30 students are as follows: **[6]**

66, 68, 65, 70, 67, 64, 68, 64, 66, 64, 70, 72, 71, 69, 69, 64, 67, 63, 70,  
71, 63, 68, 67, 65, 69, 65, 67, 66, 69, 67

prepare a frequency distribution table showing relative frequency, cumulative frequency and percent frequencies.

b) Distinguish between simple hypothesis and composite hypothesis. **[4]**

P.T.O

- Q4)** a) Write a short note on 'Experience Survey' explaining fully its utility in exploratory research studies. [6]  
b) Discuss the importance of Literature Review. [4]
- Q5)** a) What are the types of Journal papers? [5]  
b) Discuss the role of computers in Research. [5]
- Q6)** a) What are the different types of graphs/ plots in research report? Explain. [5]  
b) What is regression analysis? Explain multiple regression analysis. [5]
- Q7)** a) What are the essential requirements for the registration of design under the Designs Act,2000? [6]  
b) What should be the contents of abstract of a report? Explain. [4]
- Q8)** a) Explain the procedure for grant of an Indian patent? [5]  
b) Discuss the objectives of technological forecasting. [5]



Total No. of Questions : 8]

SEAT No. :

P4226

[Total No. of Pages : 6

**[4760] - 1211**  
**M.E. (Chemical)**  
**ADVANCED TRANSPORT PHENOMENA**  
**(2012 Pattern) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer 5 questions from 8 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronics calculator is allowed.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use equations in appendix wherever necessary.*

**Q1) a)** Derive the equation for velocity for flow through the annulus. [7]

b) Derive the equation for continuity. [3]

**Q2) a)** A Liquid of constant density and viscosity is in a cylindrical container of radius R. The container is caused to rotate about its own axis at an angular velocity  $\Omega$ . The cylindrical axis is vertical so that  $g_r = 0$ .  $g_\theta = 0$  and  $g_z = -g$  in which g is the magnitude of the gravitational acceleration. Find the shape of the free surface of the liquid when steady states have been established. [7]

b) Write note on the boundary layer theory for solving for flow near solid surfaces. [3]

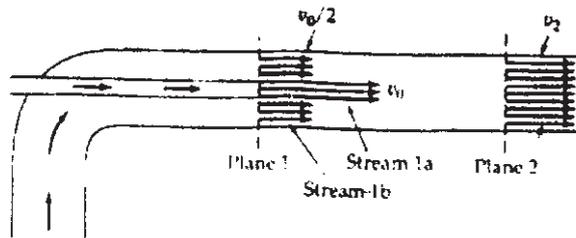
**Q3) a)** Show that the complex potential.

$$W(Z) = -v_\infty R \left( \frac{r}{R} + \frac{R}{z} \right)$$

Describe the potential flow around a circular cylindrical of radius R, when the approach velocity is  $v_\infty$  in positive x direction. Find the components of the velocity vector. Find the pressure distribution on the cylindrical surface, when the modified pressure far from the cylindrical is  $P_\infty$ . [6]

**P.T.O.**

- b) A diagram a liquid ejector shown in below. It is desired to analyze the mixing of the two streams, both of the same fluid, by means of the macroscopic balances. At plane 1 the two fluid streams merge. Stream 1a has a velocity  $v_0$  and a cross sectional area  $1/3 S_1$  and stream 1b has a velocity  $1/2 v_0$  and a cross sectional area  $2/3 S_1$ . Plane 2 is chosen far enough down-stream that the two streams have mixed and the velocity is almost uniform at  $v_2$ . The flow is turbulent and the velocity profiles at planes 1 and 2 are assumed to be flat. [4]

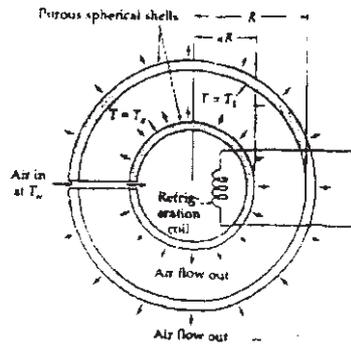


- Q4) a) A spherical nuclear fuel element, it consists of a sphere of fissionable material with radius  $R^F$ , surround by a spherical shell of the aluminum cladding with outer radius  $R^c$ . Inside the fuel element fission fragments are produced that have very high kinetic energies. Collisions between these fragments and the atoms of fissionable material provide the major source of thermal energy in the reactor. Such a volume source of thermal energy resulting from nuclear fission is  $S_n$ . This source will not be uniform throughout the sphere of fissionable material it will be smallest at the centre of the sphere. Develop the expression for temperature profile in cladding and fissionable material, take  $S_n$  as: [8]

$$S_n = S_{n0} \left[ 1 + b \left( \frac{r}{R^F} \right)^2 \right]$$

- b) What is the physical significance of the fact that the turbulent Prandtl number is of the order of unity? [2]

- Q5) A system with two concentric porous spherical shells of radii  $kR$  and  $R$  is shown in figure. The inner surface of the outer shell is at temperature  $T_1$  and the outer surface of the inner shell is at a lower temperature  $T_k$ . Dry air at  $T_k$  is blown outward radially from the inner shell into the intervening space and then through the outer shell. Develop an expression for the required rate of heat removal from the inner sphere as a function of the mass rate of flow of the gas. Assume steady laminar flow and low gas velocity. [10]



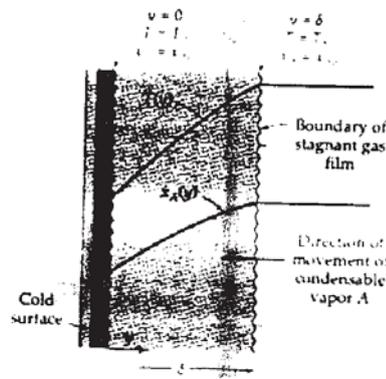
**Q6) a)** Define the heat transfer coefficient, the Nusselt number, the Stanton number, and the Chilton - Colburn  $J_H$ . How can each of these be decorated to indicate the type of temperature - difference driving force that is being used? [3]

b) Develop the expression for macroscopic energy balances and write the assumptions for developing the expression. [7]

**Q7) a)** Derive the expression for the mass flux for diffusion with a homogeneous chemical reaction. [7]

b) How the Maxwell - Stefan equations for multi-component diffusion in gases related to the Fick equation for binary system? [3]

**Q8)** Develop expressions for mole fraction profile  $x_A(y)$  and the temperature profile  $T(y)$  for the system shown in figure, given mole fractions and temperatures at both film boundaries ( $y=0$  and  $y=\delta$ ). A hot condensable vapor A is diffusing at steady state through a stagnant film of non-condensable gas B, to a cold surface at  $y=0$ , where A condenses. Assume ideal gas behavior, uniform pressure, physical properties to constant. Neglect radiative heat transfer. [10]



Equation of continuity

*Cartesian coordinates (x, y, z):*

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x} (\rho v_x) + \frac{\partial}{\partial y} (\rho v_y) + \frac{\partial}{\partial z} (\rho v_z) = 0$$

*Cylindrical coordinates (r,  $\theta$ , z):*

$$\frac{\partial \rho}{\partial t} + \frac{1}{r} \frac{\partial}{\partial r} (\rho r v_r) + \frac{1}{r} \frac{\partial}{\partial \theta} (\rho v_\theta) + \frac{\partial}{\partial z} (\rho v_z) = 0$$

*Spherical coordinates (r,  $\theta$ ,  $\phi$ ):*

$$\frac{\partial \rho}{\partial t} + \frac{1}{r^2} \frac{\partial}{\partial r} (\rho r^2 v_r) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (\rho v_\theta \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \phi} (\rho v_\phi) = 0$$

Equation of motion

*Cartesian coordinates (x, y, z)*

$$\rho \left( \frac{\partial v_x}{\partial t} + v_x \frac{\partial v_x}{\partial x} + v_y \frac{\partial v_x}{\partial y} + v_z \frac{\partial v_x}{\partial z} \right) = -\frac{\partial p}{\partial x} - \left[ \frac{\partial}{\partial x} \tau_{xx} + \frac{\partial}{\partial y} \tau_{yx} + \frac{\partial}{\partial z} \tau_{zx} \right] + \rho g_x$$

$$\rho \left( \frac{\partial v_y}{\partial t} + v_x \frac{\partial v_y}{\partial x} + v_y \frac{\partial v_y}{\partial y} + v_z \frac{\partial v_y}{\partial z} \right) = -\frac{\partial p}{\partial y} - \left[ \frac{\partial}{\partial x} \tau_{xy} + \frac{\partial}{\partial y} \tau_{yy} + \frac{\partial}{\partial z} \tau_{zy} \right] + \rho g_y$$

$$\rho \left( \frac{\partial v_z}{\partial t} + v_x \frac{\partial v_z}{\partial x} + v_y \frac{\partial v_z}{\partial y} + v_z \frac{\partial v_z}{\partial z} \right) = -\frac{\partial p}{\partial z} - \left[ \frac{\partial}{\partial x} \tau_{xz} + \frac{\partial}{\partial y} \tau_{yz} + \frac{\partial}{\partial z} \tau_{zz} \right] + \rho g_z$$

*Cylindrical coordinates (r,  $\theta$ , z)*

$$\rho \left( \frac{\partial v_r}{\partial t} + v_r \frac{\partial v_r}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_r}{\partial \theta} + v_z \frac{\partial v_r}{\partial z} - \frac{v_\theta^2}{r} \right) = -\frac{\partial p}{\partial r} - \left[ \frac{1}{r} \frac{\partial}{\partial r} (r \tau_{rr}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta r} + \frac{\partial}{\partial z} \tau_{rz} - \frac{\tau_{\theta\theta}}{r} \right] + \rho g_r$$

$$\rho \left( \frac{\partial v_\theta}{\partial t} + v_r \frac{\partial v_\theta}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_\theta}{\partial \theta} + v_z \frac{\partial v_\theta}{\partial z} + \frac{v_r v_\theta}{r} \right) = -\frac{1}{r} \frac{\partial p}{\partial \theta} - \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \tau_{r\theta}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta\theta} + \frac{\partial}{\partial z} \tau_{z\theta} + \frac{\tau_{r\theta} - \tau_{\theta r}}{r} \right] + \rho g_\theta$$

$$\rho \left( \frac{\partial v_z}{\partial t} + v_r \frac{\partial v_z}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_z}{\partial \theta} + v_z \frac{\partial v_z}{\partial z} \right) = -\frac{\partial p}{\partial z} - \left[ \frac{1}{r} \frac{\partial}{\partial r} (r \tau_{rz}) + \frac{1}{r} \frac{\partial}{\partial \theta} \tau_{\theta z} + \frac{\partial}{\partial z} \tau_{zz} \right] + \rho g_z$$

*Spherical coordinates (r,  $\theta$ ,  $\phi$ )*

$$\rho \left( \frac{\partial v_r}{\partial t} + v_r \frac{\partial v_r}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_r}{\partial \theta} + \frac{v_\phi}{r \sin \theta} \frac{\partial v_r}{\partial \phi} - \frac{v_\theta^2 + v_\phi^2}{r} \right) = -\frac{\partial p}{\partial r} - \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \tau_{rr}) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (\tau_{r\theta} \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \phi} \tau_{r\phi} - \frac{\tau_{\theta\theta} + \tau_{\phi\phi}}{r} \right] + \rho g_r$$

$$\rho \left( \frac{\partial v_\theta}{\partial t} + v_r \frac{\partial v_\theta}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_\theta}{\partial \theta} + \frac{v_\phi}{r \sin \theta} \frac{\partial v_\theta}{\partial \phi} + \frac{v_r v_\theta - v_\phi^2 \cot \theta}{r} \right) = -\frac{1}{r} \frac{\partial p}{\partial \theta} - \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \tau_{r\theta}) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (\tau_{\theta\theta} \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \phi} \tau_{\theta\phi} + \frac{(\tau_{r\theta} - \tau_{r\theta}) - \tau_{\phi\phi} \cot \theta}{r} \right] + \rho g_\theta$$

$$\rho \left( \frac{\partial v_\phi}{\partial t} + v_r \frac{\partial v_\phi}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_\phi}{\partial \theta} + \frac{v_\phi}{r \sin \theta} \frac{\partial v_\phi}{\partial \phi} + \frac{v_r v_\phi + v_\theta v_\phi \cot \theta}{r} \right) = -\frac{1}{r \sin \theta} \frac{\partial p}{\partial \phi} - \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \tau_{r\phi}) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (\tau_{\theta\phi} \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \phi} \tau_{\phi\phi} + \frac{(\tau_{r\phi} - \tau_{r\phi}) + \tau_{\theta\phi} \cot \theta}{r} \right] + \rho g_\phi$$

Equation of energy for pure Newtonian fluids with constant  $p$  and  $k$

Cartesian coordinates  $(x, y, z)$

$$\rho \hat{C}_v \left( \frac{\partial T}{\partial t} + v_x \frac{\partial T}{\partial x} + v_y \frac{\partial T}{\partial y} + v_z \frac{\partial T}{\partial z} \right) = k \left[ \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \right] + \mu \Phi_v$$

Cylindrical coordinates  $(r, \theta, z)$

$$\rho \hat{C}_v \left( \frac{\partial T}{\partial t} + v_r \frac{\partial T}{\partial r} + \frac{v_\theta}{r} \frac{\partial T}{\partial \theta} + v_z \frac{\partial T}{\partial z} \right) = k \left[ \frac{1}{r} \frac{\partial}{\partial r} \left( r \frac{\partial T}{\partial r} \right) + \frac{1}{r^2} \frac{\partial^2 T}{\partial \theta^2} + \frac{\partial^2 T}{\partial z^2} \right] + \mu \Phi_v$$

Spherical coordinates  $(r, \theta, \phi)$

$$\rho \hat{C}_v \left( \frac{\partial T}{\partial t} + v_r \frac{\partial T}{\partial r} + \frac{v_\theta}{r} \frac{\partial T}{\partial \theta} + \frac{v_\phi}{r \sin \theta} \frac{\partial T}{\partial \phi} \right) = k \left[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial T}{\partial r} \right) + \frac{1}{r^2 \sin \theta} \frac{\partial}{\partial \theta} \left( \sin \theta \frac{\partial T}{\partial \theta} \right) + \frac{1}{r^2 \sin^2 \theta} \frac{\partial^2 T}{\partial \phi^2} \right] + \mu \Phi_v$$

Dissipation function  $\Phi_v$  for Newtonian fluids

Cartesian coordinates  $(x, y, z)$

$$\Phi_v = 2 \left[ \left( \frac{\partial v_x}{\partial x} \right)^2 + \left( \frac{\partial v_y}{\partial y} \right)^2 + \left( \frac{\partial v_z}{\partial z} \right)^2 \right] + \left[ \frac{\partial v_y}{\partial x} + \frac{\partial v_x}{\partial y} \right]^2 + \left[ \frac{\partial v_z}{\partial y} + \frac{\partial v_y}{\partial z} \right]^2 + \left[ \frac{\partial v_x}{\partial z} + \frac{\partial v_z}{\partial x} \right]^2 - \frac{2}{3} \left[ \frac{\partial v_x}{\partial x} + \frac{\partial v_y}{\partial y} + \frac{\partial v_z}{\partial z} \right]^2$$

Cylindrical coordinates  $(r, \theta, z)$

$$\Phi_v = 2 \left[ \left( \frac{\partial v_r}{\partial r} \right)^2 + \left( \frac{1}{r} \frac{\partial v_\theta}{\partial \theta} + \frac{v_r}{r} \right)^2 + \left( \frac{\partial v_r}{\partial z} \right)^2 \right] + \left[ r \frac{\partial}{\partial r} \left( \frac{v_\theta}{r} \right) + \frac{1}{r} \frac{\partial v_r}{\partial \theta} \right]^2 + \left[ \frac{1}{r} \frac{\partial v_z}{\partial \theta} + \frac{\partial v_\theta}{\partial z} \right]^2 + \left[ \frac{\partial v_r}{\partial z} + \frac{\partial v_z}{\partial r} \right]^2 - \frac{2}{3} \left[ \frac{1}{r} \frac{\partial}{\partial r} (rv_r) + \frac{1}{r} \frac{\partial v_\theta}{\partial \theta} + \frac{\partial v_z}{\partial z} \right]^2$$

Spherical coordinates  $(r, \theta, \phi)$

$$\Phi_r = 2 \left[ \left( \frac{\partial v_r}{\partial r} \right)^2 + \left( \frac{1}{r} \frac{\partial v_\theta}{\partial \theta} + \frac{v_r}{r} \right)^2 + \left( \frac{1}{r \sin \theta} \frac{\partial v_\phi}{\partial \phi} + \frac{v_r + v_\theta \cot \theta}{r} \right)^2 \right] \\ + \left[ r \frac{\partial}{\partial r} \left( \frac{v_\theta}{r} \right) + \frac{1}{r} \frac{\partial v_r}{\partial \theta} \right]^2 + \left[ \frac{\sin \theta}{r} \frac{\partial}{\partial \theta} \left( \frac{v_\phi}{\sin \theta} \right) + \frac{1}{r \sin \theta} \frac{\partial v_r}{\partial \phi} \right]^2 + \left[ \frac{1}{r \sin \theta} \frac{\partial v_r}{\partial \phi} + r \frac{\partial}{\partial r} \left( \frac{v_\phi}{r} \right) \right]^2 \\ - \frac{2}{3} \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 v_r) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (v_\theta \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial v_\phi}{\partial \phi} \right]^2$$

*Equation of Continuity for Species A in terms A of ja*

*Cartesian coordinates (x, y, z)*

$$\rho \left( \frac{\partial \omega_a}{\partial t} + v_x \frac{\partial \omega_a}{\partial x} + v_y \frac{\partial \omega_a}{\partial y} + v_z \frac{\partial \omega_a}{\partial z} \right) = - \left[ \frac{\partial j_{ax}}{\partial x} + \frac{\partial j_{ay}}{\partial y} + \frac{\partial j_{az}}{\partial z} \right] + r_a$$

*Cylindrical coordinates (r, \theta, z)*

$$\rho \left( \frac{\partial \omega_a}{\partial t} + v_r \frac{\partial \omega_a}{\partial r} + \frac{v_\theta}{r} \frac{\partial \omega_a}{\partial \theta} + v_z \frac{\partial \omega_a}{\partial z} \right) = - \left[ \frac{1}{r} \frac{\partial}{\partial r} (r j_{ar}) + \frac{1}{r} \frac{\partial j_{a\theta}}{\partial \theta} + \frac{\partial j_{az}}{\partial z} \right] + r_a$$

*Spherical coordinates (r, \theta, \phi)*

$$\rho \left( \frac{\partial \omega_a}{\partial t} + v_r \frac{\partial \omega_a}{\partial r} + \frac{v_\theta}{r} \frac{\partial \omega_a}{\partial \theta} + \frac{v_\phi}{r \sin \theta} \frac{\partial \omega_a}{\partial \phi} \right) = \left[ \frac{1}{r^2} \frac{\partial}{\partial r} (r^2 j_{ar}) + \frac{1}{r \sin \theta} \frac{\partial}{\partial \theta} (j_{a\theta} \sin \theta) + \frac{1}{r \sin \theta} \frac{\partial j_{a\phi}}{\partial \phi} \right] + r_a$$



Total No. of Questions : 8]

SEAT No. :

P4409

[Total No. of Pages : 2

[4760]-1212

M.E. (Chemical Engineering)

ADVANCED PROCESS CONTROL

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Assume suitable data wherever necessary.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Use of Scientific Calculator is allowed.*
- 5) *Figures to the right indicate full marks.*

- Q1)** a) Enlist the steps involved in process identification and explain each of them. [5]
- b) Enlist and explain various forms of models. [3]
- c) Differentiate between process modelling and theoretical modelling. [2]
- Q2)** a) What are three classes of processes with difficult dynamics .Enlist and Explain each. [5]
- b) In physical terms how can the presence of time delay cause problems in conventional feedback control. [3]
- c) Define cascade control system. [2]
- Q3)** a) What is a smith predictor and how it is used for controlling time delay systems? [5]
- b) What is a main problem created by an inverse response system under conventional feedback control? [3]
- c) Define feedforward control system. [2]

*P.T.O.*

- Q4)** a) What is Neiderlinski index and how it is used for loop pairing ? [5]  
 b) Why is a single element of RGA sufficient to determine the entire array for  $2 \times 2$  system? [3]  
 c) What are some important properties of RGA? [2]
- Q5)** a) Describe digital control system with the help of block diagrams. [5]  
 b) Compare digital control with analogue control. [3]  
 c) What is the role of hold devices in digital control? [2]
- Q6)** a) Find the z-transformations of following functions [5]  
 i)  $f(t) = 1$   
 ii)  $f(t) = e^{-at}$   
 iii)  $f(t) = \sin(\omega t)$   
 iv)  $f(t) = t$   
 v)  $f(t) = \cos(\omega t)$   
 b) What is stability test for digital control systems? [3]  
 c) Write short notes on D/A and A/D converters. [2]
- Q7)** a) What are basic elements of model predictive control? [5]  
 b) Explain Internal Model Control (IMC) strategy with the help of block diagram. [3]  
 c) Enlist the applications of model predictive control. [2]
- Q8)** a) Explain the heuristic rules involved in the design of Plant Wide Control. [5]  
 b) What is top-down approach in the design of Plant wide control? Explain in brief. [3]  
 c) Explain various objectives of plant-wide control. [2]



Total No. of Questions : 8]

SEAT No. :

**P4410**

[4760] - 1213

[Total No. of Pages :2

**M.E. (Chemical)**

**ADVANCED REACTION ENGINEERING**

**(2013 Credit Pattern) (Theory) (509109) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer total 5 questions from following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain surface reaction step in solid catalyzed reactions. [5]  
b) Write a note on heterogeneous reactions. [3]  
c) Give the steps occurring in succession during reaction for unreacted core model for spherical particles of unchanging size. [2]
- Q2)** a) On doubling the particle size from R to 2R, the time for complete conversion triples. What is the contribution of ash diffusion to the overall resistance for particles of size of R and 2R? [5]  
b) Derive a model of spherical particle of unchanged size when ash diffusion is controlling resistance. [3]  
c) What are the types of contacting in gas-solid operations? [2]
- Q3)** A first order liquid phase reaction is carried out in a reactor for which the results of pulse tracer test are given below.
- |         |   |   |   |   |    |   |   |   |   |     |     |     |    |
|---------|---|---|---|---|----|---|---|---|---|-----|-----|-----|----|
| t, s    | 0 | 1 | 2 | 3 | 4  | 5 | 6 | 7 | 8 | 9   | 10  | 12  | 14 |
| C, mg/l | 0 | 1 | 5 | 8 | 10 | 8 | 6 | 4 | 3 | 2.2 | 1.5 | 0.6 | 0  |
- a) Calculate  $X_A$  assuming ideal plug flow reactor. [5]  
b) Calculate  $X_A$  assuming ideal mixed flow. [3]  
c) Calculate  $X_A$  assuming the tanks - in series model. [2]

*P.T.O.*

- Q4)** a) Evaluate E as a function of time upto  $t=180$  s for the vessel using the tanks - in - series model. Given:  $C_{in}$  with  $\bar{t} = 220$  s and  $\sigma^2 = 100$  s<sup>2</sup>  
 $C_{out}$  with  $\bar{t} = 280$  s and  $\sigma^2 = 1000$  s<sup>2</sup>. [5]  
 b) Derive Tank-In-Series model. [3]  
 c) Give the significance of dispersion coefficient, D in axial dispersion. [2]

- Q5)** The following kinetic data are obtained in an experimental packed bed reactor using various amounts of catalyst and feed rate  $F_{A0} = 10$  kmol/hr.



|                |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|
| W, kg catalyst | 1    | 2    | 3    | 4    | 5    | 6    | 7    |
| $X_A$          | 0.12 | 0.20 | 0.27 | 0.33 | 0.37 | 0.41 | 0.44 |

- a) Find the reaction rate at 40% conversion. [5]  
 b) In designing a large packed bed reactor with feed rate  $F_{A0} = 400$  kmol/hr, how much catalyst would be needed for 40% conversion? [3]  
 c) How much catalyst would be needed if the reactor employed a very large recycle of the product stream? [2]
- Q6)** a) Explain mass and heat transfer coefficients in packed beds. [4]  
 b) Write the steps of modeling diffusion with reaction. [3]  
 c) Write a note on External diffusion. [3]
- Q7)** a) Explain the importance of Effectiveness factor. [4]  
 b) Write a note on Thiele Modulus. [3]  
 c) Explain internal diffusion in porous catalyst. [3]
- Q8)** a) Explain design of Isothermal Adiabatic reactor? [5]  
 b) Write the merits and demerits of fluidized and packed bed reactors? [3]  
 c) List the various types of catalytic reactors with neat sketch. [2]



Total No. of Questions : 8]

SEAT No. :

P4227

[Total No. of Pages : 2

[4760] - 1214

M. E. (Chemical)

PROCESS MODELING & SIMULATION

(2013 Pattern)

Time :3 Hours]

[Max. Marks :50

*Instructions to the candidates:*

- 1) *Answer any five questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) What is model? [4]  
b) Why develop a process model. [3]  
c) How to determine form of model? [3]
- Q2)** a) What are the phases involved in model building? [4]  
b) What is lumped parameter? Explain. [3]  
c) What is distributed parameter ? Explain. [3]
- Q3)** a) Explain the modeling of single effect evaporater. [4]  
b) Write the assumption involved in it. [3]  
c) Give the simulation steps in it. [3]
- Q4)** a) What is regression Analysis? [4]  
b) What is design of experiment? [3]  
c) Explain factorial design. [3]

**P.T.O.**

- Q5)** a) What is process optimization? [4]  
b) Write the types of optimization. [3]  
c) Explain constrained optimization. [3]
- Q6)** a) Explain distillation process in detail. [4]  
b) Discuss the assumption involved in modeling of binary distillation. [3]  
c) Develop a model for it. [3]
- Q7)** a) What is process simulation? Explain approaches for simulation. [5]  
b) Explain each approach with example. [5]
- Q8)** Write notes on.
- a) Limitations of mathematical models. [5]  
b) Open source softwares for simulation. [5]



Total No. of Questions : 8]

SEAT No. :

**P4228**

**[4760] - 1215**

[Total No. of Pages :2

**M.E. (Chemical Engineering)**  
**ADVANCED THERMODYNAMICS**  
**(2013 Credit Pattern) (Semester - III) (509114)**

*Time : 3 Hours]*

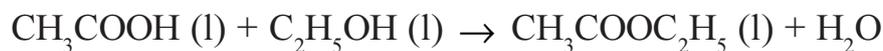
*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain liquid-liquid equilibrium with respect to upper and lower consolute temperatures. **[3]**
- b) What are the Wilson equations? **[2]**
- c) For a multicomponent mixture derive the two suffix van Laar Equation for the activity coefficient form excess functions. **[5]**

- Q2)** a) Explain equilibrium criteria in reacting systems. **[3]**
- b) Derive an equation for finding mole fractions of components in reacting systems. **[2]**
- c) Acetic acid is esterified in the liquid phase with ethanol at 100°C and atmospheric pressure to produce ethyl acetate and water. The reaction: **[5]**



$$\Delta H_{f,298}^\circ \text{CH}_3\text{COOH} = -484,500 \text{ J}; \Delta G_{f,298}^\circ \text{CH}_3\text{COOH} = -389,900$$

$$\Delta H_{f,298}^\circ \text{C}_2\text{H}_5\text{OH} = -277,690 \text{ J}; \Delta G_{f,298}^\circ \text{C}_2\text{H}_5\text{OH} = -174,780 \text{ J}$$

$$\Delta H_{f,298}^\circ \text{H}_2\text{O} = -285,830; \Delta G_{f,298}^\circ \text{H}_2\text{O} = -237,129$$

$$\Delta H_{f,298}^\circ \text{CH}_3\text{COOC}_2\text{H}_5 = -463,250\text{J}; \Delta G_{f,298}^\circ \text{CH}_3\text{COOC}_2\text{H}_5 = -318,280\text{J}$$

If initially there is one mole each of acetic acid and ethanol, estimate the mole fraction of all the components in the reacting mixture at equilibrium.

**P.T.O.**

- Q3)** a) Briefly describe rotational energy. [3]  
b) Develop the expression for thermodynamic probability. [3]  
c) 10 molecules of gas are present in a container maintained at 298K. What is probability that all ten molecules will be found simultaneously in one half of the container? [4]
- Q4)** a) Write short note on strong and weak electrolytes and explain degree of dissociation. [5]  
b) How is the activity in an electrolyte measured from Isopiestic method?[5]
- Q5)** a) Write short note on the first and second order transitions with neat sketches of phase diagrams. [5]  
b) Write a note on disorder in a system. [5]
- Q6)** a) Does the curvature of a surface have an effect on thermodynamic properties? Explain with an example. [5]  
b) Explain the effect of gravitational field on thermodynamic properties.[5]
- Q7)** a) Explain the phenomena of uncompensated heat in irreversible thermodynamics. [5]  
b) Derive the expression for first law of thermodynamics for open system assuming system behaves irreversible. [5]
- Q8)** a) Explain the thermodynamics of biological systems. [8]  
b) What are exergonic and endergonic systems? [2]



Total No. of Questions : 8]

SEAT No. :

**P4229**

[Total No. of Pages : 2

[4760] - 1216

**M.E. (Environmental Engg.) (Semester - I)**  
**APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1)** a) Discuss Spearman's Rank correlation coefficient. [4]  
b) State the difference between mean deviation and standard deviation. [3]  
c) Explain residual error in regression model. [3]

- Q2)** a) The mean weight loss of  $n = 16$  grinding balls after a certain length of time in mill slurry is 3.42 grams with a standard deviation of 0.68 grams. Construct a 99% confidence interval for the true mean weight loss of such grinding balls under the standard conditions. [4]  
b) Explain convexity of the frequency curve related to kurtosis. [3]  
c) Discuss relation between moments about mean in terms of moments about any point. [3]

- Q3)** a) Explain in detail correlation and autocorrelation with suitable examples and its plot. [4]  
b) Find the covariance of the two random variables whose joint density is given by [3]

$$f(x, y) = \begin{cases} 2 & \text{for } x > 0, y > 0, x + y < 1 \\ 0 & \text{elsewhere} \end{cases}$$

- c) Distinguish between statistic and parameter. [3]

**P.T.O.**

**Q4)** a) Five hundred ball bearings have a mean weight of 5.02 OZ and a standard deviation of 0.30 OZ. Find the probability that a random sample of 100 ball bearings chosen from this group will have a combined weight

i) Between 496 and 500 OZ

ii) More than 510 OZ

For the sampling distribution of means  $\mu_x = \mu = 50.2$  OZ. [4]

b) Explain the method of moment generating function for the CHI - square distribution. [3]

c) Explain tests of significance for attributes. [3]

**Q5)** a) State and explain the assumptions in the analysis of variance. [4]

b) What is the analysis of variance in two way classification model. [3]

c) Establish relation between t and F distribution. [3]

**Q6)** a) What is transportation model. [4]

b) Explain the stepping stone method. [3]

c) What is optimality test. [3]

**Q7)** a) Write note on least cost rule. [5]

b) Explain Northwest corner rule. [5]

**Q8)** a) What are unbound solutions in a simplex method. [5]

b) Explain randomized block design model. [5]



Total No. of Questions : 8]

SEAT No. :

**P4230**

[Total No. of Pages : 2

[4760] - 1217

**M.E. (Chemical) (Environmental Engineering)  
ENVIRONMENTAL MANAGEMENT  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic tables, tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

- Q1)** a) Discuss national and international standards for environmental management related to industries and environmental policies. [4]  
b) Discuss various environmental management tools in detail. [3]  
c) What are different factors affecting Anthro-po-centric and Eco-centric approaches to development. [3]
- Q2)** a) Explain environmental policy instruments. [4]  
b) Discuss preliminary stages of EIA. [3]  
c) Discuss trade and environmental management. [3]
- Q3)** a) Explain environmental auditing objectives and scope. [4]  
b) Explain evolution of life cycle assessment. [3]  
c) Explain the concept and objectives of green building. [3]
- Q4)** a) Discuss the role of the parliamentary committees, when a bill is issued in parliament to become an Act. [4]  
b) Explain command and control regulations. [3]  
c) How a rule is notified or Gazetted. [3]

**P.T.O**

- Q5)** a) Discuss safety related rules. [4]  
b) Explain a general procedure for risk assessment. [3]  
c) Discuss various environmental taxes. [3]
- Q6)** a) How the rule is notified. [4]  
b) Write short note on factory Act. [3]  
c) What are the negative environmental externalities related to Agriculture. [3]
- Q7)** a) How the central pollution control board functions for sustainable growth. [5]  
b) Explain Kyoto protocol. [5]
- Q8)** a) Explain the major role played by ministry of environment and forests in conservation of environment. [5]  
b) What are the salient features of the annual report of environment and forests for the current year. [5]



Total No. of Questions : 8]

SEAT No. :

**P4231**

**[4760] - 1218**

[Total No. of Pages :2

**M.E. (Environmental Engineering) (Chemical)**  
**ENVIRONMENTAL CHEMISTRY**  
**(2013 Credit Pattern) (Semester -I) (509133)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions out of eight.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume Suitable data, if necessary.*

**Q1) a)** Explain about stoichiometry and mass balance. **[4]**

b) Explain environmental significance of colloids. **[3]**

c) Explain CO<sub>2</sub> capture. **[3]**

**Q2) a)** What are the environmental significance of water quality parameters?**[4]**

b) Discuss about photo chemical smog. **[3]**

c) Explain the method to determine pH. **[3]**

**Q3) a)** Explain ozone layer depletion. **[4]**

b) What is Global warming? **[3]**

c) Briefly explain -Acid Rain. **[3]**

**Q4) a)** Explain the effects of air pollutants on health. **[4]**

b) Discuss health effects due to particulate matter. **[3]**

c) Name the Green House Gases. **[3]**

**P.T.O.**

- Q5)** a) How to determine the cation exchange capacity? [4]  
b) What is the composition of clays. [3]  
c) Discuss about reclamation of contaminated land. [3]
- Q6)** a) How to do the sorption of fe ions? [4]  
b) Explain about redox zone. [3]  
c) What is hydrolysis? [3]
- Q7)** a) Explain nanomaterial. [5]  
b) Explain the principles of Green chemistry. [5]
- Q8)** a) What are composites? [5]  
b) How to form the nano composites? Explain. [5]



Total No. of Questions : 8]

SEAT No. :

**P4232**

**[4760] - 1219**

[Total No. of Pages :2

**M.E. (Environmental Engineering) (Chemical Engg.)**

**RESEARCH METHODOLOGY (BOS)**

**(509134) (Semester - I) (2013 Credit Pattern)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Any Five questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Illustrate your answers with suitable examples and diagrams, wherever necessary.*
- 4) *Write relevant question number before writing the answer.*

- Q1)** a) "Research is nothing but proper fact finding method". Do you agree or disagree with this statement? Give suitable reasoning and examples to support your answer. **[5]**
- b) Discuss the criteria of a good research problem. Examine the sources of research problem. Elaborate with suitable example(s). **[5]**
- Q2)** a) Which are the various steps to be followed in process of engineering research work? Which step you feel most important from engineer's point of view out of all steps. **[5]**
- b) What do you understand about Research Methodology? Discuss in brief its significance. **[5]**
- Q3)** a) What do you mean by a 'case study'? Explain the steps involved in designing a case study to solve a research problem. **[5]**
- b) Why Literature survey in research is very important? How it is conducted? Write names of 5 top referred journals in your field which are used for literature survey. **[5]**
- Q4)** a) Choose any one research problem from Environmental Engineering that is in the news, now-a-days, to conduct research. To find why this problem arises and what could be its effects on a society, prepare a research plan. **[5]**
- b) Why multi-disciplinary and inter-disciplinary approach in research is needed? Elaborate your answer by giving suitable example from environmental engineering field. **[5]**

**P.T.O.**

- Q5)** a) Discuss the types, characteristics and function of hypothesis in research. [5]
- b) Discuss various problems that are usually faced by such researchers in India while doing research. [5]
- Q6)** a) Explain the significance of a research report and narrate the various steps involved in writing such reports. [5]
- b) Write a brief note on: “Intellectual Property Rights (IPR)”. [5]
- Q7)** a) “Data interpretation in fundamental component in research process”. Justify this statement by giving suitable reasoning and examples to support your answer. [5]
- b) What are the requirements of a good research report? Explain in brief, the structure of research report. [5]
- Q8)** a) Write notes on: (**Any Two**) [5]
- i) Sampling Design and Techniques.
- ii) Threats and challenges to good research.
- iii) Ethical responsibilities of Researcher.
- iv) Sample outline of any research paper.
- b) Describe some of the major projective techniques and evaluate their significance as tools of scientific research. [5]



Total No. of Questions : 10]

SEAT No. :

**P4312**

[Total No. of Pages : 3

**[4760] - 122**

**M.E. (Mechanical) (Design Engineering)**

**PROCESS EQUIPMENT DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Attempt any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Electronic pocket Calculator is allowed.*
- 6) *Assume Suitable data, if necessary and mention it clearly.*

**SECTION - I**

- Q1)** a) Explain with neat sketch floating roof types of storage tank. [8]  
b) Explain design considerations used during designing of process equipment. [5]  
c) Explain the factors that improves the weld joints efficiency. [5]
- Q2)** a) Explain golden section method of optimization. [8]  
b) Explain in brief design codes [8]  
i) IS-2825  
ii) ASME-SECT  
iii) EIGHT-DIV-II TEMA  
iv) BS-1500 & 1515

***P.T.O.***

- Q3)** a) What type of stresses are induced in the column shell? How will you account for them in the design of shell. [6]
- b) An air receiver consisting of an cylinder closed by hemispherical ends, the internal diameter ( $D_i$ ) and length of the cylinder is equal to two times of  $D_i$ . It has a storage capacity of  $0.25 \text{ m}^3$  and operating internal pressure of  $5 \text{ MPa}$ . It is made of plain carbon steel 10C4 ( $S_{ut} = 340 \text{ N/mm}^2$ ) and factor of Safety is 4. Neglect the effect of weld joint, determine the dimensions of the receivers. [10]
- Q4)** a) Explain criteria used during design of supports for process vessels. [6]
- b) Determine the wall thickness and the head thickness required for a 500mm fusion welded steel drum that is to contain ammonia at  $6 \text{ N/mm}^2$  pressure. The radius of curvature of the head is to be 450mm. [10]
- Q5)** a) Explain in detail design of standard and non standard flanges. [8]
- b) Explain design of Thick walled high pressure vessels. [8]

### SECTION - II

- Q6)** a) Explain in brief different theories of failure applied to thick walled high pressure vessels. [10]
- b) Differentiate between storage vessels and reaction vessels. [4]
- c) Need of filters and driers in process equipment design. [4]
- Q7)** a) Explain with suitable example selection and specification procedure used in design of process equipments. [10]
- b) Explain in brief with neat symbols of values used in pipe lines. [6]
- Q8)** a) Explain the purpose of agitator, mixture, centrifuges and heat exchangers used in proces equipments. [8]
- b) Explain the factors to be considered during selection of pumps & compressors. [8]

**Q9) a)** What are the distillation columns? Explain following terms related to it. **[10]**

i) Bottom product

ii) Reboiler

iii) Stripping

b) Explain the procedure to design saddle support. **[6]**

**Q10)a)** Write short notes on flow diagrams & pipe work symbols. **[6]**

b) Role of computer Aided Design in process equipment design. **[5]**

c) Explain the process of inspecting process equipments. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4233

[Total No. of Pages : 3

[4760] - 1220

M.E. (Chemical) (Environmental Engineering)

WASTE WATER TREATMENT & DESIGN

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain various types of reactions. [4]  
b) What are mass transport processes. [3]  
c) Distinguish between ideal and nonideal reactors. [3]
- Q2)** a) State and explain the design considerations of clarifiers. [4]  
b) Explain back wash hydraulics. [3]  
c) What are rapid sand and dual media filters. [3]
- Q3)** a) Explain PSA in the process of adsorption. [4]  
b) What are the factors which are influencing adsorption. [3]  
c) Explain the design of GAC contactors. [3]
- Q4)** a) A secondary clarifier is to be designed to produce an under flow concentration of 30,000 mg/lit. from an effluent with mixed liquor solids content of 4500 mg/lit. The wastewater flow rate is 0.06 m<sup>3</sup>/s. Calculate the required clarifier area. [4]

**P.T.O.**

The following data are obtained from a settling test in 100 cm. cylinder

|                       |     |      |    |    |    |    |    |    |    |    |    |
|-----------------------|-----|------|----|----|----|----|----|----|----|----|----|
| Time                  | 0   | 2    | 4  | 6  | 8  | 10 | 14 | 18 | 22 | 26 | 30 |
| Interface Height (cm) | 100 | 87.5 | 75 | 63 | 53 | 46 | 36 | 29 | 25 | 23 | 20 |

- b) What are the characteristics for ion exchange materials. [3]
- c) Explain estimation of UV dose. [3]

**Q5) a)** Design a 30 ft deep tower trickling filter using a plastic packing to treat waste water from a rural community in which a small vegetable cannery is located. Assume that the following information data, derived from local records and pilot tests. Assuming that a rotary distributor will be used. [4]

- i) Average year-round domestic wastewater flow rate = 2.5 mgal/d (9460m<sup>3</sup>/d).
- ii) Sustained peak seasonal cannery flow rate = 1.25 mgal/d (4730 m<sup>3</sup>/d).
- iii) The canning season is may through october.
- iv) Average year-round domestic BOD<sub>5</sub> = 220 mg/L.
- v) Sustained peak combined domestic and cannery BOD<sub>5</sub> = 550 mg/L.
- vi) Effluent BOD<sub>5</sub> requirement = 30 mg/L.
- vii) Critical wastewater temperature data May and October = 20°C, for January = 10°C.
- viii) Treatability constant = 0.10

- b) Explain operational characteristics of activated sludge process. [3]
- c) Discuss pure oxygen dissolution systems used in biology processes.[3]

**Q6) a)** Discuss process design consideration for Rotating Biological Contactors. (RBC). [4]

- b) What is activated biofilter process. [3]
- c) Explain trickling filter solid-contact process. [3]

**Q7)** Write short note on :

- a) UV disinfection [5]
- b) Coagulation processes. [5]

**Q8)** a) Explain fundamental aspects of anaerobic treatment. [5]

- b) What are different types of anaerobic reactors. [5]



Total No. of Questions : 8]

SEAT No. :

P4234

[Total No. of Pages : 3

[4760] - 1221

**M.E. (Chemical) (Environmental)**  
**SOLID WASTE MANAGEMENT**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Estimate the moisture content of a solid waste sample with following compositions. **[4]**

| Component        | % by mass | % moisture content |
|------------------|-----------|--------------------|
| Food waste       | 15        | 70                 |
| Paper            | 45        | 6                  |
| Cardboard        | 10        | 5                  |
| Plastics         | 10        | 2                  |
| Garden trimmings | 10        | 60                 |
| Wood             | 5         | 20                 |
| Tin cans         | 5         | 3                  |

- b) How to calculate the density of a solid waste sample. Explain the formula. **[3]**
- c) Explain how to determine energy content on a dry basis of solid waste sample. **[3]**

**Q2) a)** Solid waste from a new industrial park is to be collected in a large containers, some of which will be used in conjunction with stationary compactors based on the traffic studies at similar parks it is estimated that the average time to drive from garage to the first container and from the last container to the garage each day will be 15 & 20 min. respectively. If the average time required to drive between container is 6 min and the one way distance to the disposal site is 25 km (speed limit 88 km/h), determine the number of containers that can be emptied per day, based on 8 hr workday. **[4]**

**P.T.O.**

- b) Explain the layout collection route for the residential area for a town.[3]
- c) If you were asked to determine the solid waste generation rates for four community, how would you assess the seasonal effects if the only data available had been collected during the month of december? [3]

**Q3) a)** Determine the amount of air required to oxidize completely 1 tonne of waste having chemical equation

$C_{50}H_{100}O_{40}N$  The required coefficients are  $a = 50, b = 100, c = 40, d = 1$ . [4]

- b) Estimate the theoretical volume of methane gas that would be expected from the anaerobic digestion of a tonne of waste having composition  $C_{50}H_{100}O_{40}N$ . [3]
- c) Discuss the fundamental laws on which all combustion calculations are based. [3]

**Q4) a)** Determine the heat available in the exhaust gases from the combustion of 100 tonnes/d of solid waste with an energy content of 10,500 kJ/kg and the following composition. Assume the incinerator residue contains 5% carbon and the temperatures of the entering air and residue from the grate are 25 and 425°C respectively. [4]

| Element  | % by mass |
|----------|-----------|
| carbon   | 28        |
| Hydrogen | 5         |
| Oxygen   | 22        |
| Nitrogen | 4         |
| Sulfur   | 1         |
| Water    | 20        |
| Inerts   | 20        |

- b) Explain mass fired incinerators with figure. [3]
- c) Explain the use of RDF. [3]

**Q5) a)** What is meant by proximate analysis and ultimate analysis of solid waste? [4]

- b) Define motion time measurement [3]
- c) What are the factors to be considered deciding collection frequency in SWM system? [3]

- Q6)** a) If the overall efficiency of energy conversion process is 12.6%, estimate the original energy content of the solid waste using the following information. [4]
- i) Energy loss = 25%
  - ii) Process fuel uses = 8%
  - iii) Gas turbine efficiency = 24%
  - iv) Electrical Generator efficiency = 96%
  - v) In plant power usage = 21%
- b) With the help of neat sketch describe the operational components of a land fill and state their functions. [3]
- c) Elaborate the post closure care required for a secure landfill. [3]
- Q7)** a) A land fill area of (150 m × 100 m) is available for handling 25 years. MSW for a town of 5,00,000 people. Out of the total landfill area only 80% is actually available for land fill and other is used for auxiliary services. Assuming that average per capita MSW discard per year in town is 0.05 tonne, land fill density is 500 kg/m<sup>3</sup>, and that the 15% of the actual land fill cell volume is used for solid cover, estimate. [5]
- i) Land fill lift in one year
  - ii) Number of years for which the land fill can be used if the land fill can't be increased beyond 25 m.
- b) Explain the procedure for leachate management. [5]
- Q8)** a) Explain the economics of biomethanation plant in detail. [5]
- b) Explain plasma arc process with neat diagram. [5]



Total No. of Questions : 8]

SEAT No. :

**P4411**

**[4760]-1222**

[Total No. of Pages : 2

**M.E. (Chemical)(Environmental Engineering)**  
**INDUSTRIAL WASTE TREATMENT**  
**(2013 Credit Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Discuss the Industrial water quality requirements? [4]  
b) Discuss the water budgeting. [3]  
c) Explain the reuse and recycling concept in water management. [3]

- Q2)** a) Discuss the waste volume reduction. [4]  
b) Discuss the oil and grease removal technique from Industrial waste. [3]  
c) Enlist the techniques for heavy metals removal technique from Industrial waste. [3]

- Q3)** a) Give the distinction between clean up and cleaner technologies. [4]  
b) Discuss the partially treated industrial wastewater with domestic sewage. [3]  
c) Explain the stream and effluent standards. [3]

- Q4)** The BOD results given below are observed on a sample of waste water. [10]

|            |     |    |    |    |    |    |
|------------|-----|----|----|----|----|----|
| t, days    | 1   | 2  | 4  | 6  | 8  | 10 |
| BOD,mg/lit | 6.5 | 11 | 18 | 22 | 24 | 26 |

Plot BOD curve.

Calculate parameters  $K_1$  &  $L_u$ .

**P.T.O.**

- Q5)** a) Draw a flowsheet for the treatment of fertilizer industry wastewater. [5]  
b) Discuss the sources characterization and treatments of wastewater in sugar industry. [5]
- Q6)** a) What is a necessity of common Effluent treatment plant (CETP)? Enlist treatment units used for CETP. [10]
- Q7)** a) Discuss the cost benefit analysis of common effluent Treatment plant. [10]
- Q8)** a) Write short note on Advanced wastewater treatment system in Industries. [5]  
b) Write a note on Treatability Index. [5]



Total No. of Questions : 8]

SEAT No. :

**P4621**

[Total No. of Pages : 2

**[4760] - 1223**

**M.E.(Chemical) (Environment Engg.)**

**Remote Sensing & GIS Application in Environmental Engineering  
(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1) a)** What is Remote sensing & its different applications? Explain data acquisition process & the elements of data acquisition. **[6]**

b) Explain **[4]**

- i) Radiance
- ii) Reflectance
- iii) Irradiance
- iv) Spectral radiance

**Q2) a)** Explain 'Maxwells' electromagnetic wave theory for the propagation & macroscopic optical effects of electromagnetic energy. **[4]**

b) Discuss the atmospheric interaction with electromagnetic Radiation. What are the atmospheric effects on spectral Response pattern. **[6]**

**Q3) a)** What are the broad classification of satellites? Explain the IFOV & its applications. **[4]**

b) What are the different types of earth Resources satellite? Explain Indian Remote Sensing Satellite (IRS) in detail. **[6]**

**P.T.O.**

- Q4)** a) Explain "Spectral signature" & its utility in image interpretation. What are image interpretation keys & their types, explain each in detail. [4]
- b) Explain procedure applied for photo interpretation. [4]
- c) Discuss pocket stereoscope & mirror stereoscope. [2]
- Q5)** a) What is the advantage of digital image processing over visual image interpretation? What are the different steps in digital image processing. Explain geometric correction method of preprocessing. [6]
- b) What are filters & their types? Explain low pass filters. [4]
- Q6)** a) Explain the need of image classification & explain supervised classification. [6]
- b) Explain [4]
- i) Drainage Texture
- ii) Rectangular drainage pattern
- iii) Image tone
- iv) Drainage density
- Q7)** a) What are field applications of GIS & discuss the historical development of GIS. [4]
- b) Explain [6]
- i) Geographical entity
- ii) GIS queries
- iii) Hardware components of GIS
- Q8)** a) Explain [6]
- i) Rapid land information system development
- ii) Land use / land cover system in India
- iii) Groundwater Resources development in any area
- b) What is Digital elevation model or digital terrain model? What are the different steps in digital terrain modeling? [4]



Total No. of Questions : 8]

SEAT No. :

**P4412**

**[4760] - 1224**

[Total No. of Pages :2

**M.E. (Chemical) (Environmental Engineering)**  
**INDUSTRIAL POLLUTION PREVENTION AND CLEANER**  
**PRODUCTION**  
**(2013 Credit Pattern) (Semester - III) (509144)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt any five questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*

**Q1) a)** Discuss the industrialization and sustainable development. **[5]**

b) What are the barriers of the sustainability? **[5]**

**Q2) a)** Explain the cleaner technology and cleaner production concept. **[5]**

b) Discuss the Regulatory versus Market-based approaches in pollution prevention. **[5]**

**Q3) a)** Discuss historical evolution of pollution prevention and control. **[5]**

b) Explain the Environmental Management Hierarchy. **[5]**

**Q4) a)** Explain the use of Internet information for pollution prevention & cleaner production. **[5]**

b) Write a brief note on source reduction techniques in pollution control. **[5]**

**Q5) Disucss the following in detail;** **[10]**

a) Overview of CP Assessment steps and skills

b) Pollution Prevention and Cleaner Production Project development.

**P.T.O.**

**Q6)** Discuss the importance of process and equipment optimization aspect in pollution prevention & cleaner production. **[10]**

**Q7)** Discuss the technical and environmental feasibility analysis as well as total cost analysis of pollution prevention & cleaner production program. **[10]**

**Q8)** Write short note on; **[10]**

- a) Environmental Management system (EMS).
- b) Elements of Life Cycle Assessment (LCA).



Total No. of Questions : 8]

SEAT No. :

**P4413**

**[4760] - 1225**

[Total No. of Pages : 2

**M.E. (Petroleum Engineering)**

**NUMERICAL SIMULATION IN PETROLEUM ENGINEERING**

**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) What is numerical simulation technique how does it differ from analytical methods? Indicate relative advantage and disadvantage of both the techniques. **[5]**
- b) With help of suitable example explain how 2D simulation improves the preliminary results of simple one dimensional model equations. **[5]**
- Q2)** a) Discuss Up scaling techniques using Pseudo functions. **[5]**
- b) Write a detailed note on History Matching Technique. In this context also highlight Regression Analysis. **[5]**
- Q3)** a) Write a short note on non-Darcy effects on fluid flow through porous media. **[4]**
- b) Define : Porosity, Absolute Permeability, Effective Permeability, and Relative Permeability. **[4]**
- c) What is mobility and mobility Ratio? **[2]**
- Q4)** a) Name four important Commercial Simulators. How does the field data of actual petroleum reservoirs and production facilities be hooked to these simulators? **[4]**
- b) With help of neat diagram explain PVT behavior of a Crude reservoir. **[4]**
- c) Mention the benefits obtained through PVT study of a hydrocarbon reservoir. **[2]**

**P.T.O.**

- Q5)** a) Write a short note on stability and accuracy of numerical solutions. [3]  
 b) Solve the following reservoir equation : [5]

$$\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$$

subject to the conditions

$$u(0, t) = 2$$

$$u(4, t) = 4.8$$

$$u(x, 0) = x(2.6 - x)$$

$$\frac{\partial u}{\partial t} = 0 \text{ at } t = 0$$

- c) What is compositional model? [2]
- Q6)** a) Develop Mass Balance and Momentum Balance equations for one dimensional flow through porous media. [3]  
 b) What is IMPES formulation? [3]  
 c) Derive black oil model equations using compositional model equation. [4]
- Q7)** a) Write a short note on Pore scale modeling. [3]  
 b) With help of case study explain multiphase flow behavior in reservoir. in this context also highlight single and multi component transport. [4]  
 c) Name the numerical methods often used by simulators discuss any one of these methods in details. [3]
- Q8)** a) With proper diagram explain treatment of wells in reservoir simulation. [4]  
 b) Discuss importance of capillary pressure in reservoir simulator. [2]  
 c) What are the major challenges of Reservoir Simulation Packages, how to address the issues. [4]



Total No. of Questions : 8]

SEAT No. :

**P4235**

[Total No. of Pages : 3

[4760] - 1226

**M.E. (Petroleum Engineering)**

**GEOLOGY IN RESERVOIR DESCRIPTION**

**(2013 Pattern) (Credit System) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

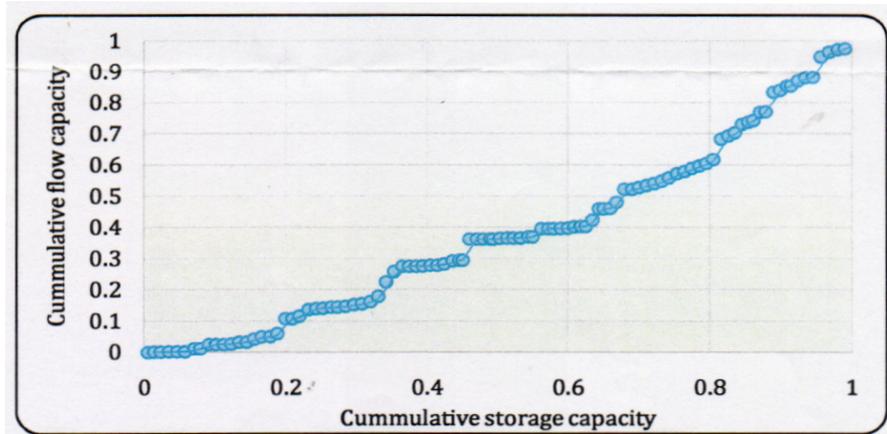
*Instructions to the candidates:*

- 1) *Answer Any Five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) Draw and describe the Dunham scheme of classification of carbonate rocks. [4]  
b) Write in brief about textural maturity of sediments. [4]  
c) What is a clastic sedimentary rock? [2]
- Q2)** a) Define the following : [4]  
Effective Porosity, Pore throat, fluid saturation and capillary pressure  
b) Write an equation for calculation of Original Oil in Place. [4]  
c) How is fracture porosity add to significant change in permeability. [2]
- Q3)** a) Draw and explain relative permeability curve for oil and water. [4]  
b) What are the components of petroleum system? [3]  
c) Comment on the relationship between shale volume and permeability.[3]
- Q4)** a) Draw and explain the concept of abnormal pressure zone. [4]  
b) Distinguished with the help of good diagram between anticline and syncline. [3]  
c) How is reservoir heterogeneity recognized on core scale? [3]

**P.T.O**

- Q5)** a) A graph of cumulative flow capacity drawn against cumulative storage capacity is given below. Comment on the number of hydraulic units present in this. What is the significance of the terms given in x and y axis? [4]



- b) How do we understand the uncertainties while creating integrated geological model? [3]
- c) Draw a diagram showing zonal and geometric anisotropy. What information these two parameters provide? [3]
- Q6)** a) Write Geological Time Scale in a tabular form with important events in each era. [4]
- b) What is autocorrelation? [3]
- c) How is cyclicity in deposition recognized on logs? [3]
- Q7)** a) Following are the details of different parameters required in the volumetric estimation of reserves. [5]

| Parameter                | Range of value                              |
|--------------------------|---|
| Area                     | 10 to 30 km <sup>2</sup>                    |
| Formation thickness      | 11 to 19 m                                  |
| Porosity                 | 9 to 19%                                    |
| Water Saturation         | 15 to 45%                                   |
| Formation Volume Factor, | 1.14 to 1.26m <sup>3</sup> /sm <sup>3</sup> |
| Recovery Factor          | 20 to 30%                                   |

Calculate Minimum and Maximum Recoverable Reserves.

- b) What is the reason for uncertainty in different parameters? What may be the errors in the calculations? [5]

- Q8)** a) Calculate the Geological risk involved and state whether the risk involved in the search of hydrocarbons is low or high? [5]

| <b>Event</b>                                  | <b>Probability</b> |
|---|--------------------|
| Maturity of source rock                       | 0.85               |
| Migration path to reservoir                   | 0.80               |
| Reservoir rock with porosity and permeability | 0.75               |
| Trapping mechanism                            | 0.70               |
| Existence and persistence of seal             | 0.70               |

- b) What are structure contour maps? Draw a map showing presence of a dome. [5]



Total No. of Questions : 4]

SEAT No. :

P4414

[4760] - 1227

[Total No. of Pages :1

M.E.(Petroleum)

**ADVANCED DRILLING ENGINEERING  
( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Question no. 1 is compulsory.out of remaining attempt 2 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Your are advised to attempt not more than 3 questions.*
- 5) *Use of logarithmic tables slide rule,Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** Discuss casing buckling in detail.Using following data investigate possibility of buckling in 9-5/8” casing. **[18]**

| DEPTH<br>ft | Grade | weight<br>PPF | Area<br>int.<br>sq.in.Ai | Area<br>ext.Sq.<br>In.Ae | $\rho_i$<br>psi/ft | $\rho_e$<br>psi/ft |
|-------------|-------|---------------|--------------------------|--------------------------|--------------------|--------------------|
| 0-440       | N80   | 53.5          | 57.21                    | 72.76                    | 0.52               | 0.52               |
| 440-6070    | N80   | 40            | 61.31                    | 72.76                    | 0.52               | 0.52               |
| 6070-8900   | N80   | 53.5          | 57.21                    | 72.76                    | 0.52               | 0.52               |
| 8900-9500   | N80   | 53.5          | 57.21                    | 72.76                    | 0.52               | 0.59               |

Cement

**Q2)** Discuss different types of multilateral wells and discuss geometrical planning of ‘S’ type directional well.In detail **[16]**

**Q3)** Write short note on **[16]**

- a) LWD
- b) Intelligent wells

**Q4)** a) discuss causes of well bore instability in detail **[8]**

b) Discuss cement rheology and primary cementation in detail. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P4236**

**[4760] - 1228**

[Total No. of Pages :2

**M.E. (Petroleum Engineering)  
RESEARCH METHODOLOGY**

**(Semester - I) (2013 Credit Pattern) (512104)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Any Five questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Illustrate your answers with suitable examples and diagrams, wherever necessary.*
- 4) *Write relevant question number before writing the answer.*

- Q1)** a) What is a research problem? Define the necessity of identifying a research problem. Also briefly examine the sources of research problem. [4]
- b) Define the term Research Methodology. Explain in brief its significance. [3]
- c) State the importance of references in scientific research. [3]
- Q2)** a) Examine the various techniques used for data analysis. Show how far this will be useful in your research. [4]
- b) Explain the steps in process of engineering research work. [4]
- c) What are the different types of research? [2]
- Q3)** a) Examine the different types of observations and their uses in Petroleum engineering research. Also, discuss the ethical issues involved in making use of the various Observational techniques. [4]
- b) What is research design? Explain the different types of research designs and formulate a research design for your research problem. [4]
- c) What are the essential characteristics of a good questionnaire? [2]

*P.T.O.*

- Q4)** a) Empirical research in India in particulars creates so many problems for the researchers. State the problem that are usually faced by such researchers. [4]
- b) Critically examine the qualitative and quantitative research methods. Elaborate your answer by giving suitable example. [4]
- c) Point out main two differences between applied research and fundamental research regarding researcher's qualities. [2]
- Q5)** a) What do you mean by a 'case study'? Explain the steps involved in designing a case study to solve a research problem. [4]
- b) What is Research Design? Explain the different types of Research Designs and formulate a Research Design for your research problem. [4]
- c) Define sampling and discuss the different types of sampling. [2]
- Q6)** a) Write a brief note on : Ethics in Research. [4]
- b) Describe some of the major projective techniques and evaluate their significance as tools of scientific research. [4]
- c) Write the steps involved in report writing and elaborate the importance in effective report writing. [2]
- Q7)** a) Describe, in brief, the layout of a research report, covering all relevant points. [5]
- b) What do you mean by a 'case study'? Explain the steps involved in designing a case study to solve a research problem. [5]
- Q8)** a) Write notes on: (**Any Two**) [5]
- i) Intellectual Property Rights (IPR).
- ii) Ethics in Research.
- iii) Threats and challenges to good research.
- b) What is chi-square test? Explain its significance in statistical analysis. [5]

Total No. of Questions : 8]

SEAT No. :

P4415

[Total No. of Pages : 3

[4760] - 1229

**M.E. (Petroleum Engineering)**

**ADVANCED RESERVOIR ENGINEERING**

**(2013 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) What are the five types of reservoirs that are encountered? Explain with appropriate figures. [5]
- b) Calculate the mass of methane gas contained at 1000 psi and 68 degree F in a cylinder with volume of 3.20 Cu ft. Assume that methane is an ideal gas. [3]
- c) Calculate the density of methane, at the conditions given in above problem? [2]
- Q2)** a) What do you mean by reserves? Explain all types of reserves in detail.[5]
- b) What do you mean by areal and vertical sweep efficiency? Explain with figures. [3]
- c) What do you mean by the z-factor? Explain its relevance. [2]
- Q3)** a) Explain how is chemical EOR methods are different than thermal EOR methods. [5]
- b) Write a detailed note on MEOR. [3]
- c) What do you mean by ASP flooding? What is the contribution of each of the individual elements? [2]

**P.T.O.**

- Q4)** a) Write a detailed note on in-situ combustion, along with an appropriate diagram. [5]
- b) What do you mean by CO<sub>2</sub> flooding? How different is it from inert gas flooding? [3]
- c) Explain in detail, how interfacial tension is important in EOR? What are its units, and how does it affect the transition zone. [2]

- Q5)** a) What do you mean by wettability, and how does it affect an EOR strategy? [5]
- b) What do you mean by reaction kinetics? Explain its relevance. [3]
- c) Explain what you mean by transient, pseudo-steady and steady state flow regimes in detail. [2]

- Q6)** a) What do you mean by relative permeability and relative permeability ratio? Explain with diagrams. [4]
- b) What is the difference between SAGD and Huff-and-puff method? Explain in detail. [4]
- c) Write a short note on saturation and effective permeability. [2]

- Q7)** a) Dry air is a gas mixture consisting essentially of Nitrogen, oxygen, and small amounts of other gases. Calculate the apparent molecular weight of air, given its composition: [5]

| Component | Composition, mole fraction |
|-----------|----------------------------|
| Nitrogen  | 0.78                       |
| Oxygen    | 0.21                       |
| Argon     | 0.01                       |

- b) Thermal EOR, with its screening criteria. [5]

- Q8)** a) Explain in detail, what do you mean by LTO and HTO. [5]
- b) Calculate the partial pressure exerted by Methane in the following gas, when the gas is at a pressure of 750 psia. Assume that the gas is a mixture of ideal gases: [5]

| Component | Composition, mole fraction |
|-----------|----------------------------|
| Methane   | 0.85                       |
| Ethane    | 0.10                       |
| Propane   | 0.05                       |



Total No. of Questions : 10]

SEAT No. :

**P3787**

[Total No. of Pages : 2

[4760] - 123

**M.E. (Mechanical) (Design Engg.)**

**ROBOTICS (Elective - II)**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answer 3 questions from Section I and 3 questions from Section - II.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Write down definitions of Robot & its Historical background. [8]  
b) Explain different elements of Robot. & Illustrate with appropriate sketch. [7]
- Q2)** a) Explain procedure to determine find position of gripper by forward kinematics. [8]  
b) Write a note on inverse kinematics technique for Robot analysis. [7]
- Q3)** a) Write a note on 3R manipulator & explain method for specify the position & orientation. [8]  
b) Explain working of point to point type Robot & its applications. [7]
- Q4)** a) Write a note on Eule's equation & its application in Robot analysis. [8]  
b) Explain different methods for trajectory plancy. [7]
- Q5)** Write a note on following (any three) [20]  
a) Velocity & Acceleration kinematics  
b) Lagrange formulation of manipulata system  
c) Continuous path Robots  
d) Welding Robot for Industrial application

**P.T.O.**

**SECTION - II**

- Q6)** a) Explain working of optical encoder. [8]  
b) Write a note on touch & slip sensor. [7]
- Q7)** a) List down & explain different drives used for Robotic system. [8]  
b) Write a note on  $\mu$  - controllers used in Robots. [7]
- Q8)** a) Write a note on image acquisition system of Robotics. [8]  
b) Write a note on image sensing & list down different types of cameras used for Robotic vision system. [7]
- Q9)** a) List down requirements of Robot progracy. [8]  
b) Write a note on different progracy languages used in Robotics. [7]
- Q10)** Write a note on following (any three) [20]  
a) MEMS &  $\mu$  - Robotics  
b) Fabrication of  $\mu$  - Robots  
c) Proximity sensors  
d) Real time operating system



Total No. of Questions : 8]

SEAT No. :

P4237

[Total No. of Pages : 2

[4760]-1230

M.E. (Petroleum Engineering) (Semester - II)

**ENVIRONMENTAL TECHNOLOGY IN PETROLEUM  
ENGINEERING**

**(2013 Pattern) (Credit System)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Any Five questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Illustrate your answers with suitable examples and diagrams, wherever necessary.*
- 4) *Write relevant question number before writing the answer.*

- Q1)** a) Explain different types of spills and its treatment methods. [4]  
b) Explain significance of Environmental Management System. [3]  
c) Write a note on 'Clean Development Mechanism. [3]

- Q2)** a) Discuss the methods used for disposing solid exploration and production waste. [4]  
b) What is down hole oil water separator? Discuss about types and advantages of down hole oil water separator. [3]  
c) What are the causes of oil spills? Describe chemical methods to prevent oil spills [3]

- Q3)** a) Discuss about environmental control technology in drilling fluid and produced water. [4]  
b) Explain about offshore and onshore waste management options in oil industry [3]  
c) Describe waste water treatment technology in oil industry. [3]

- Q4)** a) Describe environmental control technology in production operation. [4]  
b) What are the steps in minimizing pollution related to petroleum industry? [3]  
c) Discuss about potential impacts of oil industry on the environment. [3]

*P.T.O.*

- Q5)** Write notes on: (Any Two) **[10]**
- a) PTW (Permit to Work)
  - b) Disaster Management
  - c) QRA (Qualitative Risk Analysis)
- Q6)**
- a) What do you mean Environmental impact assessment? Explain in brief with suitable example. **[4]**
  - b) Explain the principle of ALARP. **[3]**
  - c) Explain in brief responsibilities of team members in typical HAZOP study. **[3]**
- Q7)**
- a) Discuss current environmental issues in offshore oil and gas field with suitable examples. **[5]**
  - b) Discuss in brief various Environmental Regulations, Health and Safety laws applicable in Oil and Gas Industries. **[5]**
- Q8)** Write notes on: (Any Two) **[10]**
- a) Accidents in oil and Gas industry
  - b) Risk Analysis and Management
  - c) HAZID Analysis



Total No. of Questions : 8]

SEAT No. :

**P4238**

[4760] - 1231

[Total No. of Pages :3

**M.E. (Petroleum)**

**ADVANCED PRODUCTION OPERATIONS**

**(2013 Credit Pattern) (Semester - II) (512109)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Classify different types of artificial lifting techniques and write working of continuous and intermittent gas lift technique. [5]
- b) Draw neat schematic sketch of surface equipment and subsurface pumping cycle of Sucker rod pumping system. [3]
- c) Show and explain the need of artificial lifting on a VLP-IPR plot. [2]

- Q2)** a) Draw process flow diagram of a typical Group Gathering Station and indicate various feature of it. You may divide it into separate plants such as GCS, water treating facility etc; [5]
- b) Decide depth for point of gas injection in continuous gas lifting system using following data on a graph paper. [3]

Well depth = 9000 ft. Expected production rate = 1000 bbls/day. Tubing size =  $2 \frac{3}{8}$  inch.  $P_{wh} = 150$  psig, SBHP = 3000 psig. P.I. = 3 bbl/day-psi, solution GOR = 300, SCF/STB, Sp. Gravity of injection gas = 0.65, S/C available pressure for injection gas = 1000 psig, °API = 38, Surface Temp. = 120 °F. B.H. Temp. = 220 °F. Assume, 260 psi / 1000 ft = flowing gradient of FBHP. 20 psi / 1000 ft = casing pressure gradient. Subtract 100 psi from the pressure at point of balance before you fix the point of gas injection.

- c) Derive an equation to determine oil pad thickness required in case of a three phase separator. [2]

- Q3)** a) Draw neat schematic sketch of a typical petroleum production system and explain graphically any one application of nodal analysis in detail. **[4]**
- b) Draw neat schematic sketch of a three phase horizontal separator and write its advantages. **[4]**
- c) Explain: **[2]**
- i) Liquid fall back
- ii) Optimum GLR
- Q4)** a) What are the necessary elements and essential conditions for an emulsion to exist? Discuss in brief different methods to treat produced emulsions from an oil well. **[5]**
- b) Discuss the principle mechanisms and features responsible for separation of oil, gas and water in a separator. **[3]**
- c) In which kind of field conditions you will recommend three phase horizontal separator? Write. **[2]**
- Q5)** a) Write usability of SRP, PCP and ESP only in terms of excellent/good/fair/poor in a tabular form for following well conditions. Low PI, High GOR, adaptability to deviated wells, capability to produce sand, high volume lift capability and ability to handle viscous oil. **[5]**
- b) What is formation damage? Describe any one method to overcome the problem of formation damage. **[3]**
- c) Draw neat schematic sketch of a horizontal heater treater. **[2]**
- Q6)** a) What is production optimization? Explain the scope and example of it in Petroleum production operations. **[4]**
- b) Write the objectives of stage separation. **[3]**
- c) Write and discuss the working of Progressive cavity pumping system. **[3]**

- Q7)** a) Define and derive: effective plunger stroke, volumetric efficiency, rod stretch, tubing stretch and ideal counterbalance effect in case of SRP. **[5]**
- b) With the help of a neat schematic sketch explain working of a subsea production system. **[5]**

- Q8)** a) Draw neat schematic sketch of a casing pressure operated gas lift valve and discuss its working in brief. **[5]**

- b) Design a two phase horizontal separator using the following data: **[5]**

Gas flow rate ( $Q_g$ ) = 11 MMscf/day. Oil flow rate ( $Q_o$ ) = 2000 bbls/day. Oil gravity = 42° API. Operating Pressure = 980 psia. Operating Temperature = 60 °F. Specific Gravity of Gas = 0.6. Gas Compressibility =  $Z = 0.83$ . From std. graph value of 'k' or drag coefficient  $C_d = 0.284$  (Constant based on liquid gas properties). Liquid drop to be separated =  $d_m = 100$  micron. Assume slenderness ratio of 3 & 4. Retention time 2.5 & 3 minutes.



Total No. of Questions : 8]

SEAT No. :

**P4416**

[4760] - 1232

[Total No. of Pages : 2

**M.E. (Petroleum Engineering)(Semester - III)**

**ADVANCED WELL TESTING**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

**Instructions to the candidates:**

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) State the laws which are used for deriving the diffusivity equation, and explain each one of them in detail. [5]
- b) What is meant by ETR, MTR and LTR? Explain in detail. [3]
- c) What is the relevance of transient, pseudo steady state and steady state flow regime in well testing? [2]
- Q2)** a) What do you mean by the continuity equation? What are the assumptions that are used to derive the same? [5]
- b) Explain the concept of superposition in space, with appropriate diagrams. [3]
- c) Write down the assumptions for deriving the line source solution of the diffusivity equation. [2]
- Q3)** a) What are the objectives of a well test? Explain in detail. [5]
- b) What do you mean by DST? Explain with its different time phases. [3]
- c) What is significance of the multiple buildups and drawdowns in a DST?[2]

**P.T.O.**

- Q4)** a) How is an isochronal test different from a modified isochronal test? [5]  
b) Explain why a gas well test is different from an oil well test. [3]  
c) Explain what is meant by pseudo pressure. [2]
- Q5)** a) What do you mean by method of images? [5]  
b) Plot pseudo-pressure function vs. pressure, with the help of a graph. Explain. [3]  
c) Explain the various slopes that are observed in a typical well test. [2]
- Q6)** a) Explain the three types of empirical decline curves. [4]  
b) What do you mean by IPR and VLP? What happens when they intersect? [4]  
c) What happens when you change the node position in Nodal Analysis? Explain with graphs. [2]
- Q7)** Write short notes on:  
a) Types of graphs used in decline curve analysis. [5]  
b) Analytical decline curves. [5]
- Q8)** Explain in detail, What do you mean by:  
a) Various solutions to the diffusivity equation. [5]  
b) Bourdet derivative and its impact on pressure transient analysis. [5]



Total No. of Questions : 4]

SEAT No. :

**P4417**

**[4760] - 1233**

[Total No. of Pages :2

**M.E. (Petroleum Engineering)  
ADVANCE WELL CONTROL  
(2013 Credit Pattern) (Semester -III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Question Nos.4 is compulsory. Out of the remaining attempt 2 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Your are advised to attempt not more then 3 questions.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data if required.*

**Q1) a)** Discuss driller's method in detail. **[8]**

b) What are causes of kick and indications of Kick? **[8]**

**Q2) a)** Discuss accumulator system in detail. **[8]**

b) Well depth 9,500ft, casing shoe depth 7400ft, water depth 900ft Air gap 90ft, mud in use 12.5ppg, casing shoe strength 17.6ppg SIDPP 500psi, SICP 700psi, circulating pressure through riser at 30spm 300psi Circulating pressure through choke with BOP close at 30spm 550psi Calculate dynamic MAASP and dynamic choke pressure. **[8]**

**Q3) a)** Discuss well control during testing and cementation. **[8]**

b) Discuss Snubbing operation in detail. **[8]**

**Q4) Well data:** **[18]**

Hole size:8-1/2", Hole depth 11,962 ft/10,892 ft

Casing 13-5/8" set at 9,537ft/9,472ft

**P.T.O.**

Drill pipe 5" OD, 4.26" ID

HWDP 5", 484 ft long, capacity 0.0088 bbl/ft

Drill collar 6.25", 720 ft long capacity 0.007 bbl/ft

Mud density 14.5 ppg

Capacities

Drill pipe x casing = 0.0493 bbl/ft

Mud pump displacement 0.109 bbl/stroke

SCR 30 spm 720 psi

Fracture mud weight at casing shoe 16.9ppg

SIDPP 550psi, SICP = 783 psi, Pit gain 12 bbl

- a) Pressure safety margin at casing shoe with the well shut in
- b) Number of strokes mud pump to bit
- c) Number of strokes mud bit to casing shoe
- d) Time for complete circulation
- e) Kill mud density
- f) ICP
- g) FCP
- h) MAASP at the time of well shut in
- i) MAASP after circulation of kill mud.



Total No. of Questions : 5]

SEAT No. :

**P4239**

[Total No. of Pages : 2

**[4760] - 1234**

**M.E. (I. T.)**

**MATHEMATICAL FOUNDATION OF INFORMATION TECHNOLOGY**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary,*

**Q1)** Solve any two

- a) Prove that  $\text{Var}[X+Y]=\text{Var}[X]+\text{Var}[Y]$ , if X and Y are independent random variable. **[5]**
- b)
  - i) In how many ways can the letter in the word MISSISSIPPI can be arranged. **[5]**
  - ii) In how many ways can they be arranged if the two P's must be separated?
- c) Cards are drawn from a desk of 52 cards with replacement. In how many ways can 10 cards be drawn so that the 10<sup>th</sup> card is the first repetition?**[5]**

**Q2)** Solve any two

- a) Define membership function and state its importance in fuzzy logic. **[5]**
- b) Using your own intuition and your own definition of universe of discourse, plot fuzzy membership functions to the following variables. **[5]**
  - i) Very small
  - ii) Small
  - iii) Empty
  - iv) Full
  - v) Veryfull
- (c) Consider a data manipulation system with source probabilities 0.30, 0.25, 0.20, 0.15, 0.10. Find the source entropy  $H(X)$ . **[5]**

**P.T.O.**

**Q3)** Solve any two

- a) A die is thrown 132 times with the following results [5]  
Number turned up : 1 2 3 4 5 6  
Frequency : 16 20 25 14 29 28  
Is the die unbiased?
- b) Eight coins were tossed 256 times and the following results were obtained [5]  
Number of heads: 0 1 2 3 4 5 6 7 8  
Frequency : 2 6 30 52 67 56 32 10 1  
Are the coins biased? Use chi-square test.
- c) What is hypothesis testing? What are the different ways of hypothesis testing? [5]

**Q4)** Solve any two

- a) Describe a method for generating cyclic code with example. [5]
- b) Suppose a source produces independent symbols from the alphabet  $a_1, a_2, a_3$  with probabilities  $p_1=0.4999999$ ,  $p_2=0.4999999$ , and  $p_3=0.0000002$   
Compute the entropy  $H(X)$  of this source and find the optimal code. [5]
- c) Derive Shannon's information theorem. [5]

**Q5)** Solve any two

- a) Let  $G=(V,E)$  be an undirected graph with  $k$  components and  $|V|=n$  and  $|E|=m$ . Prove that  $m \geq n - k$ . [5]
- b) The value of any flow in a given transport network is less than or equal to the capacity of any cut in the network. Prove This? [5]
- c) In a random selection 64 of the 2400 intersections in a small city, the mean number of scooter accidents per year was 3.2 and sample standard deviation was 0.8. [5]
- i) Make an estimation of the standard deviation of the population from the sample standard deviation.
- ii) Work out the standard error for this finite population.



Total No. of Questions : 8]

SEAT No. :

**P4240**

[Total No. of Pages : 2

[4760] - 1235

**M.E. (Information Technology)**

**APPLIED ALGORITHMS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) Explain the characteristics of Dynamic programming algorithm strategy. [2]

b) Give the recursive algorithm for binary search. Comment on its complexity. [4]

c) Prove by mathematical induction that every positive integer can be expressed as a product of prime numbers. [4]

**Q2)** a) Solve following inhomogeneous recurrence [3]

$$t_n - 2t_{n-1} - 1 = 3n$$

b) Define best case, worst case and average case efficiency. [3]

c) Give the algorithm for Quick Sort. Identify its worst case instance and find the complexity in worst case scenario with appropriate mathematical treatment. [4]

**Q3)** a) Define convex hull. [2]

b) Give divide and conquer algorithm for constructing convex hull. Comment on its time complexity. [4]

c) Give an algorithm to find the closest pair in one dimension. Comment on its complexity. [4]

**P.T.O**

- Q4)** a) Explain the data structure heap and give one example where min/max heap is used in solving the problems other than sorting. [2]  
 b) Give steps for solving travelling salesman problem using approximation algorithm. [4]  
 c) Solve the travelling salesman problem using approximation algorithm. [4]

|    |    |    |    |
|----|----|----|----|
| 0  | 10 | 5  | 12 |
| 10 | 0  | 15 | 13 |
| 5  | 15 | 0  | 8  |
| 12 | 13 | 8  | 0  |

- Q5)** a) Describe various models for parallel computing. [4]  
 b) Give the pseudo code for testing whether two line segments intersect or not. [3]  
 c) Explain with diagram any method to construct voroni diagram. [3]

- Q6)** a) What is randomized algorithm? Write and explain algorithm for pattern matching. [4]  
 b) Give the properties of RED-BLACK-TREE. [2]  
 c) Explain the use of recurrences in performing the analysis of algorithms. Give one example. [4]

- Q7)** a) Explain with figures zig-zag and zig operations on splay tree. [4]  
 b) Explain various cases for deletion of nodes from B-Tree. Give example from each case and show deletion before and after deletion. [6]

- Q8)** a) Define following Terms related to computational complexity. [5]  
 i) P  
 ii) NP  
 iii) NP hard  
 iv) NP Complete

Also draw the diagram showing their relationships.

- b) What is online algorithm? Explain online algorithm for Euclidean spanning tree problem solved by greedy method. [5]



Total No. of Questions : 8]

SEAT No. :

**P4241**

**[4760] - 1236**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**ADVANCED OPERATING SYSTEMS**  
**(2013 Credit Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions from eight questions.*
- 2) Figures to the right hand indicates full marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume Suitable data wherever necessary.*

**Q1) a)** Explain the buddy system in Linux with an example. **[4]**

b) Explain the concept of fork system call. **[3]**

c) Explain the concept of execve system call. **[3]**

**Q2) a)** Explain the concept of paging with example. **[4]**

b) Explain the multilevel page table organization. **[3]**

c) Explain the hashed page table organization. **[3]**

**Q3) a)** What is mutual exclusion in operating system? Explain it with the example of readers-writers problem. **[5]**

b) Differentiate between kernel-level and user-level threads. **[3]**

c) What is lightweight process? **[2]**

**Q4) a)** Explain the crash resiliency. **[5]**

b) Explain the inode in file system. **[3]**

c) What is a file descriptor? **[2]**

**P.T.O.**

- Q5)** a) Explain the transparency in Distributed System and explain location transparency. [4]  
b) Explain the message passing features in a Distributed System. [4]  
c) What do you mean by process addressing in Message Passing? [2]
- Q6)** a) Enlist the different types of consistency models in Distributed shared memory systems? [4]  
b) Explain the various design issues of DSM. [4]  
c) What is distributed shared memory? [2]
- Q7)** a) Explain in detail different load estimation policies. [5]  
b) What is the need for leader election. Explain ring election algorithm. [5]
- Q8)** a) Write a short note on the following (any one) [5]  
i) Physical clock synchronization  
ii) Logical clock synchronization  
b) Write a short note on the following (any one). [5]  
i) Optimal task assignment  
ii) RPC mechanism in Amoeba



Total No. of Questions : 5]

SEAT No. :

**P4242**

**[4760]- 1237**

[Total No. of Pages :2

**M.E. (Information technology)  
RESEARCH METHODOLOGY  
(514404) ( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat Diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** What do you mean by research design? Differentiate between research methodology and research design. Illustrate your answer with suitable example. **[5]**

b) Explain and illustrate the following types of variables: (a) Experimental variable (b) Controlled variable (c) Intervening variable. **[5]**

**Q2) a)** How is a problem stated? describe the various ways of defining a research problem. **[5]**

b) Enumerate the different methods of collecting data. Which one is the most suitable for conducting enquiry regarding family welfare program in india? Explain its merits and demerits. **[5]**

**Q3) a)** Describe some of the important research designs used in experimental hypothesis testing research study. **[5]**

b) Describe the difference between restricted and unrestricted sampling, Convenience and purposive sampling, Systematic and stratified sampling. **[5]**

**P.T.O.**

**Q4) a)** How would you differentiate between primary and secondary data? What are the advantages and limitations of secondary data? And also list the sources of published secondary data. **[5]**

b) Distinguish between the following.

i) Simple hypothesis and composite hypothesis

ii) Null hypothesis and alternative hypothesis **[5]**

**Q5) a)** Differentiate between bibliography and footnotes or references. Illustrate your answer with examples. **[5]**

b) What do you mean by the term 'Randomization'? Indicate the methods of randomization and their advantages and limitations. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4243

[Total No. of Pages : 2

[4760] - 1238

M.E. (I.T.) (Semester - II)

WIRELESS COMMUNICATION TECHNOLOGIES

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Assume suitable data if necessary.*
- 2) *Answer any 5 out of 8 questions.*
- 3) *Figures to the right indicate full marks.*

- Q1)** a) What are the characteristics of a wireless channel? [2]  
b) Explain working of wireless routing protocol. [4]  
c) Draw frame format of IEEE 802.11. [4]
- Q2)** a) List the characteristics of an ideal routing protocol for ad hoc wireless networks. [3]  
b) Explain working of LAR. [3]  
c) Explain different challenges in designing ad hoc mobile networks. [4]
- Q3)** a) What is hard state receiver-initiated multicast protocol? [3]  
b) Explain in brief Energy Efficient Multicast Routing. [3]  
c) Explain the architecture and components of a PRNET. [4]
- Q4)** a) Enlist the issues in designing multicast Routing Protocol. [4]  
b) Explain the routing protocol which uses a link-reversal algorithm and provides loop- free multicast path routes to destination node. [4]  
c) Why DDM is not scalable with respect to the group size? [2]

*P.T.O.*

- Q5)** a) State Classification of Energy Management Schemes. [3]  
b) State different attacks at network layer in network protocol stack. [3]  
c) Explain in short Type-I and Type-2 update messages used in predictive location-based QoS routing protocol. [4]
- Q6)** a) State different issues to provide Qos in ad hoc wireless networks. [3]  
b) What are the pros and cons of assigning the responsibility of end-to-end reliability to the application layer? [3]  
c) Explain System Power Management Schemes. [4]
- Q7)** a) What are the reasons for TCP throughput degradation in ad hoc wireless network? [5]  
b) Discuss the following Qos frameworks for ad hoc Wireless Network.[5]  
i) PRTMAC  
ii) INORA
- Q8)** a) Write a short note on- Generalized pulse discharge PAMAS protocol.[5]  
b) Explain the battery management protocol, which tries to increase the lifetime of the nodes by exploiting the recovery capacity effect of battery. [5]



Total No. of Questions : 8]

SEAT No. :

**P4244**

[Total No. of Pages : 2

**[4760] - 1239**

**M.E. (Information Technology)**  
**ADVANCED DATABASE SYSTEMS**  
**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) What do you mean by distributed data processing? [4]  
b) Explain layers of transparency. [3]  
c) What are components of distributed DBMS? [3]
- Q2)** a) What is vertical fragmentation? Explain with examples. [4]  
b) What are layers of query processing? [3]  
c) Give an example of operation tree. [3]
- Q3)** a) Explain distributed cost model with an example. [4]  
b) Explain in detail join ordering in fragment queries. [3]  
c) What is classification of concurrency control algorithm? [3]
- Q4)** a) How do you perform deadlock management in concurrency control mechanism? [4]  
b) Explain execution of LRM commands. [3]  
c) Draw a diagram of state transition in 3PC protocol. [3]
- Q5)** a) Explain database server approach through diagram. [4]  
b) What are the parallel execution problems? Explain in detail. [3]  
c) Explain fundamental object concept and models. [3]

**P.T.O.**

- Q6)** a) What do you mean by vertical class partitioning. [4]  
b) What are architectural issues in distributed object DBMS? [3]  
c) What is object identity? Explain with example. [3]
- Q7)** a) Define OODBMSs. Describe the features of OODBMSs. [5]  
b) Explain data warehousing architecture. [5]
- Q8)** a) Discuss various data mining techniques. [5]  
b) Explain knowledge discovery database process. [5]



[4760] - 124

M.E. (Mechanical) (Design Engineering)

VIBRATIONS AND NOISE CONTROL

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

*Instructions to the candidates:*

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate book.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables slide rule. Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data whenever necessary.

**SECTION - I**

**Q1)** Find the lowest natural frequency of transverse vibrations for the system shown in fig. 1 by Rayleigh's method.  $E = 1.96 \times 10^{11} \text{ N/m}^2$ ,  $I = 10^{-6} \text{ m}^4$  [16]

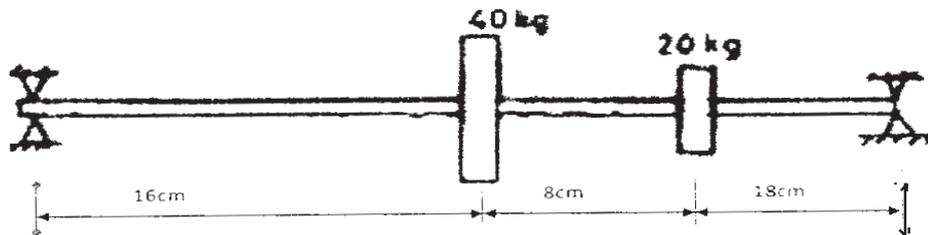


Fig. 1

**Q2)** A three rotor system shown in Fig.2 has the following physical constants.[16]

$$J_1 = 50 \text{ kg - cm sec}^2$$

$$J_2 = 1000 \text{ kg - cm - sec}^2$$

$$J_3 = 70 \text{ kg - cm - sec}^2$$

$$K_{t1} = 2.2 \times 10^6 \text{ kg - cm/rad}$$

$$K_{t2} = 0.8 \times 10^6 \text{ kg - cm/rad}$$

Find the natural frequency of the system and corresponding mode shapes.

**P.T.O.**

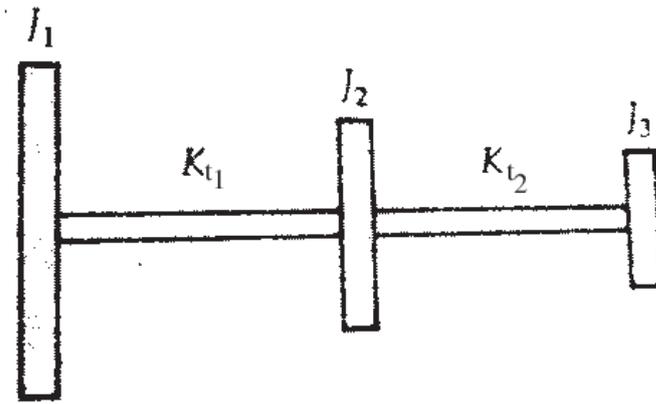
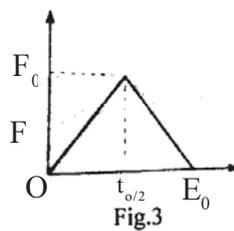


Fig.2

**Q3)** Derive the frequency equation for a beam with both ends free and having transverse vibration. [16]

**Q4)** Determine the response of an undamped, single degree spring mass system subjected to triangular impulse as shown in Fig.3 [16]



**Q5)** Write the short notes of the following (Any two) [18]

- a) Axial forced vibration of rod.
- b) Influence coefficients.
- c) Duhamel 's Integral.

**SECTION - II**

**Q6)** a) State and explain different machine vibration monitoring techniques. [8]

b) With a suitable example explain Experimental Modal Analysis. [8]

**Q7)** A non - linear spring for a single degree of freedom system is given by  $k(x) = 10x + 2000x^3$ . Damping coefficient for viscous damping is 1.5 Kg - sec /cm. a harmonic force 5N acts on the mass of 1 kg. Find the steady state response of system. [16]

**Q8)** A single DOF system with natural frequency  $\omega_n = \sqrt{k/m}$  and damping  $\zeta = 0.20$  is excited by the force

$$F(t) = F \cos \frac{1}{2} \omega_n t + F \cos \omega_n t + F \cos \frac{3}{2} \omega_n t = \sum_{m=1,3/2} F \cos m \omega_n t \quad [16]$$

Determine the mean square response and compare the output spectrum with that of the input.

**Q9) a)** Add the noise of six machines, which individually make a noise level of 78, 81, 81, 79, 72 and 65 dB respectively. [8]

b) Explain Noise absorber. [8]

**Q10)** Write the short notes of the following (any three): [18]

- a) Octane and 1/3 octane analysis of sound.
- b) Auto correlation function
- c) Wide band and narrow band process
- d) Differentiate a linear and non linear system for their behaviour and analysis



Total No. of Questions : 8]

SEAT No. :

**P4245**

**[4760] - 1240**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**ADVANCE COMPUTER ARCHITECTURE**  
**(2013 Credit Pattern) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) List out different categories of parallel processing systems. [2]
- b) Discuss the components of the multiprocessor systems with clear descriptions on parallelism in the multiprocessor systems. [4]
- c) Explain Flynn's classification of Computers. What are the different classes of computers are considered as Parallel systems? [4]
- Q2)** a) Explain data hazards in pipeline structures. Explain dynamic scheduling and discuss its use to overcome data hazards in pipeline structures. [4]
- b) Explain the working of instruction level parallelism with an example. [2]
- c) Situations or conditions due to which the pipeline stalls are called hazards, Show such hazards through space time diagram and discuss various types of hazards. [4]
- Q3)** a) Explain multithreading architecture in brief. Discuss the support of ILP to exploit thread level parallelism in detail. [4]
- b) What is the difference between thread level and instruction level parallelism. Discuss about the performance of the system supporting thread level parallelism over ILP. [4]
- c) Discuss the limitations of instruction level parallelism in brief. [2]

**P.T.O.**

- Q4)** a) Explain shared memory system architecture in detail. Discuss the difference between Uniform Memory Access and Non Uniform Memory Access types of shared memory systems. [4]
- b) Explain symmetric shared memory systems in brief. Discuss about the performance of symmetric shared memory architecture with an example. [4]
- c) Explain cache coherency in association with multiprocessor systems in brief. [2]
- Q5)** a) How multiple processes can execute without any interference with each other in a multiprocessor system? Discuss the protection mechanism supported by the underlying operating system to handle multiple processes executions. [4]
- b) Explain about the use of cache memory in enhancement of the system performance. Discuss about the advanced optimizations of cache performance. [4]
- c) Explain in brief about the working of simultaneous multithreading systems. [2]
- Q6)** a) Explain multithreaded architecture in detail. With diagrammatic representation differentiate the working of Multiple cores per chip and Multiple threads per core systems in brief. [4]
- b) Explain Intel Multicore architecture with block diagram in detail. Discuss the types of applications most suitable for multicore systems in terms of efficient utilizations. [4]
- c) Discuss how Chip level multiprocessing is advantageous over multiprocessing systems. [2]
- Q7)** a) Discuss the effectiveness of multicore systems for general purpose machines and application specific machines. Also explain IBM cell architecture with its block diagram. [5]
- b) Explain various multicore system organizations achieved by the use of different levels of cache with their respective block diagrams. [5]
- Q8)** a) Explain data flow architecture in detail. Differentiate between static and dynamic data flow machines in brief. [5]
- b) How data flow graph is used in data flow systems, explain with an example data flow graph. State the firing rule of a node in static data flow architecture. [5]



Total No. of Questions : 8]

SEAT No. :

P4246

[Total No. of Pages : 2

[4760] - 1241

**M.E. (Information Technology) (Semester - III)**  
**INFORMATION ASSURANCE AND SECURITY**  
**(2013 Pattern)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions from eight questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Define Confidentiality and Vandalism. [2]  
b) Explain how critical characteristics of information are used in the study of computer security? [4]  
c) What are the three components of the C.I.A. triangle? What are they used for? [4]
- Q2)** a) What are the components of an Information Security? [3]  
b) Explain with example concept of False Accept Rate and False Reject Rate. [3]  
c) Compare application gateways with circuit gateways. [4]
- Q3)** a) Identify the six components of an information system and explain which are most directly affected by the study of computer security. [3]  
b) What is privacy in an information security context? [3]  
c) Why is data the most important asset of an organization? State other assets in the organization that require protection? [4]

**P.T.O.**

- Q4)** a) What do you mean computer forensics? List the uses. [4]  
b) What are various types of malware? Differentiate between worms and viruses. [4]  
c) What measures can individuals take to protect against shoulder surfing?[2]
- Q5)** a) What is a buffer overflow, and how is it used against a Web server? [3]  
b) What is information extortion? Describe how such an attack can cause losses with an example. [3]  
c) Explain the features of Biometric Access Controls. [4]
- Q6)** a) What are the three types of security policies? [2]  
b) What are the differences between a policy, a standard, and a practice?[4]  
c) Why do employees constitute one of the greatest threats to information security? [4]
- Q7)** a) Define Cyber Crime. Enlist at least six types of cyber crime. [5]  
b) List and describe the three control strategies proposed for IDPS control. [5]
- Q8)** a) What is risk management? Why is the identification of risks, by listing assets and their vulnerabilities. so important to the risk management process? [5]  
b) Discuss any two types of Firewall architectures. [5]



Total No. of Questions : 8]

SEAT No. :

**P4247**

**[4760] - 1242**

[Total No. of Pages :3

**M.E. (Information Technology)**  
**NETWORK PROGRAMMING**  
**(2013 Credit Pattern) (Semester - III) (514414)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain the working nature of passive open and active open in client server communications. **[2]**
- b) Describe the working of select function used by the server to handle multiple client requests? **[4]**
- c) Write a program using TCP socket to perform file related operations like file reading and file writing. It is expected to have multiple clients request to the concurrent server. **[4]**
- Q2)** a) With clear diagrammatic representation of state transition diagram, describe the working of TCP connection establishment between client and server? **[4]**
- b) Discuss the importance of byte ordering in client server communication over a TCP network. **[2]**
- c) How client and server exchanged packets in connection establishment and connection termination. **[4]**
- Q3)** a) What is routing socket? Why routing socket does not required to have associated with any specific network protocols? **[4]**

**P.T.O.**

- b) What are functions provided by the system to maintain byte orders properly? Discuss about the use of these functions in the network communications. [4]
- c) What are the various types of messages exchanged across a routing socket? [2]
- Q4)** a) Describe the structure of data link socket with explicit focus on the significance of each members of the structure. [4]
- b) Describe the purpose of IPv6 address-testing macros with respect to interoperability in communications. [3]
- c) How resolvers and name servers work in association with client server communication over a TCP network? [3]
- Q5)** a) Discuss about the interoperability issues while an IPv4 server handles a request from IPv6 clients. What are the steps IPv4 server handles for processing of IPv6 clients depending on address types and socket types? [4]
- b) Explain about the steps performed by the UDP client and UDP server with clear diagrammatic representation. [3]
- c) Describe various steps used by IPv6 server for handling of an IPv4 client requests in a client/server communications. [3]
- Q6)** a) Discuss with neat diagram how mapping of IPv4 and IPv6 multicast addresses to Ethernet addresses works? [4]
- b) Explain the working of Clock synchronization using SNTP across a WAN or a LAN in communication. Give some examples of NTP packet formats used for synchronization. [4]
- c) Discuss the steps required for the multicast packets go from the sender to all the receivers on a WAN. [2]

- Q7)** a) How to create threads using POSIX library of threads? What are thread specific data? Write about information maintained by each thread with suitable examples. [5]
- b) Write a program for TCP concurrent server, where one child process is created to process per client's request. Include proper comments for each operation in brief. [5]
- Q8)** a) Discuss the approaches for process based and thread based concurrent server creations. How the performance related issues impacts in thread based and process based concurrent servers creations play important roles in application developments. [5]
- b) Write a program using POSIX thread to implement echo server using one thread per client. [5]



Total No. of Questions : 8]

SEAT No. :

**P4248**

[Total No. of Pages : 2

**[4760] - 1243**

**M.E. (Instrumentation and Control) (Biomedical Instrumentation)**

**MATHEMATICAL METHODS IN INSTRUMENTATION**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions.*
- 2) *Assume suitable data if necessary.*
- 3) *Use of calculators, log tables, charts is allowed.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** Check the following vector for linearly dependent or independent [4]  
 $u = (1,2,3), v = (0,1,1), w = (1,3,4).$

b) Calculate the Singular Value Decomposition of the matrix [4]

$$\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$$

c) Define Euclidean distance and Euclidean inner products of the vectors.[2]

**Q2) a)** Transfer the following vectors to orthonormal vectors using Gram Schimmit Method.

$$u = (1, 1, 1), v = (-1, 1, 0), w = (1, 2, 2) \quad [5]$$

b) Obtain the orthogonal projections of the following vectors on X and Y axis:

$$u = (1, 1), v = (2,2). \quad [2]$$

c) Explain orthonormal vectors with suitable examples. [3]

**Q3) a)** Using Gauss Elimination method, obtain the solutions of the followings:[5]

$$x + 2y + z = 3,$$

$$2x + .3y + z = 6,$$

$$x - y - z = -3$$

b) Find the fourth root of 74 using Newton Raphson method. [3]

c) Discuss the role of Numerical methods in mathematics. [2]

**P.T.O.**

- Q4)** a) Explain mathematical definition of probability with suitable example. [4]  
 b) Define addition and multiplication theorems of probability. [4]  
 c) 'The mean of binomial distribution is 3 and variance is 5', explain the statement is True or False? [2]
- Q5)** a) Find the probability distribution of boys and girls in families with 3 children assuming equal probabilities for boys and girls and plot the graph of that distribution. [6]  
 b) Define the probability function for a Normal distribution. [4]
- Q6)** The joint PDF of two random variables X and Y is given by  
 $f(x,y) = c(2x+y)$  for  $0 \leq x \leq 2$ ,  $0 \leq y \leq 3$  and  $f(x,y) = 0$  otherwise.  
 Find:  
 a) Find the value of C [2]  
 b) Find  $p[x = 2, y = 1]$  [2]  
 c) Find  $p[x \geq 1, y \leq 2]$  [2]  
 d) Find the maximum probability functions of x and y. [4]
- Q7)** a) Explain the role of vector orthonormalisation in biomedical signal processing. [5]  
 b) Find the expectation of a random variable X whose PDF is given by  $f(x) = (1/2)^x$ ,  $x = 1, 2, 3$ . [5]
- Q8)** a) Explain the role of Singular Value Decomposition of the matrix in biomedical signal processing. [5]  
 b) Explain linear dependency of vectors with suitable application. [5]



Total No. of Questions : 5]

SEAT No. :

**P4249**

[Total No. of Pages : 2

**[4760] - 1244**

**M.E. (Instrumentation & Control) (Process - Instrumentation)**

**TRANSDUCER DESIGN**

**(2013 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right candidates indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following :

- a) Explain different pressure gauges for vacuum measurement. **[5]**
- b) Explain pH measurement using pH sensor. **[5]**
- c) Discuss any two techniques used for detection of radioactive radiations. **[5]**

**Q2)** Attempt any two of the following :

- a) In detail explain signal conditioning circuit used for piezoelectric sensor. **[5]**
- b) Discuss signal conditioning circuit of RTD for temperature measurement with zero and span adjustments. **[5]**
- c) Explain design of capacitive sensor for level measurement. **[5]**

**Q3)** Attempt any two of the following :

- a) Explain strain gauge transducer for force measurement with its signal conditioning circuits. **[5]**
- b) List different types of torque transducers and discuss any one in detail. **[5]**
- c) Explain industrial applications of Gas sensors. **[5]**

**P.T.O**

**Q4)** Attempt any two of the following :

- a) Give selection criteria for electromagnetic flowmeter. Also explain different types excitation used in it. [5]
- b) Explain nano sensors in detail with example. [5]
- c) Explain manufacturing process of MEMS with neat sketch. [5]

**Q5)** Attempt any two of the following :

- a) List different Biosensors and explain each sensors application. [5]
- b) List different Chemical sensors and explain any two in detail. [5]
- c) Explain LASER application in micromachining operations. [5]



Total No. of Questions : 8]

SEAT No. :

**P4250**

**[4760] - 1245**

[Total No. of Pages :2

**M.E. (Instrumentation & Control)**  
**INDUSTRIAL AUTOMATION**  
**Process Instrumentation**  
**(2013 Credit Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** Discuss the various selection criteria that must be considered for selection of a suitable PLC for a specific process control. **[5]**

b) Explain working principle of HART protocol in detail. **[5]**

**Q2) a)** List various major types of PLC analog inputs and outputs. Enlist specifications of any typical PLC. **[5]**

b) Explain in brief IEC 61511 standard for functional Safety. **[5]**

**Q3) a)** Explain consequences of risk. **[5]**

b) List different types of Profibus. Explain in brief calibration of Profibus. **[5]**

**Q4) a)** Explain with neat sketch famous automation hierarchy for an industrial application. **[5]**

b) Give guidelines for designing of Field bus. **[5]**

**P.T.O.**

- Q5)** a) Two lights are to flash on and off at different intervals. One is on 4 seconds and off 4 seconds. The other is on for 7 seconds and off 7 seconds. Two lights are to flash alternately, one for 4 seconds, one for 7 seconds. After five cycles both lights must go off. [5]
- b) Explain HAZOP w.r.t [5]
- i) Definition
- ii) Objectives
- Q6)** a) Explain with an example 'Sequential Function Chart'. [5]
- b) Explain in brief application of safety system. [5]
- Q7)** a) Discuss in brief with suitable block diagram any two major components of the DCS. [5]
- b) Explain in brief Role of Automation in Industries. [5]
- Q8)** a) Develop programmable ladder diagram for flashing of lamp for every 20 seconds. [5]
- b) Describe in brief SCADA systems in terms of their architecture and interface to process hardware. [5]



Total No. of Questions : 8]

SEAT No. :

**P4251**

**[4760]- 1246**

[Total No. of Pages :2

**M.E. (Instrumentation & Control)(Process & Biomedical)**

**RESEARCH METHODOLOGY**

**( 2013 Credit Pattern) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat Diagrams should be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** “Empirical research in India in particular creates so many problems for the researchers”. State the problems that are usually faced by such researchers. **[5]**

b) What are types of research? Explain significance of research in modern times. **[5]**

**Q2) a)** What do you mean by lines of regression? How are regression coefficients related to correlation coefficients? **[5]**

b) What are the various steps involved in a research process? **[5]**

**Q3) a)** What do you mean by research? **[5]**

b) Explain the meaning and significance of a research design. **[5]**

**Q4) a)** Which method of primary data, do you think, is the best and why? **[5]**

b) Describe some of the important research designs used in experimental hypothesis-testing research study. **[5]**

**P.T.O.**

- Q5)** a) Differentiate between pure research and applied research. [5]  
b) Explain the difference between  $R^2$  and adjusted  $R^2$ . [5]
- Q6)** a) How will you classify various multivariate techniques? Give details. [5]  
b) What is the relevance of Setting objectives in research? How are they set? [5]
- Q7)** a) Mention different types of report, particularly pointing out the difference between a technical report and a popular report. [5]  
b) Explain the significance of a research report and narrate various steps involved in writing such a report. [5]
- Q8)** a) Define the main issues which should receive the attention of the researcher in formulating the research problem. [5]  
b) Discuss in brief principal component analysis. [5]



Total No. of Questions : 8]

SEAT No. :

**P4252**

[Total No. of Pages : 2

**[4760] - 1247**

**M.E. (Process Instrumentation)**  
**INSTRUMENTATION & CONTROL**  
**Advanced Process Control**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Discuss with suitable example Control Objectives and their benefits. [5]  
b) What is the need of Mathematical Model in process control? [5]
- Q2)** a) Describe the process reaction curve method for identifying dynamic models. [5]  
b) Explain with suitable application "Feedforward Control". [5]
- Q3)** a) Explain design procedure of IMC for FOPDT process. [5]  
b) Discuss in brief dynamics of second order process to identify key performance characteristics. [5]
- Q4)** a) Discuss in brief MIT rule and its application to a first order system. [5]  
b) Explain design procedure of MRAS using Lyapunov rule. [5]

**P.T.O.**

- Q5)** a) Describe with suitable application Feedback controller. [5]  
 b) Explain with suitable application how an Override Control scheme is implemented to protect the equipment. [5]
- Q6)** a) Explain in brief self tuning regulator. [5]  
 b) What is DMC? State its importance. [5]
- Q7)** a) Discuss in brief effect of ‘Interaction’. [5]  
 b) Explain in brief Decoupling of control loops. [5]
- Q8)** a) What is the significance of SPC in Process Plants? [5]  
 b) Consider the process  $G(s) = \frac{1}{s(s+p)}$ , Where p is an unknown parameter.

Determine a controller that can give the closed loop system

$$G(s) = \frac{1}{s(s+p)}. \quad [5]$$



Total No. of Questions : 8]

SEAT No. :

P4622

[Total No. of Pages : 2

[4760]-1248

M.E. (Instrumentation & Control) (Process Instrumentation)

**EMBEDDED SYSTEM DESIGN**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain the 8 bit timer/counter of AVR microcontroller with neat diagram. Also describe the different input and output registers used in timer. Also describe the different modes of the counter operation. [6]
- b) Write a program in assembly language to find the smallest number among 7 numbers. You choose any seven numbers. [6]

OR

- Q2)** a) The output of temperature signal conditioning is from 0-5V for 0-100° C. The ADC of AVR microcontroller 8535 is to be used for converting this signal in to 10 bit binary number. The conversion should be as Per the following. For - 100°C – the output should be - 111111111 and For - 0°C – the output should be - 000000000. This output should be outputted on the port PA and PB of the AVR microcontroller.
- Draw the interfacing diagram and write a program in assembly language to achieve this [6]
- b) Explain in the detail memory organization of AVR Atmega8335 microcontroller. [6]
- Q3)** a) Explain the interrupt structure of ARM microcontroller. [7]
- b) Describe ARM core architecture. [6]

OR

**P.T.O.**

- Q4)** a) Explain the memory organization and registers of ARM microcontroller. [7]  
b) Write a program in assembly language to add two 16 bit binary numbers using ARM microcontroller. [6]

- Q5)** a) Explain the Serial Peripheral Interface protocol (SPI). [6]  
b) Explain how you will drive a relay using parallel port of PC. [6]

OR

- Q6)** a) Describe RS-485 serial communication protocol. [6]  
b) Explain the handshaking in serial communication [6]

- Q7)** a) Explain the CAN bus with respect to frames, bit stuffing and nominal bit timing. [7]  
b) Describe USB bus communication. [6]

OR

- Q8)** a) Compare the FPGA vs ASIC design with examples. [7]  
b) Explain the impact of the area, speed and power in the FPGA design. [6]

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Total No. of Questions : 5]

SEAT No. :

**P4253**

**[4760] - 1249**

[Total No. of Pages :2

**M.E. (Instrumentation & Control) (Process Instrumentation)**

**ADVANCED CONTROL SYSTEM**

**(2013 Credit Pattern) (Semester - II) (506109)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following:

- a) Discuss linear and non-linear system. **[5]**
- b) List different nonlinearities in control system and also draw any three nonlinearities with their mathematical representation. **[5]**
- c) Explain concept of phase plane in control system analysis. **[5]**

**Q2)** Attempt any two of the following:

- a) Define describing function? Find describing function for relay nonlinear element. **[5]**
- b) Write short note on describing function for nonlinear systems. **[5]**
- c) Define limit cycle. Also discuss its importance in detail. **[5]**

**Q3)** Attempt any two of the following:

- a) Explain direct method of Lyapunov with suitable example. **[5]**
- b) Show that following quadratic form is positive definite. **[5]**  
$$V(x) = 8x_1^2 + x_2^2 + 4x_3^2 + 2x_1x_2 - 4x_1x_3 - 2x_2x_3$$
- c) Determine the stability of a non-linear system governed by equation. **[5]**

$$\dot{x}_1 = -x_2 + 2x_1^2$$

$$\dot{x}_2 = -x_2$$

**P.T.O.**

**Q4)** Attempt any two of the following:

- a) Explain zero dynamics in feedback linearization with example. [5]
- b) Explain input-output linearization in detail with example. [5]
- c) Explain input-state linearization in detail with example. [5]

**Q5)** Attempt any two of the following:

- a) Design a sliding mode control for a system given by [5]

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -4x_1 - 10x_2 + u$$

Where  $u$  is input. Use linear sliding surface.

- b) With reference to sliding mode control theory explain sliding surface and reachability in detail with necessary diagrams. [5]
- c) Explain chattering effect in SMC in detail. [5]



Total No. of Questions : 10]

SEAT No. :

**P3788**

**[4760] - 125**

[Total No. of Pages : 4

**M.E. (Mechanical - Design Engg.)  
ADVANCED MACHINE DESIGN  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *figures to the right indicate full marks.*
- 5) *Use to logarithmic tables, calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Give the design procedure for helical spring. **[6]**

b) A semi-elliptic multi leaf spring is used for the suspension. It consist of two extra full length leaves & ten graduated - length leaves including master leaf. The centre - to - centre distance between the spring eyes is 1.2 m. The leaves are made of steel

( $S_{yt} = 1500 \text{ N/mm}^2$  and  $E = 207000 \text{ N/mm}^2$ ) and factor of safety is 2.5. The maximum load acting on spring is 30 KN. The leaves are prestressed so as to equalize stresses in all leaves. **[10]**

Determine :

- i) The cross section of leaves; and
- ii) The deflection at the end of spring.

**Q2) a)** Explain the following terms in context to creep. **[8]**

- i) Stress relaxation
- ii) Estimated time to rupture.

b) Following data refers for creep rate at 800°C. **[8]**

stress  $\sigma_1 = 21 \text{ MPa}$  creep rate = 0.128% per 1000 Hrs.

$\sigma_2 = 28 \text{ MPa}$  creep rate = 0.64% per 1000 Hrs.

Determine the creep rate per 1000 Hrs for stress value of 10 MPa by using both exponential & hyperbolic laws of creep. Which of the two method a designer will prefer?

**P.T.O.**

**Q3) a)** What is the cumulative fatigue damage? How the life if the component subjected to different values of fluctuating stresses in cycle is estimated. [6]

b) A machine component subjected to two dimensional stresses. The tensile stress in X direction varies from 40 N/mm<sup>2</sup>, to 100 N/mm<sup>2</sup>, while the tensile stress in Y direction varies from 10 N/mm<sup>2</sup> to 80 N/mm<sup>2</sup>. The frequency of variation of there stresses is equal. The corrected endurance limit of the component is 270 N/mm<sup>2</sup>. The ultimate tensile strength of the material of component is 660 N/mm<sup>2</sup>. Determine the factor of safety. [10]

**Q4) a)** Explain the use of composite materials in mechanical engineering, giving examples of such use, state reasons for a preference in favour of such materials. [6]

b) A tensile load of 120 N is applied to an aluminium baron composite of 1mm<sup>2</sup> cross sectional area. The volume at the parallel fibre is 30%. What is the stress in the fiber when load axis is ; [10]

i) parallel to the fibres

ii) perpendicular to the fibres

The young's modulus of aluminium & baron are 71 GN/m<sup>2</sup> and 440 GN/m<sup>2</sup> respectively.

**Q5) Write short note on the following [18]**

a) Analysis of variance

b) Design for fatigue failure

c) Vibration & surging of Helical springs.

## SECTION - II

- Q6)** a) How do you obtain the optimum solution for the simplex method? [6]
- b) In a light weight equipment shaft is transmitting a torque of 900 N - M & is to have a rigidity of 90 Nm/ degree. Based on yield strength factor of safety is 1.5. Design a shaft with minimum weight. What will be the change in design for minimum cost. Assume max. shear stress theory of failure. Use following data. [10]

| Material        | Mass density (Kg/m <sup>3</sup> ) | Material cost/wt. (Rs/N) | Yield strength (MPa) | Shear Modulus (GPa) |
|-----------------|-----------------------------------|--------------------------|----------------------|---------------------|
| Alloy Steel     | 8500                              | 16                       | 130                  | 80                  |
| Al. alloy       | 3000                              | 32                       | 50                   | 26.7                |
| Titanium alloy  | 4800                              | 480                      | 90                   | 40                  |
| Magnesium alloy | 2100                              | 32                       | 20                   | 16                  |

- Q7)** a) Explain the term peaking & topping as applied to gear. [6]
- b) Two 20° full depth gear of 20 & 30 teeth are to be designed on the extended centre distance system using the recommended values for clearance.  $F = 0.25/P_d$ . Make the calculations for  $P_d = 1$ . [10]

Find the following :

- i) values of  $q_1$  and  $q_2$
  - ii) the actual angle  $\phi$
  - iii) the radius of actual pitch circle & centre distance.
  - iv) the tooth thickness on actual pitch circle.
- Q8)** a) Explain multiple regression analysis & factorial design. [8]
- b) Prove that reliability with respect to time 't' is : [8]

$$R(t) = \text{Exp} \left[ - \int_0^t h(t) dt \right]$$

**Q9) a)** Why 'I' section is selected for connecting rod of high speed I.C. engine? [6]

b) Design an aluminium alloy piston for I.C. engine with following specifications. [10]

Cylinder bore = 100 mm; stroke length = 120 mm

Max. gas pressure = 5 N/mm<sup>2</sup>; Brake mean

Effective pressure = 0.65 N/mm<sup>2</sup>;

Fuel consumption = 0.227 kg/kw/hr

Speed = 2200 rpm

Assume suitable data.

**Q10)** Write a short note on the following. [18]

- a) Design for safety.
- b) Design for assembly & manufacture.
- c) Design considerations for cylinder of I.C. engine.



Total No. of Questions : 5]

SEAT No. :

**P4254**

[Total No. of Pages : 2

**[4760] - 1250**

**M.E. (Instrumentation and Control) (Process Instru.)**

**ADVANCED SIGNAL PROCESSING**

**(2012 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Attempt any two parts from each question.*
- 3) *Neat diagram must be drawn whenever necessary.*
- 4) *Figure to the right indicate full marks.*
- 5) *Use of electronic pocket calculator.*
- 6) *Assume suitable data, if necessary.*

**Q1) a)** Compute DFT of sequence  $x[n] = \{1, 0, -1, 2\}$ . **[5]**

b) Compute IDFT if  $X(k) = \{2, 2 + 2j, -2, 2 - 2j\}$ . **[5]**

c) List and explain properties of STFT. **[5]**

**Q2) a)** Explain application of adaptive filtering in signal prediction. **[5]**

b) How homomorphic signal processing is used for image enhancement. **[5]**

c) Explain how homomorphic deconvolution used for separation echoes in speech signals. **[5]**

**Q3) a)** Explain noble identities for interchange between sampler and filters. **[5]**

b) Explain DFT filter bank with analysis and synthesis section. **[5]**

c) What do you mean multiresolution formulation of wavelet systems? **[5]**

**P.T.O.**

**Q4)** a) Develop a two band poly phase decomposition for the following Transfer

function  $H(z) = \frac{1 + z^{-1} + 2z^{-2}}{1 + 0.8z^{-1} + 0.6z^{-2}}$  [5]

b) Explain wavelet based filter design with four coefficients. [5]

c) Explain any one application of multirate signal Processings. [5]

**Q5)** a) Explain forward linear prediction with block diagram [5]

b) State the computational requirements of nonparametric power spectrum estimation methods. [5]

c) How ARMA model used for power spectrum estimation? [5]



Total No. of Questions : 7]

SEAT No. :

**P4255**

[4760] - 1251

[Total No. of Pages :2

**M.E. (Process Instrumentation & Control)**  
**BUILDING AUTOMATION**  
**(2013 Credit Pattern) (606102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain FAS Components with neat sketch. **[6]**

b) Write a short notes on “Fire Triangle”. **[4]**

**Q2) a)** Explain Standalone and network Access Control System with neat Sketch. **[6]**

b) Write a short notes on NIDS. **[4]**

**Q3) a)** Explain Dual duct multiple zone variable air volume Air conditioning system with neat sketch. **[6]**

b) Write a short notes on Air Handling Unit (AHU). **[4]**

**Q4) a)** Explain Vapour compression cycle with neat sketch. **[6]**

b) Write a short notes on Chilled water coil. **[4]**

**Q5) a)** Explain DDC architecture with sketch. **[6]**

b) Write a short notes on two position and floating control. **[4]**

**P.T.O.**

**Q6) a) What is green building. Explain goals of green building. [6]**

**b) Write a short notes on MODBUS Protocol. [4]**

**Q7) a) Explain Project Management, what are the characteristics of project. [6]**

**b) Write a short note on Total cost Management. [4]**



Total No. of Questions : 8]

SEAT No. :

**P4256**

[Total No. of Pages : 2

[4760] - 1252

**M.E. (Instrumentation and Control) (Biomedical Instrumentation)**

**BIO SIGNAL PROCESSING**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Compute the cross-correlation of the sequences,

$$x(n) = \{2, 3, 4, 2, 1\}, y(n) = \{1, 2, 2, 3, 1\} \quad [10]$$

**Q2)** a) Determine the unit step response of the system described by,

$$y(n) = 3y(n-1) + 2y(n-2) + x(n) \quad [6]$$

b) Explain the properties of Z-transform (any four). [4]

**Q3)** a) Find the 4-point DFT of  $x(n) = \{2, 1, 1, 2\}$  [4]

b) Sketch the signal flow graph of 8-point decimation-in-frequency (DIF) algorithm. [6]

**Q4)** a) Determine and plot the frequency response of the filter impulse response,  $h(n) = \{0.5, 0, 0.5\}$  [5]

b) Design the causal linear phase FIR filter for following specifications :

$$\text{Length } M = 7$$

$$\text{Cut - off frequency} = 3 \text{ rad/sec}$$

Window function = Hamming window [5]

**P.T.O**

- Q5)** a) A filter operating at a sampling frequency of 1000 samples/sec has a pole at  $z = -1$  and a zero at  $z = -2$ . Determine the magnitude of its amplitude response at 500 Hz, and 600 Hz. [4]
- b) Determine the transfer function of a filter described by the difference equation,  
 $y(n) = y(n-1) - y(n-2) + x(n) + x(n-1)$   
 Also, sketch the pole-zero plot. [6]
- Q6)** a) A Butterworth analog filter has the cut-off frequency 0.707 rad/sec and order  $N = 3$ . Plot the poles on the Butterworth circle. Obtain the transfer function of this analog filter. Using the impulse invariance method, transform this an analog filter  $H(s)$  to a digital filter  $H(z)$ . Assume  $T = 1$  sec. [6]
- b) Compare the Butterworth and Chebyshev filters. [4]
- Q7)** a) What are the main advantages of adaptive filters over fixed filters? [2]
- b) Discuss the LMS algorithm in adaptive filtering. [4]
- c) Explain in brief any two medical applications of adaptive filtering. [4]
- Q8)** a) Describe the advantages and disadvantages of modified Huffman coding. [5]
- b) What are the various finite word length register effects? Describe the quantization error in detail. [5]



Total No. of Questions : 8]

SEAT No. :

**P4257**

**[4760] - 1253**

[Total No. of Pages :2

**M.E. (Instrumentation and Control) (Biomedical Instrumentation)**

**ANALYTICAL INSTRUMENTATION**

**(2013 Credit Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1)** Classify the instrumental techniques in detail. What are the important considerations in analysis of instrumental methods. **[10]**

**Q2)** Explain principle and working of automatic absorption spectroscopy and IR spectroscopy with the help of neat block diagram and schematic. **[10]**

**Q3)** Explain principle and working of fluorescence spectrometer and phosphorescence spectrometer with the help of neat block diagram and schematic. **[10]**

OR

**Q4)** Explain ionisation methods, mass analysers, mass detectors in mass spectroscopy. **[10]**

**Q5)** Explain Gas chromatography and Liquid chromatography in detail. **[10]**

**Q6)** Explain x-ray absorption, fluorescence and diffractometric techniques in detail. **[10]**

**Q7)** Explain electron microscope and microprobe, ESCA and Auger techniques, nuclear radiation detectors in detail. **[10]**

**Q8)** Explain principle, chemical shift, spin-spin coupling, types of NMR. **[10]**



Total No. of Questions : 5]

SEAT No. :

**P4258**

[Total No. of Pages : 2

**[4760] - 1254**

**M.E. (Instru. & Control) (Biomedical Instrumentation)**

**TRANSDUCER DESIGN**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following :

- a) Discuss different phenomena considered for designing of transducers. **[5]**
- b) Explain proximity sensors with its importance and applications. **[5]**
- c) With neat sketch explain different signal conditioning circuits used for conversion of capacitance in to voltage. **[5]**

**Q2)** Attempt any two of the following :

- a) In detail explain signal conditioning circuit of piezoelectric sensor. **[5]**
- b) Discuss signal conditioning circuit of thermocouple for temperature measurement with room temperature compensation, zero and span adjustments. **[5]**
- c) Explain design of resistive sensor for level measurement. **[5]**

**Q3)** Attempt any two of the following :

- a) Give design aspects of LVDT with its signal conditioning circuits and its importance. **[5]**
- b) List different types of vibration transducers and discuss any one in detail. **[5]**
- c) Explain industrial applications of Chemical sensors. **[5]**

**P.T.O.**

**Q4)** Attempt any two of the following :

- a) Give selection criteria for electromagnetic flowmeter. Also explain different types excitation used in it. [5]
- b) Explain Nano sensors and its applications. [5]
- c) Explain manufacturing process of MEMS with neat sketch. [5]

**Q5)** Attempt any two of the following :

- a) List different Biosensors and explain each sensors application. [5]
- b) List different Gas sensors and explain any two in detail. [5]
- c) Explain LASER application in welding and cutting operations. [5]



Total No. of Questions : 8]

SEAT No. :

P4259

[Total No. of Pages : 2

[4760] - 1255

**M.E. (Instrumentation and Control)**  
**BIOMEDICAL INSTRUMENTATION**  
**Digital Image Processing**  
**(2013 Pattern)**

*Time : 3 Hours]*

*[Maximum Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions.*
- 2) *Assume suitable data if necessary.*
- 3) *Use of Calculators, log tables, charts is allowed.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Describe various components of digital image processing system. [5]  
b) Explain bightness adaption and descrimination. [3]  
c) Calculate the memory required to store the 256\*256 image with 32 gray levels. [2]

- Q2)** a) Explain connectivity and adjacency with suitable examples. [4]  
b) Explain Histogram Specifications with suitable example. [4]  
c) Define distance measures and state their uses. [2]

- Q3)** a) Obtain the magnitude and phase spectrum of the following image: [5]  
10 20 30  
40 50 60  
70 80 90  
b) Explain Radaon Transform. [5]

- Q4)** a) Enhance the following image with laplacian filter. [5]  
1 2 3  
4 5 6  
7 8 9  
b) Compare image smoothing and image sharpening. [5]

**P.T.O.**

- Q5)** a) Compare image enhancement and restoration. [3]  
b) Explain the process of image restoration. [3]  
c) Explain image restoration using inverse filter and its digital implementation.[4]

- Q6)** a) Explain any one pattern classification using suitable example. [4]  
b) Explain signature descriptors. [3]  
c) Explain canny operator for edge detection. [3]

- Q7)** a) Enhance the following image using high pass filter. [5]

1 2 3  
4 5 6  
7 8 9

- b) Detect edges in the following image using sobel operator. [5]

1 1 1  
0 0 0  
1 1 1

- Q8)** a) Enhance the following image using high pass filter in frequency domain.[5]

1 2 3  
4 5 6  
7 8 9

- b) Explain JPEG 2000 image compression process. [5]



Total No. of Questions : 8]

SEAT No. :

**P4260**

**[4760] - 1256**

[Total No. of Pages :2

**M.E. (Instrumentation & Control)**

**COMMUNICATION PROTOCOLS FOR INSTRUMENTATION**

**(2013 Credit Pattern) (506209) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) Explain the following topologies used in implementing different protocols with neat diagrams. **[4]**
- i) Chicken foot
  - ii) Daisy chain
  - iii) Point to point
  - iv) Spur
- b) List and explain any four teams involved along with their responsibilities in implementing Fieldbuses on a sizable automation project. **[4]**
- c) Explain the classes of HART Commands. **[2]**
- Q2)** a) Explain the Profibus PA network elements. **[4]**
- b) With neat diagram explain the balanced 2 wire and 4 wire RS 485 serial interface system. **[4]**
- c) Explain terminations and its use with respect to Fieldbus devices. **[2]**
- Q3)** a) Explain point to point and multidrop networks in HART devices. **[4]**
- b) Explain the steps involved in calibrating the HART field devices. **[4]**
- c) What is the difference between conventional and Fieldbus devices. **[2]**

- Q4)** a) With respect to communication basics, explain the following: [5]
- i) Asynchronous communication
  - ii) Manchester encoding
  - iii) Parity
  - iv) Cyclic Redundancy Codes
  - v) Analog Signaling
- b) Explain the role of Ethernet in communication protocol. [3]
- c) Explain the role of LAS in Fieldbus system. [2]
- Q5)** a) In short explain the MODBUS ASCII protocol. [5]
- b) List and explain any three logical media access and arbitration methods. [3]
- c) List and explain the variants of Profibus. [2]
- Q6)** a) List and explain the information contained in Segment drawings. [4]
- b) Explain the information contained in the physical block of Profibus. [4]
- c) List any two physical network design rules applying to Spurs in Profibus PA. [2]
- Q7)** Write short notes:
- a) Architecture and advantages of Data Highway Plus. [5]
  - b) Z Wave. [5]
- Q8)** Write short notes:
- a) Hierarchical communication model in Process Automation. [5]
  - b) Wi-Fi. [5]



Total No. of Questions : 8]

SEAT No. :

**P4261**

[Total No. of Pages : 2

[4760] - 1257

**M.E. (Biomedical Instrumentation) (Semester - III)**

**MEDICAL IMAGING TECHNIQUES**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain the role of energy in medical imaging. **[4]**

b) How the ultrasound wave interacts with matter? **[4]**

c) What is the difference between photon and particle? **[2]**

**Q2) a)** Explain principle of generation of Bremsstrahlung Xrays. **[4]**

b) What is Angiography? Why a contrast agent is needed? **[4]**

c) How filters help in increasing energy of Xrays? **[2]**

**Q3) a)** What is role of Automatic Exposure Control in X ray imaging. **[4]**

b) With the help of graphs explain the effect of mA and kVp on Xray emission spectrum. **[4]**

c) Explain how the ripple in input voltage affects the Xray quality? **[2]**

**P.T.O.**

- Q4)** a) Enlist the advantages and limitations of MRI [5]  
 b) Express Ultrasound velocity in terms of density and compressibility. How does it influence Ultrasound Imaging. [3]  
 c) Name the detectors used in Thermography. [2]
- Q5)** a) Write a shortnote on 'Xero Radiography' [5]  
 b) What should be the focal spot size of Mammography Xray tube and how it is achieved? [3]  
 c) Which target materials are used in Mammography? [2]
- Q6)** a) List various controls and their function present at operating console in Computed Tomography? [5]  
 b) Elaborate on different applications of ultrasound in medical field. [3]  
 c) State Huygen's Principle. [2]
- Q7)** a) Draw and explain the block diagram of B mode ultrasound scanner. [5]  
 b) Define Sensitivity and Specificity. Describe the relationship between them with the help of ROC curve. [5]
- Q8)** a) Explain the concept of 3D imaging in Computed tomography with a suitable diagram. [5]  
 b) Draw and explain the construction of Gamma Camera. [5]



Total No. of Questions : 8]

SEAT No. :

**P4262**

**[4760] - 1258**

[Total No. of Pages :2

**M.E. (Instrumentation and Control) (Biomedical Instrumentation)**  
**ADVANCED DIGITAL SIGNAL PROCESSING**  
**(2013 Credit Pattern) (Semester - III) (606202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain short Time Fourier Transform with its properties. [4]  
b) Discuss the need of Time frequency analysis with suitable example. [4]  
c) Define Wigner Ville Distribution. State its properties. [2]
- Q2)** a) Explain Interpolation with suitable examples. [3]  
b) Explain polyphase decomposition of the filter with suitable example. [5]  
c) Discuss the need of multi rate signal processing with suitable applications. [2]
- Q3)** a) What is power spectral estimation? State methods of PSD estimation. [3]  
b) How do you compute the energy of a discrete signal in time and frequency domain? [2]  
c) Explain Yule-Walker equation and its solution. [5]
- Q4)** a) Write the difference between LMS algorithm and RLS algorithm. [4]  
b) What is the principle of steepest descent adaptive FIR filter? [4]  
c) Why LMS is normally preferred over RLS? [2]

**P.T.O.**

- Q5)** a) Compare SSS and WSS processes. [4]  
b) Discuss the concept of signal modeling. [3]  
c) Explain spectral factorization. [3]
- Q6)** a) Compare various compression standards. [5]  
b) Explain JPEG 2000 standard of image compression. [5]
- Q7)** a) Explain need of up sampling and down sampling in multirate systems. [5]  
b) Explain homomorphic signal processing with suitable application. [5]
- Q8)** a) Explain RLS algorithm. [4]  
b) Explain Blackman-Tukey method for power spectrum estimation. [4]  
c) Define TFD. [2]



Total No. of Questions : 8]

SEAT No. :

**P4263**

[Total No. of Pages : 3

**[4760] - 1259**  
**M.E. (Polymer)**  
**MATHEMATICAL AND STATISTICAL METHODS**  
**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Solve the system of equations, using Gauss - seidal method. **[5]**

$$3x + y + z$$

$$x + 3y - z = 11$$

$$x - 2y + 4z = 21$$

Do four iterations.

**b)** Find the largest eigen value of the following matrix using power method:**[5]**

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$

Also find the corresponding eigen vector. Choose initial vector  $\bar{X} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$

**Q2) a)** Find Z - transform of the following (any two): **[6]**

i)  $4^k + 5^k, k \geq 0$

ii)  $e^{-3k} \cos 4k, k \geq 0$

iii)  $(k + 1)a^k, k \geq 0$

**P.T.O.**

b) Find inverse Z - transform of the following (any one): [4]

i)  $\frac{1}{(z-3)(z-2)}$ ,  $2 < |z| < 3$

ii)  $\frac{z^2}{z^2+1}$  using inversion integral method.

Q3) a) Solve the difference equation: [5]

$$f(k+1) + \frac{1}{2}f(k) = \left(\frac{1}{2}\right)^k, k \geq 0, f(0) = 0$$

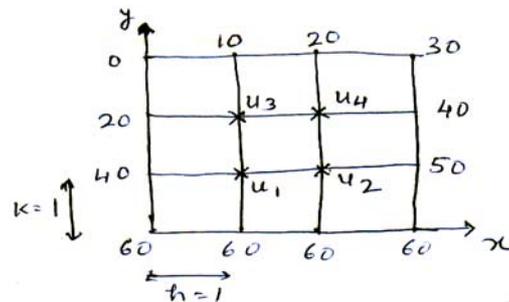
b) Use Gauss quadrature three point formula to evaluate  $\int_{-1}^1 \sqrt{x+2} dx$  [5]

Q4) a) Use Runge - kutta method of fourth order to solve

$$\frac{dy}{dx} = 1 + y^2, \text{ at } x=0, y=0 \text{ to compute } y \text{ at } x=0.2 \text{ taking } h=0.1. [5]$$

b) The values of  $u(x,y)$  is given on the boundary of the square as shown below. Evaluate the function  $u(x,y)$  at nodal point 1, 2, 3 and 4 where

$$u(x,y) \text{ satisfies the equation } \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0, h = k = 1 [5]$$



Q5) a) Solve the boundary value problem  $y'' - 64y + 10 = 10$  using finite difference method. Given  $y(0) = y(1) = 1$ ,  $h = 0.2$ . [5]

b) Explain the explicit finite difference scheme to solve one dimensional heat flow equation. Discuss the stability of the method. [5]

Q6) a) Find the extremal of the functional [5]

$$\int_{x_1}^{x_2} y \sqrt{1 + (y')^2} dx$$

b) Solve  $y'' - y + x = 0$  ( $0 \leq x \leq 1$ )  
 $y(0) = y(1) = 0$  using Galerkin's method. [5]

- Q7) a)** Use householder's method to reduce the following matrix into tridiagonal form : **[5]**

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$$

- b) Solve the following system of equations by LU decomposition method:**[5]**

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

- Q8) a)** The table below gives the number of accidents that occurred in the certain factory on the various days of a particular week. **[5]**

| Days                | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---------------------|--------|--------|---------|-----------|----------|--------|----------|
| Number of accidents | 6      | 4      | 9       | 7         | 8        | 10     | 12       |

Test at 5% level whether accidents are uniformly distributed over the different days.

Given  $\chi^2_{6;0.05} = 15.592$

- b) The mean weekly sales of TVs of a particular brand in company's show room was 14.6 TV per show room. After launching a few incentives the mean weekly sales in 22 stores for a typical week increased to 15.4 with standard deviation of 1.7. were the incentives announced effective in boosting the sale?

Given at 5% level of significance  $t = 1.72$  **[5]**



Total No. of Questions : 10]

SEAT No. :

**P4564**

**[4760]-126**

[Total No. of Pages : 3

**M.E. (Mechanical) (Design Engineering)**  
**ANALYSIS AND SYNTHESIS OF MECHANISMS**  
**(2008 Course) (Semester - II) (502210)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*
- 6) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Distinguish between simple & complex mechanism. Explain function generation and path generation. **[8]**
- b) Explain clearly with sketches the 'Method of Normal acceleration', stating the principles on which it is based, and by taking an example of a complex mechanism. What are the limitations to the applicability of the method. **[8]**
- Q2)** a) Explain type, number and dimensional synthesis. Explain Kutzbach criterion for spatial mechanisms. **[8]**
- b) Explain the matrix method of analysis of 4-Bar planer mechanism. **[8]**
- Q3)** Determine the cubic of stationary of curvature for plane motion equivalent to the rolling of a circle along a fixed straight line & compare the result with rolling of a straight line along a circle. **[16]**
- Q4)** a) Explain the term 'fixed and moving centrodes' and osculating circles. **[8]**
- b) Explain with neat sketch the Hartmann construction and show that it satisfies the Euler Savary equation. **[8]**

**P.T.O.**

**Q5)** Write a note on (Any Three):

**[18]**

- a) Inertia forces in linkages.
- b) Ball's Point.
- c) Auxiliary Point method for velocity acceleration analysis.
- d) Application in dwell mechanisms.
- e) Elastic linkage model.

### **SECTION - II**

**Q6)** Determine the length of the link of a four bar linkage to generate  $Y = \log_{10} X$  in the interval  $1 \leq X \leq 10$ . The length of the smallest link is 5 cm. Use three accuracy points with Chebyshev spacing. Draw the final sketch of linkages. (For input lever select  $54^\circ$  starting angle and  $60^\circ$  total swing angle, for the Output lever select  $135^\circ$  starting angle with total swing angle of  $90^\circ$  travel.) **[16]**

**Q7) a)** Explain Freudenstein's method of synthesis of mechanisms. Derive the expressions for displacement, velocity and acceleration of a four bar mechanism. **[8]**

b) What do you mean by 'center point and circle point circles'. Explain Bernester points. **[8]**

**Q8) a)** State and prove Robert-Chebyshev theorem. Comment on its use. **[8]**

b) Find the Denavit-Hartenberg' parameter for Hook joint. **[8]**

**Q9)** What is Dyad? Derive its standard form. Explain the procedure of synthesizing a four bar for path generation with prescribed timing, with three accuracy points. Can such a synthesized mechanisms have an order defect? **[16]**

**Q10)** Write a note on (ANY THREE):

**[18]**

- a) Eulerian angles.
- b) Branch and order defect.
- c) Cognates.
- d) Symmetry of coupler curves.
- e) Structural error.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4418**

[4760] - 1261

[Total No. of Pages :2

**M.E. (Polymer Engineering)**

**ADVANCED POLYMER TECHNOLOGY**

**(2013 Credit Pattern) (End Semester) (509117) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*

- Q1)** a) Write a note on characterization of Chain Microstructure. [4]  
b) Explain Entropy and Enthalpy of Mixing. [3]  
c) Discuss the term Copolymer Sequence Distribution. [3]
- Q2)** a) Explain Phase Behaviour of Polymer Blends and solutions. [5]  
b) Explain Flory-Huggins theory of polymer solution. [5]
- Q3)** a) Explain with one example Living Cationic Polymerization. [5]  
b) Explain in detail metal catalyzed olefin polymerization. [5]
- Q4)** a) Explain Piezoelectric polymers with two examples. [5]  
b) Write a note on: [5]  
Biopolymers and Liquid crystalline polymers
- Q5)** a) Explain in detail with two examples polymers used for Heat Resistant polymers. [4]  
b) Write a note on Silicone Polymers. [4]  
c) What are the properties and applications of fluoroelastomers? [2]

*P.T.O.*

- Q6)** a) Explain the structure, properties and applications of polybenzimidazole. **[4]**  
b) Write a note on electroconductive polymers. **[3]**  
c) Explain with one example functional polymers. **[3]**
- Q7)** a) Explain with examples microbial synthesis of polymers. **[5]**  
b) Write a note on “Dendritic polymers”. **[5]**
- Q8)** a) Discuss in detail “Concept of self-assembly”. **[5]**  
b) Write a note on “Supramoleculer polymers and their applications”. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P4419**

**[4760] - 1262**

[Total No. of Pages :2

**M.E. (Polymer Engineering)**  
**RESEARCH METHODOLOGY**  
**(2013 Credit Pattern) (Semester - I) (End Semester) (509118)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Students are permitted to use standard statistical tables having normal distribution area, F-test data,  $\chi^2$  test data etc.*

- Q1)** a) Write a note on “Types and Importance of Research Design”. [4]  
b) Explain the term Hypothesis and what are the characteristics features of a hypothesis. [3]  
c) What is a case study? [3]
- Q2)** a) Define research and state the significance of research. [4]  
b) Discuss the qualities of a researcher and explain different research approaches. [3]  
c) Explain in detail various sources of review of literature. [3]
- Q3)** a) Write a note on “Methods of Correlation Analysis”. [4]  
b) Explain important methods used for studying variation and also explain different types of averages used in statistical methods. [4]  
c) Discuss the factors which should be considered while deciding the Sample size and explain how to determine Sample size. [2]

*P.T.O.*

- Q4)** a) Explain the term Regression Coefficient and calculate the correlation Coefficient if two Regression lines of a sample are  $X + 6Y = 6$  and  $3X + 2Y = 0$ . [4]
- b) Explain the procedure of Testing Hypothesis. [3]
- c) The life time of plastic parts for a random samples of 10 from a large consignment gave the following data: Can we accept the hypothesis that the average life time of parts is 4000 hours, Applying the t-test the Table value is  $t_{0.05} = 2.262$ . [3]

| Item               | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Life in '000 Hours | 4.2 | 4.6 | 3.9 | 4.1 | 5.2 | 3.8 | 3.9 | 4.3 | 4.4 | 5.6 |

- Q5)** a) Discuss the process of a discrete frequency distribution with one example. [4]
- b) Explain Tabulation of data. [2]
- c) Explain different graphical ways of frequency distributions with examples. [4]
- Q6)** a) Explain general outline relating the presentation of report. [4]
- b) Give Dos and Don'ts of Report writing. [3]
- c) Discuss in short framework of a research report. [3]
- Q7)** a) Write a note on "Simulated Annealing". [5]
- b) Explain the basic characteristics of a good report. [3]
- c) Explain Chi-square test. [2]
- Q8)** a) Explain in detail Process of Patenting and Development. [4]
- b) Explain the term Patent Rights. [2]
- c) Explain Patents, Designs, Trademarks and Copyright. [4]



Total No. of Questions : 8]

SEAT No. :

P4420

[Total No. of Pages : 2

[4760] - 1263

M.E. (Polymer Engineering) (Semester - II)

POLYMER PROCESSING AND TESTING

(2013 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*

**Q1)** a) Explain in detail the following additives: Antioxidants, Plasticizers, Antistatic agents, Blowing agents. **[4]**

b) Explain different principles of mixing used in processing. **[3]**

c) Discuss compounding of PVC with one example. **[3]**

**Q2)** a) Explain with neat diagram Devolatilization Extrusion process. **[4]**

b) Explain Tubing Extrusion die equipped with internally cooled sizing mandrel. **[3]**

c) Explain with neat sketch Reactive Extrusion with one example. **[3]**

**Q3)** a) Explain the following: Parison Sag, Wall thickness control in blow molding. **[5]**

b) Explain in detail different Downstream Equipments and Auxiliary Units For Film extrusion Lines. **[5]**

**P.T.O.**

- Q4)** a) Write a note on “Heat Transfer analysis in Thermoforming”. [4]  
b) Discuss different parameters which affect the thickness distribution of Thermoformed product. [3]  
c) Discuss in detail Rotational Molding. [3]
- Q5)** a) Explain in detail Flexural test with its significance. test methods. [4]  
b) Write a note on Creep and Stress relaxation. [3]  
c) Discuss classification of polymeric materials with applicable Tensile Stress-strain curves. [3]
- Q6)** a) Explain the importance of ASTM standards, Preparations of test Samples and Conditioning in testing. [3]  
b) Discuss radiography, optical Non-destructive test methods with one example. [4]  
c) Explain the importance of Compression test. [3]
- Q7)** a) Discuss different parameters which affect the electrical properties of polymers. [4]  
b) Write a note on Arc resistance Measurement. [3]  
c) Write a note on Dielectric strength Measurement. [3]
- Q8)** a) Explain any one method used for testing of plastic tank product. [4]  
b) Write a note on “Fire Resistance test and its applications”. [3]  
c) Discuss HDT and VST test methods used for polymers. [3]



Total No. of Questions : 8]

SEAT No. :

P4421

[Total No. of Pages : 2

[4760]-1264

M.E. (Polymer Engineering)

**POLYMER PHYSICS AND CHARACTERIZATION**

**(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions from total eight questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** a) Sketch a typical thermogram obtained from DSC for an amorphous and crystalline polymers. Show and discuss the various transitions. [4]

b) Write a note on refractive index detector and UV detectors used in GPC. [6]

**Q2)** a) Write a detailed note on SAXS. [6]

b) Discuss in details the terms hydrodynamic volume and radius of gyration in context with polymer molecules. [4]

**Q3)** a) Write a short note on dielectric analysis of polymers. [5]

b) Explain in detail <sup>13</sup>C NMR technique. [5]

**Q4)** a) TGA test is to be run on Nylon 66 sample. Will it possible to detect the percentage moisture absorption and degradation temperature using TGA? Show the same on TGA thermogram. Explain the constructional features of the instrument used for TGA. [5]

b) Explain the concept of spin-spin coupling in NMR with an example. [5]

**P.T.O.**

- Q5)** a) Discuss the following storage modulus, loss modulus and loss tangent. **[6]**  
b) Explain the terms - volume resistivity, surface resistivity, break down voltage and relative permittivity. **[4]**
- Q6)** a) Explain the terms solubility parameter and cohesive energy density. **[4]**  
b) What is proton shielding and de-shielding in  $^1\text{H}$  NMR? Explain with examples. **[6]**
- Q7)** a) State the Mark-Howink equation. Explain what is meant by size exclusion chromatography technique. **[5]**  
b) Discuss creep and stress relaxation in polymers. Explain relevance of creep curves and stress relaxation curves. **[5]**
- Q8)** a) Discuss Dispersive IR and FTIR techniques. Explain the construction of the instrument used for these techniques. **[6]**  
b) List the various techniques used in determination of crystallinity in polymers. Write down basic principles of these techniques. **[4]**



Total No. of Questions : 8]

SEAT No. :

**P4422**

**[4760] - 1265**

[Total No. of Pages :2

**M.E. (Polymer Engineering)**  
**POLYMER STRUCTURE AND PROPERTIES**  
**(2013 Credit Pattern) (Semester - II) (509123)**

*Time : 3Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any 5 questions from total 8 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1)** a) What are various factors which make polydimethylsiloxane (PDMS) as one of the most flexible polymer? [3]
- b) With suitable examples explain the effect of various types of bonds between carbon and Oxygen on polymer properties. [4]
- c) Comment on the structural features which resist internal rotation. [3]
- Q2)** a) What are Spherulites? Comment on the factors affecting their growth as well as their effect of properties. [5]
- b) Comment on the significance of morphology in fibers and films properties. Give suitable example. [5]
- Q3)** a) Explain the concept of average molecular weight and molecular weight distribution. Comment on their requirements for manufacturing fibers. [5]
- b) Give at least one example of aromatic polyamide (Aramids) and linear aliphatic polyamide (Nylons) used in fibers. w.r.t. structure, explain why aramids have better mechanical and thermal properties compared to Nylons. [5]
- Q4)** a) What are various transitions seen in polymers? [2]
- b) Explain how additives affect these transitions. [3]
- c) What do you understand by multiphase systems? Miscibility affects properties of polymer blends. Justify the statement. [5]

- Q5)** a) Explain how bond polarity and bond type effects electrical properties of polymer. Give suitable examples. [6]  
b) With suitable example explain the effect of processing conditions on polymer properties, thereby, polymer properties. [4]
- Q6)** a) What are various theories of polymer crystallization? Explain any one. [6]  
b) Hydrogen bonding affects polymer properties. Do you agree with statement? Justify with suitable example. [4]
- Q7)** a) Comment on the Thermodynamic factors affecting polymer properties. [5]  
b) Write a short note on various factors affecting adhesion properties of polymers. [5]
- Q8)** a) What are polymer nanocomposites? Explain the concept of exfoliation and intercalation. Draw appropriate sketches. [4]  
b) Why polymers having nano-fillers have better barrier properties? [3]  
c) Briefly explain the concept of dendrimers and hyperbranched polymers. [3]



Total No. of Questions : 8]

SEAT No. :

**P4264**

[Total No. of Pages : 3

**[4760]- 1266**

**M.E. (Polymer Engineering)  
POLYMER RHEOLOGY  
(2013 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max Marks :50*

*Instructions to the candidates:*

- 1) *Solve any five questions from total 8 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Correct section of runner of 50 mm length in an injection mould is to be selected based on the minimum pressure drop as per the designer's requirement. Full circular, half circular and rectangular are the three sections considered by him. Runner diameter for circular or half circular of 8 mm can be accommodated and section size of 5 mm by 8 mm for rectangular section can be accommodated. The mould is designed for flow rate of 25 gms/sec for the polymer whose melt density is 0.8 gms per cubic centimetre. The polymer follows the power law of the form  $\tau = 2,00,000 \gamma^{0.5}$  where  $\tau$  is in  $\text{N/m}^2$  and  $\gamma$  is in  $\text{sec}^{-1}$

What should be the choice? **[4]**

- b) An injection mould of eight cavities is to be designed for balanced flow. Suggest at least one balanced as well as one un-balanced layout. For un balanced layout suggest the methodology to balance the runner system. **[4]**
- c) Write in short about Planar Extension. **[2]**

**Q2) a)** Explain Boltzmann Superposition Principle. **[5]**

- b) Explain in detail at least two rheological models for extensional viscosity. **[5]**

**P.T.O.**

- Q3)** a) A certain polymer exhibits non-Newtonian behavior conforming to power law with constants  $n = 0.4$  and  $k = 10$  ( $\text{Pasec}^{0.4}$ ) The solution flows through a tube having 20 mm diameter with a flow rate of  $200 \times 10^{-3} \text{ m}^3/\text{hr}$  under laminar flow. Calculate the velocity at the centre and also 5 mm away from the centre. Also calculate wall shear stress and shear rate for the pressure gradient of the flow of 40 K Pa/m [4]
- b) Write in short about effect of following process parameters on Polymer rheology. [4]
- i) Plasticizer addition
- ii) Inert filler addition
- c) Write in short about WLF equation. [2]
- Q4)** a) Obtain an expression for the wall shear rate for the Non-Newtonian flow through a parallel plate. [4]
- b) Analyze Maxwell Model for static stress relaxation. [4]
- c) Write in short about Ryan Johnson Criteria. [2]
- Q5)** a) Write in short about- [3]
- i) Loss tangent  $\tan \delta$
- ii) Concentric cylinder rheometer
- b) Write in short about phase separated block and graft copolymers. [4]
- c) Explain the various effects of normal stress differences in case of polymeric fluid flow. [3]
- Q6)** a) Prove that Non-Newtonian index of Power law model is the ratio of activation energy of flow at constant rate of shear to that at constant shear stress. [5]
- b) Write in short about Turbulence damping (Tom's Effect). [5]

- Q7)** a) Write in short about the concept of constant stress and constant strain rate rheometer. [4]  
b) Discuss Ellis model for polymeric flow. [3]  
c) Write in short about non-linear viscoelasticity. [3]
- Q8)** a) Discuss effect of molecular weight distribution on polymer rheology. [4]  
b) Discuss the use of online rheometer. [3]  
c) Write in short about Zener model. [3]



Total No. of Questions : 8]

SEAT No. :

**P4423**

**[4760] - 1267**

[Total No. of Pages :2

**M.E. (Polymer Engineering)**  
**TRANSPORT PHENOMENON IN POLYMERS**  
**(2013 Credit Pattern) (Semester -III) (509128)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain Divergence of vector field with help of suitable mathematical expression and its usage in Transport Phenomena. **[5]**

b) Explain with necessary expressions the unit, symmetric tensor. **[5]**

**Q2) a)** With the help of neat diagram explain the components of the tensor for non Newtonian radial flow between parallel disks. **[4]**

b) Discuss the term polymer deformation. **[4]**

c) Explain Stress Tensors. **[2]**

**Q3) a)** Discuss in detail Bingham, Ostwald-de Waele Model for non Newtonian fluids. **[5]**

b) Explain the importance of elastic and viscous effects with one example. **[3]**

c) Discuss the pressure and temperature dependence of viscosity. **[2]**

**Q4) a)** Discuss the effect of viscosity of non Newtonian fluids in mixing operation. **[5]**

b) Discuss with applicable diagram flow phenomena through a circular tube. **[5]**

**P.T.O.**

- Q5)** a) Explain in detail mass transport through polymeric films. [3]  
b) Discuss applicable theories of diffusion through polymers. [3]  
c) Derive the permeability equations for diffusion in solids. [4]
- Q6)** a) Write a short note on factors affecting Permeability of polymers. [4]  
b) Discuss with three examples different application of Diffusion in polymer field. [4]  
c) Discuss the term Diffusion Coefficient. [2]
- Q7)** a) Explain in details the applicable tray tower design method used in distillation. [5]  
b) Explain with neat diagram equipment used in liquid-liquid extraction. [5]
- Q8)** a) Explain in details heat conduction with viscous heat generation of fluid flow. [5]  
b) Compare Forced Convection and Free Convection Heat transfer and also explain the importance of both in polymer processing. [5]



Total No. of Questions : 3]

SEAT No. :

**P4265**

[Total No. of Pages : 2

[4760] - 1268

**M.E. (Printing Engineering)**

**PROBABILITY, STATISTICS & REGRESSION ANALYSIS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer all the questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Electronic Pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Attempt Any Two :

- a) In a certain factory turning out razor blades, there is a small change of  $1/500$  for any blade to be defective. The blades are supplied in a packet of 10. Use Poission distribution to calculate the approximate number of packets containing no defective and two defective blades, in a consignment of 10,000 packets. **[9]**
- b) A throw is made with two dice. Find the probability of getting a score of
  - i) 10 points,
  - ii) At least 10 points,
  - iii) At most 10 points **[9]**
- c) Given the following information : **[9]**

|                    | Variable $x$ | Variable $y$ |
|--------------------|--------------|--------------|
| Arithmetic mean    | 8.2          | 12.4         |
| Standard deviation | 6.2          | 20           |

Coefficient of correlation between  $x$  and  $y$  is 0.9. Find the linear regression estimate of  $x$ , given  $y = 10$ .

**P.T.O.**

**Q2) a)** Use the data from table to make a run chart. Assume that the order of production is by column and the target measurement is .910. **[16]**

|      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|
| .912 | .910 | .911 | .904 | .905 | .910 | .910 |
| .914 | .912 | .914 | .910 | .913 | .908 | .909 |
| .907 | .909 | .913 | .813 | .912 | .909 |      |
| .902 | .906 | .908 | .909 | .907 | .906 |      |
| .915 | .909 | .909 | .910 | .911 | .912 |      |

OR

Make an x bar and R chart

| Sample Number | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Record Sample | 933 | 911 | 889 | 882 | 903 | 890 | 892 | 908 | 895 | 916 |
| Measurements  | 897 | 898 | 915 | 913 | 930 | 940 | 912 | 920 | 920 | 890 |
|               | 885 | 900 | 905 | 930 | 890 | 895 | 895 | 896 | 922 | 891 |
|               | 900 | 905 | 902 | 900 | 890 | 909 | 896 | 894 | 928 | 920 |
|               | 879 | 862 | 873 | 871 | 900 | 915 | 902 | 906 | 926 | 915 |

**Q3) a)** Planning Experiments for design. **[5]**

b) Concept of variance analysis. **[5]**

c) Experimental strategy of Design of experiments. **[6]**



Total No. of Questions : 6]

SEAT No. :

P4266

[Total No. of Pages : 1

[4760] - 1269

M.E. (Printing) (Semester - I)

PRINTING TECHNOLOGY MANAGEMENT

(2013 Pattern)

Time :2½ Hours]

[Max. Marks :50

*Instructions to the candidates:*

- 1) *All questions compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Assume suitable data if necessary.*

**Q1)** a) Explain organizational structure of a commercial printing business in detail. [9]

b) Explain different types of print products under commercial printing.[9]

OR

**Q2)** Explain any 3 problem identification techniques. [18]

**Q3)** a) What is the need for a Quality Program for a CTP unit. [8]

b) Explain how a customer driven quality program is necessary. [8]

OR

**Q4)** Explain activities of a quality assurance department in a book binding department. [16]

**Q5)** Explain the Six Sigma process. What are the advantages in any processing industry. [16]

OR

**Q6)** What is frequency histogram? Explain its purpose in process control. [16]



Total No. of Questions : 8]

SEAT No. :

**P3938**

**[4760]-127**

[Total No. of Pages : 3

**M.E. (Mechanical) (Design Engineering)**  
**RELIABILITY ENGINEERING**  
**(2008 Course) (Semester-II) (502211)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of non-programmable electronic calculators is allowed.*

**SECTION-I**

- Q1)** a) Explain quality and reliability assurance rules with practical examples. **[8]**
- b) Following table shows the test results of 900 machine components, tested simultaneously. Evaluate: Hazard rate, failure density function and reliability. **[8]**

|                             |     |     |     |     |     |     |     |     |     |     |      |
|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Operating Time (Hrs.)       | 0   | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
| No. of surviving components | 900 | 870 | 670 | 640 | 630 | 590 | 580 | 540 | 400 | 384 | 360  |

- Q2)** a) Explain distribution functions in brief. **[8]**
- b) The temperature inside the testing chamber is controlled by three independent thermostats whose behavioural patterns are not completely predictable. It has been observed that their cut off temperatures is higher than the temperatures to which they are set. Assuming these excess temperatures are independent normal variants  $T_a$ ,  $T_b$ ,  $T_c$  with means  $2^\circ\text{C}$ ,  $2.5^\circ\text{C}$ ,  $3^\circ\text{C}$  and coefficient of variation 20%, 20%, 25% respectively, What is the probability that maximum excess temperature will exceed  $4^\circ\text{C}$ ? **[8]**

**P.T.O.**

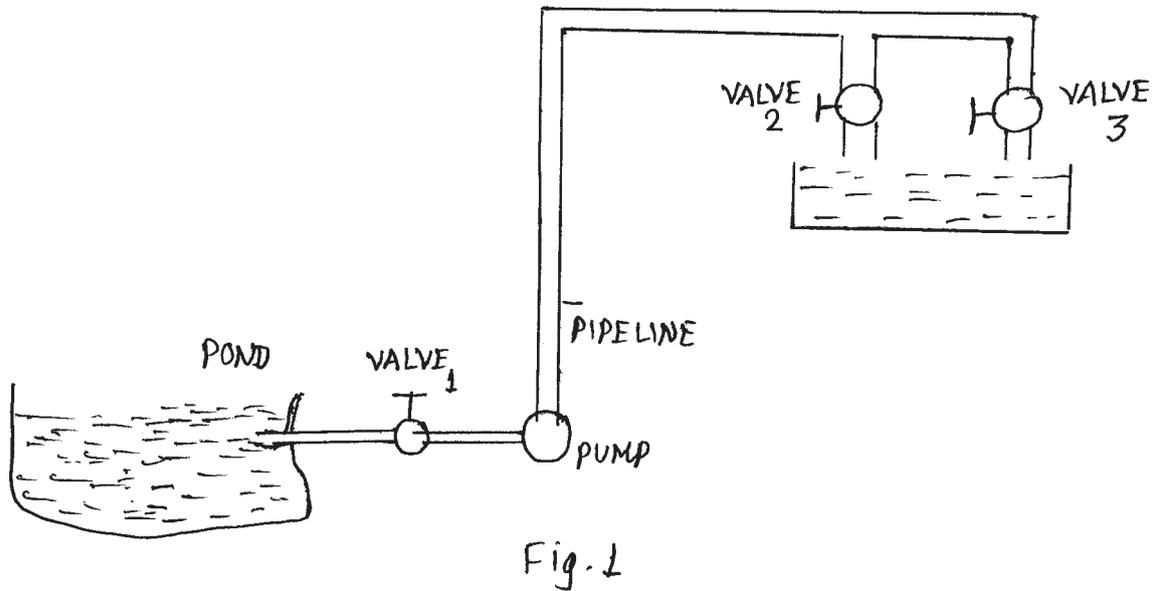
- Q3)** a) Explain stand by redundancy with their types. [8]
- b) A television camera focus system has 8 components in series. Each components failure has an exponential distribution with a failure rate of 40 per  $10^6$  hours. Determine reliability at the end of 6,000 hours of operation. Also calculate MTTF for the system. If a reliability of 0.98 is desired after 6,000 hours for the television camera, what should be the failure rate for each component? [8]
- Q4)** Write short note (Any three): [18]
- a) Laws of probability.
- b) Cut set and tie set method.
- c) Markov analysis.
- d) Life characteristics phases.

## SECTION-II

- Q5)** a) Discuss the role of reliability and maintainability trade off in system reliability. [8]
- b) An mechanical component has to be designed that its minimum reliability is 0.85, for an operation time of 1500 hours. The minimum availability value over the same period has to be 0.99. Estimate time to failure and mean repair time. [8]
- Q6)** a) Discuss the reliability predictions from predicted unreliability. [8]
- b) Different six mechanical components are connected in series with reliabilities 0.8, 0.86, 0.88, 0.72, 0.78 and 0.92. Calculate the system reliability. If the reliability is to be increased to a value of 0.80, how should be this apportioned among the six units according to minimum effort method. [8]

**Q7) a)** Explain reliability testing with any one practical example. [8]

b) For the system shown in Fig. 1 which consist of three valves, a pump, a pipeline and a tank to collect water pumped from the pond, construct a fault tree corresponding to the top event: “no flow of water into the tank”. [8]



**Q8) Write short note (Any Three):** [18]

- a) Strength based reliability.
- b) AGREE method.
- c) Monte Carlo evaluation.
- d) Maintainability.



Total No. of Questions : 3]

SEAT No. :

**P4267**

**[4760]-1270**

[Total No. of Pages : 1

**M.E. (Printing Engineering & Graphic Communication)**

**MODERN TRENDS IN PRINTING**

**(2013 Credit Pattern) (Semester-I) (508103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Draw neat diagram wherever necessary.*
- 2) *Figures to the right side indicate full marks.*

**Q1)** Explain in detail flexo press configurations. **[18]**

OR

Explain the unit configuration of offset. **[18]**

OR

Explain in detail optimization of flexo photopolymer plate. **[18]**

OR

Explain in detail effect of speed on printability. **[18]**

**Q2)** Explain the working of shaftless technology. **[16]**

OR

Explain the pressurization systems for impression roller. **[16]**

**Q3)** Mention the care and maintenance for flexo plates. **[16]**

OR

Explain the effect of climatic conditions on printability. **[16]**



Total No. of Questions : 3]

SEAT No. :

**P4268**

**[4760] -1271**

[Total No. of Pages :1

**M.E. (Printing)**

**RESEARCH METHODOLOGY**

**(2013 Credit Pattern) (Semester - I) (508104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer all the questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Electronic Pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Attempt any THREE.

**[6×3 = 18]**

- a) Explain the term hypothesis.
- b) What is research design? Write important concept relating to research design.
- c) Define research? What are the characteristics & objectives of research?
- d) What precautions are to be taken in collection of data? Indicate the limitations in data collection.

**Q2)** Attempt any TWO.

**[8×2 = 16]**

- a) What do you understand by research report or thesis?
- b) Indicate the general format of research report and mention its specific category.
- c) Differentiate between footnotes and bibliography or references.

**Q3)** Attempt any TWO.

**[8×2 = 16]**

- a) How is Research Proposal done?
- b) Describe different types of technical papers.
- c) Explain the aspects of trade related intellectual property rights.



Total No. of Questions : 4]

SEAT No. :

P4424

[Total No. of Pages : 2

**[4760] - 1272**  
**M.E. (Printing)**  
**COLOR SCIENCE**  
**(2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Explain following terms:

**[9]**

- a) Simultaneous Contrast
- b) Retinal After image
- c) Color Temperature

OR

Differentiate between:

Perceptability Vs Acceptability

**Q2)** What is metamerism? Explain; degree of metamerism. Index of metamerism and color inconstancy in greater details. **[9]**

OR

What is Mac Adam Ellipse? Explore its use in color matching.

**Q3)** What is profiling? What are its different types; explain in greater details. **[16]**

OR

Which are the 4 C's of color management one must follow to get consistency and quality in printing?

**P.T.O.**

**Q4)** Explain with the help of suitable diagram how materials modify the light via:[16]

- a) Transmission
- b) Absorption

OR

What is light scattering? Explain its effect on color perception, measurement etc. in details with the suitable diagram?



Total No. of Questions : 3]

SEAT No. :

**P4269**

[Total No. of Pages : 2

[4760] - 1273

**M.E. (Printing Engineering & Graphic Communication)**

**WEB HANDLING ON PRESS**

**(2013 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Draw neat diagram wherever necessary.*
- 2) Figures to the right indicate full marks.*

**Q1)** Explain the web viewing system for a press.

**[18]**

**OR**

Explain the treatments required on the substrate.

**OR**

Explain in detail the tension control system for a press.

**OR**

Explain in detail circumferential register control system.

**Q2)** Explain in detail balancing of rollers.

**[16]**

**OR**

Explain the correction methods for guiding a web.

**P.T.O.**

**Q3)** Explain the role of web transport rollers in a press.

**[16]**

**OR**

Write notes on:

- a) Lead-in and Lead-out rollers
- b) Idler Roller specifications.



Total No. of Questions : 3]

SEAT No. :

**P4270**

**[4760]-1274**

[Total No. of Pages : 1

**M.E. (Printing Engineering and Graphic Communication )**

**SUBSTRATE AND INK**

**(2013 Credit Pattern) (Semester-II) (508109)**

*Time : 2Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data wherver necessary.*

**Q1) a) Explain paper manufacturing process. [6]**

b) Discuss any two optical properties of paper and testing methods. [6]

c) What are metallic inks? [6]

**Q2) Calculate the total quantity of paper required in the size  $45.5 \times 58.5$  cms for printing monthly magazine 500 copies in the size  $210 \text{ mm} \times 297 \text{ mm}$  assuming the magazine contains 32 pages. [16]**

**Q3) Write notes on: [16]**

a) Quality control for substrate and ink.

b) Sustainability and Waste management.



Total No. of Questions : 3]

SEAT No. :

**P4271**

[Total No. of Pages : 1

**[4760] - 1275**

**M.E. (Printing Engineering and Graphic Communication)**

**PRINTED ELECTRONICS AND RFID**

**(2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Assume suitable data wherever necessary.*
- 3) *Figures on right indicate marks.*

**Q1) a) What do you mean by Organic Electronics? [6]**

b) Explain Conventional method of electronics manufacturing. [6]

c) Write in detail about conductive ink. [6]

**Q2) Explain working principal of RFID. Discuss merits and demerits of using RFID for item level tagging. [16]**

**Q3) Discuss various applications of Organic electronics. [16]**



Total No. of Questions : 3]

SEAT No. :

**P4272**

**[4760] - 1276**

[Total No. of Pages :1

**M.E.**

**Pringing Engineering & Graphic Communication  
ADVANCES IN CONVERTING AND PACKAGING  
(2013 Credit System) (Semester - III) (608102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Draw neat diagram wherever necessary.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Explain the importance of security features in packaging. **[18]**

OR

Explain in detail coating techniques for packaging. **[18]**

OR

Explain in detail types of lamination for converting. **[18]**

OR

Explain the different types of wrapping techniques. **[18]**

**Q2)** Explain the Bag-in-Box for solid products. **[16]**

OR

PET Bottles play an important role in packaging. Explain. **[16]**

**Q3)** Explain in detail FFS machines for packaging. **[16]**

OR

Explain the trends in barrier technology. **[16]**



Total No. of Questions : 8]

SEAT No. :

**P3789**

**[4760]-128**

[Total No. of Pages : 2

**M.E. (Mechanical - Design Engineering)**

**ENGINEERING FRACTURE MECHANICS**

**(2008 Course) (Semester - II) (Elective - III) (502211 - B)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Question No. 4 & 8 are compulsory.*
- 2) *Solve any two questions out of 1, 2 & 3 and solve any two questions out of 5, 6 & 7.*
- 3) *Answers to the two sections should be written in separate answer books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of logarithmic tables, slide rule and non-programmable electronic pocket calculator is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** For the infinite plate loaded by an applied uniaxial stress  $\sigma$ , derive the expression for maximum stress. **[16]**

**Q2)** Explain the experimental procedure to quantify the fracture toughness. **[16]**

**Q3)** List and explain the expression for stress field around crack tip (center crack of length  $2a$  in the infinite plate) during mode I loading. **[16]**

**Q4)** Write a short note on: **[18]**

- a) Crack modes and SIF
- b) Fracture toughness
- c) Plastic constraint

**P.T.O.**

## SECTION - II

**Q5)** Explain the numerical methods to evaluate fracture toughness. [16]

**Q6)** Explain the procedure to measure fatigue crack growth rate. [16]

**Q7)** Explain the different stages of fatigue crack initiation and propagation. [16]

**Q8)** Write a short note on the following: [18]

- a) Paris law
- b) Creep strength
- c) J - Integral

*EEE*

Total No. of Questions : 10]

SEAT No. :

**P4314**

**[4760] - 129**

[Total No. of Pages :2

**M.E. (Mechanical) (Design Engg.)**  
**COMPUTER AIDED ENGINEERING**  
**(2008 Course) (Semester - II) (Elective - III) (502211 C)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is Modeling? Write its design procedure in detail. [8]  
b) Discuss the design procedure of simulation and its application? [8]
- Q2)** a) What is concept of geometric modeling technology? [8]  
b) What is need of data exchange system? [8]
- Q3)** a) Write in detail features based modeling? [8]  
b) Explain in detail topology in geometry. [10]
- Q4)** a) What is need of FEM? [8]  
b) What are major steps in FEA software. [8]

**P.T.O.**

- Q5) a)** Write short note on [10]  
i) Need of Meshing  
ii) Data exchange mechanism  
b) Discuss in detail Mechanical design criteria? [6]

**SECTION - II**

- Q6) a)** Write in detail concept of CAD. [8]  
b) Explain need of Von Misses stresses. [8]
- Q7) a)** Explain in detail design of component for stress analysis. [8]  
b) Explain in detail need of FEA software. [8]
- Q8) a)** Explain in detail verification of result for component analyzed. [8]  
b) Define CFD? Write formulation of CFD problem? [10]
- Q9) a)** Explain solution algorithm in detail? [8]  
b) What are features of CFD modeling for steady in compressible flow?[8]
- Q10)a)** Write short notes on [8]  
i) Modeling of fluid properties  
ii) Modeling pressure drop  
b) What is a role of CFD software in engineering applications? [8]



Total No. of Questions : 8]

SEAT No. :

**P4551**

[Total No. of Pages : 3

**[4760] - 13**

**M.E. (Civil) (Construction and Management)**

**PROJECT ECONOMICS AND FINANCIAL MANAGEMENT**

**(2008 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any 3 questions from each section.*
- 2) *Q. No. 1 & 5 are compulsory.*
- 3) *Solve any two from remaining in each section.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule and electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Dealing with the objectives of F.M. explain in detail.
- i) Profit/Earning per share (EPS) maximization approach. **[5]**
  - ii) Wealth maximization approach. **[5]**
- Give suitable examples.
- b)** Explain role of finance manager related to **[8]**
- i) Investment Decision
  - ii) Dividend policy decisions
  - iii) Working capital management
  - iv) Attainment of financial objectives

- Q2)** As a finance manager how you assess/measure the risk associated with an asset from both behavioural and a quantitative/Statistical point of view. Give the required statistical formulae and suitable examples for the techniques considered. **[16]**

***P.T.O.***

- Q3) a)** Write short notes on : [8]
- i) Portfolio expected return
  - ii) Portfolio Risk (Two Asset portfolio)
- b) With the help of neat sketch, discuss [8]
- i) Perfect positive correlation
  - ii) Perfect negative correlation
  - iii) Zero correlation
- Q4) a)** Discuss the elements of Capital Asset Pricing Model (CAPM). [6]
- b) Discuss the following with respect to one step optimization technique for portfolio selection. [6]
- i) Efficient frontier
  - ii) Global maximum return portfolio
  - iii) Global minimum variance portfolio
  - iv) Efficient portfolios
  - v) Dominated portfolios
  - vi) CML
- c) Define the terms. [4]
- i) Systematic Risk
  - ii) Non - Systematic Risk

### **SECTION - II**

- Q5) a)** Discuss in detail the "Cash Budget" as a tool of planning. [8]
- b) Giving the definitions of Gross Working Capital and Net Working Capital (NWC), discuss the effect of change in level of current assets and current liabilities on the profitability risk trade-off. [10]

- Q6)** a) A factory producing only one item, which it sells for Rs. 12.50 per unit, has a fixed cost equal to Rs. 60,000 and variable cost Rs. 7.50 per unit. Find out [6]
- i) The number of units to be produced to break-even.
  - ii) Number of units to be produced to earn a profit of Rs. 12,000/-.
  - iii) The profit, if 25,000 units are produced and sold.
- b) In depreciation Enlist. [4]
- i) The factors affecting the periodic depreciation
  - ii) Reasons for depreciation.
  - iii) Methods of depreciation (explain any one)
- c) Differentiate between cost control and cost reduction. [3]
- d) State the characteristics of Trade Cycle. [3]
- Q7)** a) Discuss the actions taken by CIDC and its recommendations regarding financing requirement of the construction sector. [8]
- b) How is the "Working Capital in Construction Industry" estimated? Explain in detail. [8]
- Q8)** a) Discuss the Lender's perspective in assessment of Risk of a big construction project. Discuss role of Lender's Engineer. [12]
- b) Discuss in detail with factual figures the management of funds for Konkan Railway Project or any similar project. [4]



Total No. of Questions : 10]

SEAT No. :

P3790

[Total No. of Pages : 3

[4760] - 130

**M.E. (Mechanical) (Design Engineering)**

**VEHICLE DYNAMICS (Elective - IV)**

**(2008 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in brief the combined pitch and bounce motion an application to multi wheel station vehicles. [8]
- b) The sprung parts of a passenger car weigh 10 KN and the unsprung parts weigh 950 N. The combined stiffness of the suspension springs is 48.5 KN/m and that of the tires is 641 KN/m. Determine the two natural frequencies of bounce motion of the sprung and unsprung mass. [8]
- Q2)** a) A rear engine rear wheel drive passenger car has a mass of 1200 kg. The weight distribution on the front axle is 38 % and that on rear axle is 69 % under static condition. If cornering stiffness each of the front tires is 34 KN/rad and that of rear tires is 37 KN/rad determine the steady state handling behavior of the vehicle. If the vehicle has wheel base of 2.31 m find critical/characteristics speed of vehicle. [8]
- b) Explain Kinematic behavior of vehicles with rigid wheels and with complaint tires. [8]

**P.T.O.**

**Q3)** a) Derive an expression for the steer angle  $\delta_f$  required to negotiate a given turn with usual notations. [8]

b) Explain most commonly used frequency weightings for whole-body vibration with example. [8]

**Q4)** What are test carried out for determining handling characteristics of vehicle? Explain each test in detail [16]

**Q5)** Write short notes on : [18]

a) Two degrees of freedom vehicle model for pitch and bounce.

b) Characteristic and Critical speeds.

c) Effect of wheelbase in road and suspension modelling

## SECTION - II

**Q6)** A passenger car weighs 1.5 kN and has a wheelbase of 2.4 m. The center of gravity is 0.85 m behind the front axle and 0.54 m above ground level. The braking effort distribution on the front axle is 68%. The coefficient of rolling resistance is 0.03. Determine which set of the tires will lock first on two road surfaces: one with a coefficient of road adhesion  $\mu = 0.8$ , and the other with  $\mu = 0.2$ . [16]

**Q7)** A passenger car weighs 20 kN and has a wheelbase of 2.8 m. The center of gravity is 1.3 m behind the front axle and 50 cm above ground level. In practice, the vehicle encounters a variety of surfaces, with the coefficient of road adhesion ranging from 0.2 to 0.8 and the coefficient of rolling resistance of 0.015. With a view to avoiding the loss of directional stability on surfaces with a low coefficient of adhesion under emergency braking conditions, what would you recommend regarding the braking effort distribution between the front and rear axles? [16]

**Q8)** Explain with the help of labeled sketch mechanism and handling of tracked vehicle (military vehicle). **[16]**

**Q9)** a) Explain two degree of freedom theory to include effects of traction and braking. **[8]**

b) Explain in Brief the analysis of sprocket torques and speeds, required to skid steer a tracked vehicle. **[8]**

**Q10)** Write short notes : **[18]**

a) Steering force and moments.

b) Types of dependent and independent suspensions.

c) ISO Standard for Human Response to Vibrations.



Total No. of Questions : 10]

SEAT No. :

**P3939**

[Total No. of Pages : 2

**[4760] - 131**

**M.E. (Mechanical) (Design Engineering)**

**INDUSTRIAL TRIBOLOGY**

**(2008 Pattern) (Elective - IV(b))**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answer 3 questions from Section - I and 3 questions from Section - II.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to right indicate full marks.*
- 6) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) State and Explain various factors affecting wear. [8]  
b) Derive equation for the law of adhesive wear as proposed by Archad.[8]
- Q2)** a) State possible causes of friction. [8]  
b) Discuss various types of friction and Explain Coulomb classical theory of friction. [8]
- Q3)** Derive the full Reynolds equation with assumptions and its significant terms. [16]
- Q4)** a) Derive expression for flow rate through rectangular slot. What are assumptions made while deriving the equation? [8]  
b) State advantages, limitations and applications of hydrostatic bearings. [8]
- Q5)** Write a short note on (Any THREE) : [18]  
a) Tribology in industry.  
b) Heat in bearings.  
c) Petroff's equation.  
d) Tribological properties of lubricants.

**P.T.O.**

## SECTION - II

- Q6)** Derive Ertel-Grubin equation in case of elasto hydrodynamic lubrication. Discuss the shortcomings in this equation. **[16]**
- Q7)** a) Explain Gas lubricated bearings and state advantages and disadvantages of gas bearings. **[8]**  
b) Rayleigh step bearing has the greatest load carrying capacity of all slider shapes. Explain. **[8]**
- Q8)** For Non -Newtonian behavior of lubrication oils explain the following. **[16]**
- a) Bingham fluids
  - b) Thixotropy
  - c) Pseudo plastic flow
  - d) Dilatancy
  - e) Elasticity
- Q9)** a) With the simple sketch resolve the frictional effects in Tyre -road contact. **[8]**  
b) Explain tribological aspect of rolling motion. **[8]**
- Q10)** Write a short note on (Any THREE) : **[18]**
- a) Elasto-hydrodynamic lubrication.
  - b) Tilting pad bearing.
  - c) Hertz Theory.
  - d) Piston pin lubrication.



Total No. of Questions : 8]

SEAT No. :

**P4527**

**[4760] - 133**

[Total No. of Pages : 2

**M.E. (Mechanical) (Mechatronics)**  
**APPLIED NUMERICAL METHODS AND COMPUTATIONAL**  
**TECHNIQUES**  
**(2008 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** Find approximate value of  $y$  at  $x = 4$ . The governing differential equation is  $dy/dx = 1 + xy$  with  $y(0) = 2$

Using RK II order method find  $y(0.1)$ ,  $y(0.2)$  **[16]**

**Q2)** Solve the following set of differential equations using Euler's method.

Given  $x = 0$ ,  $y_1 = 4$  and  $y_2 = 6$ . Integrate to  $x = 2$  with step size  $h = 0.5$

$$\frac{dy_1}{dx} = 0.5y_1 \quad \text{and} \quad \frac{dy_2}{dx} = 4 - 0.3y_2 - 0.1y_1 \quad \text{[16]}$$

**Q3)** a) Compute L and U matrices for the following matrix. **[9]**

$$\begin{bmatrix} 2.00 & -1.00 & 0.00 \\ -1.00 & 2.00 & -1.00 \\ 0.00 & -1.00 & 2.00 \end{bmatrix}$$

b) Calculate inverse of the matrix in Q3(a) using suitable numerical method. **[9]**

**P.T.O.**

- Q4)** a) Fit a straight line to the points (1,0.5), (2,2.5),(3,2),(4,4),(5,3.5),(6,6) and (7,5.5) using linear regression. [8]
- b) Apply Lagrange's interpolation formula to find a polynomial which passes through the points (0,-20),(1,-12),(3,-20) and (4,-24). [8]

### SECTION - II

**Q5)** Evaluate  $I = \int_1^2 \int_1^2 \frac{1}{x+y} dx dy$  using Trapezoidal rule with  $h = k = 0.25$  [16]

**Q6)** Use Predictor Corrector Method to calculate  $y$  at  $x = 4$  with step size  $h = 1$  and initial conditions as  $y = 0$  at  $x = 0$  for the differential equation.

$$\frac{dy}{dx} = 12x^2 - 20x + y^2 \quad [16]$$

- Q7)** a) Compare Simpson's One Third rule and Simpsons 3/8 rule used for numerical integration. [8]
- b) Write a short note on Implicit method to solve partial differential equations. [8]

**Q8)** For axially loaded column, it follows that, [18]

$$\frac{d^2 y}{dx^2} = \frac{M}{EI}$$

with usual notations. As  $M = -Py$  it reduces to

$$\frac{d^2 y}{dx^2} + p^2 y = 0, p = \frac{P}{EI}$$

For  $E = 10(10^9)Pa$ ,  $I = 1.25(10^{-5})m^4$ ,  $L = 3$  Determine eigen values of two interior nodes using polynomial method.



Total No. of Questions : 8]

SEAT No. :

**P4710**

[Total No. of Pages : 2

**[4760] - 134**

**M.E. (Mechanical) (Mechatronics)**

**MECHANICAL & ELECTRONIC MEASUREMENTS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any THREE questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) With respect to principle of operation, working and applications, describe Vortex Flow meter. [9]  
b) Differentiate between Regression analysis and Correlation analysis. [9]
- Q2)** a) Describe Hot wire anemometer with two modes of applications. [8]  
b) Explain the infrared imaging system [8]
- Q3)** a) For a Mcleod gauge, with a capillary of 1 mm diameter and effective bulb volume of 80 cc find the reading as indicated by mercury column for 10 Pascal pressure. [8]  
b) Elaborate various standards used in measurements. [8]
- Q4)** a) A Thermometer is calibrated between 145°C and 215°C. The specified accuracy is within  $\pm 0.25\%$  of instrument span. Find maximum static error. [8]  
b) Explain with block diagram of working of logic analyzer. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain any one surface finish measuring instrument. [8]  
b) Describe effect of EMI [8]
- Q6)** a) An analog voltage signal whose highest significant frequency is 1 KHz, is to be digitally coded with resolution of 0.01% covering a voltage range of 0 – 10 V. Determine [9]  
i) Minimum no. of bits in the digital code  
ii) Analog value of LSB  
iii) RMS value of Quantization error.  
b) Explain binary weighted DAC used in instrumentation. [9]
- Q7)** a) With an suitable example describe the significance and advantages of impedance matching. [8]  
b) Write a short note on Hall Sensor. [8]
- Q8)** a) With respect to Op-Amps describe schematic and advantages of instrumentation amplifier. [8]  
b) Describe with a neat diagrammatic sketch, successive approximation register based ADC. [8]



Total No. of Questions : 8]

SEAT No. :

**P3791**

**[4760]-135**

[Total No. of Pages : 3

**M.E. (Mechanical-Mechatronics)**  
**DESIGN OF MACHINE ELEMENTS**  
**(2008 Course) (Semester-I) (Elective-I) (502804-A)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from section-I and three questions from section-II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) How do you classify the materials for engineering use? What are the factors to be considered for selection of materials for the design of machine elements? **[8]**
- b) Explain the following heat treatment process; **[8]**
- i) Normalizing.
  - ii) Hardening.
- Q2)** a) What is factor of safety? Why it is necessary in design? **[6]**
- b) Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa. **[10]**

**P.T.O.**

**Q3) a)** Define endurance limit. Differentiate between moment and equivalent bending moment. [4]

b) A shaft is supported on bearings A and B, 800 mm between centers. A  $20^\circ$  straight tooth spur gear having 600mm pitch diameter, is located 200 mm to the right of the left handbearing A and a 700mm diameter pulley is mounted 250mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having  $180^\circ$  angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3:1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. [12]

**Q4)** Write short note on the following (Any Three): [18]

- a) ASME code of shaft design.
- b) Criteria for selecting the material for a particular application.
- c) Maximum Principle stress theory.
- d) Design procedure for Bushed-pin type flexible coupling.

## SECTION-II

**Q5) a)** What is the function of spring? Explain what you understand by A.M. Wahl's factor and state it's important in the design of helical spring? [6]

b) A single plate clutch is to be designed for a vehicle. Both sides of the plate are to be effective. The clutch transmits 30 kW at a speed of 3000 r.p.m. and should cater for an over load of 20%. The intensity of pressure on the friction surface should not exceed  $0.085 \text{ N/mm}^2$  and the surface speed at the mean radius should be limited to 2300 m/min. The outside diameter of the surfaces may be assumed as 1.3 times the inside diameter and the coefficient of friction for the surfaces may be taken as 0.3. If the axial thrust is to be provided by six springs of about 25mm meancoil diameter, design the springs selecting wire from the following gauges:[10]

|           |       |       |       |       |       |       |       |       |       |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| SWG       | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    |
| Dia. (mm) | 5.893 | 5.385 | 4.877 | 4.470 | 4.064 | 3.658 | 3.251 | 2.946 | 2.642 |

Safe shear stress is limited to 420 MPa and modulus of rigidity is 84 kN/mm<sup>2</sup>.

- Q6)** a) What is meant by hydrodynamic lubrication? Explain wedge film journal bearing. **[6]**
- b) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 percent of time, 2 kN for 20 percent of time, 1 kN for 30 percent of time and no load for remaining time of cycle. If the total life expected for the bearing is  $20 \times 10^6$  revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing. **[10]**
- Q7)** a) State and explain the factors to be considered while selecting the type of gear drives for given application. **[4]**
- b) A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500mm. The speed of the electric motor is 900 r.p.m. and the speed of the compressor shaft is desired to be 200 r.p.m. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine: 1. Module and face width of the gears using 20 degrees stub teeth, and 2. Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor. **[12]**
- Q8)** Write short note on the following: **[18]**
- a) Nipping of leaf spring.
- b) Preloading in rolling contact bearing.
- c) Explain various types of failures in rolling contact bearings.



Total No. of Questions : 10]

SEAT No. :

**P3792**

**[4760]-136**

[Total No. of Pages : 3

**M.E. (Mechanical) (Mechatronics)  
DIGITAL SIGNAL PROCESSING  
(2008 Pattern) (Semester-I) (Elective-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

**Q1) a)** What is sampling and quantization? Explain Nyquist rate criteria. **[8]**

b) Consider an analog signal

$$X_a(t) = 3 \cos(50\pi t) + 2 \sin(300\pi t) - 4 \cos(100\pi t),$$

What is the Nyquist rate for this signal? If the signal is sampled with the sampling frequency of 200 Hz, what will be the DT signal obtained after sampling? What will be the recovered signal? **[8]**

**Q2) a)** Find the Linear convolution of the input signal  $x(n) = \{1 \ 2 \ 4 \ 5\}$  and impulse signal  $h(n) = \{4 \ 7 \ 3 \ 4\}$ . **[8]**

b) Determine whether each of the following systems defined below is causal, linear, dynamic, and time variant **[8]**

i)  $y(n) = x(n^2)$

ii)  $y(n) = 2x + 3$

**P.T.O.**

- Q3)** a) Explain how Z transform can be used to find causality and stability of the system. Is it possible to design causal and stable system? If yes or no then give proper justification. [8]
- b) Find Z transform of the following discrete time signal and ROC for each [8]
- i)  $x(n) = \delta(n) + 3\delta(n - 1) - 5\delta(n - 2)$
- ii)  $x(n) = n u(n)$

**Q4)** Explain in detail the DIF-FFT algorithm using mathematical derivation and butterfly pattern for 8 data point. [16]

**Q5)** Write short note (Any Three): [18]

- a) Comparison between Linear and Circular convolution.
- b) Relation between ZT and FT.
- c) Energy and power signal.
- d) DTME.
- e) Barrel shifter.

### SECTION-II

- Q6)** a) Perform circular convolution of the following two sequences [8]
- $X_1(n) = \{1, 2, 1, 1\}$  and  $X_2(n) = \{1, 2, 3, 4\}$ .
- b) Compute the DFT of the signal  $x(n) = \{1, 3, -1, 2\}$  considering  $N = 4$ . [8]

- Q7)** a) Distinguish between microprocessor and Digital signal processor. [8]
- b) With neat block diagram explain the architectural detail of DSP chip. [8]

**Q8) a)** Obtain the system transfer function of the system defined by [8]

$$y(n) - (1/4) y(n - 1) = x(n) - (3/4) x(n - 1)$$

Also realize the same using DF-I and DF-II methods.

**b)** Give the equation for and characteristics of the following windows [8]

i) Hamming.

ii) Rectangular window.

**Q9) a)** With the help of frequency response explain HPF and LPF in detail. [8]

**b)** Explain any one application of DSP in mechatronics in brief. [8]

**Q10) Write short note on (Any Three):** [18]

a) Selection criteria for any DSP processor as per application.

b) Power spectral density.

c) Linear filtering based on DFT.

d) Modified Harvard architecture.

e) Parallel Filter structures.



Total No. of Questions : 8]

SEAT No. :

**P3793**

[Total No. of Pages : 3

**[4760] - 138**

**M.E. (Mechanical) (Mechatronics)**

**CONTROL SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

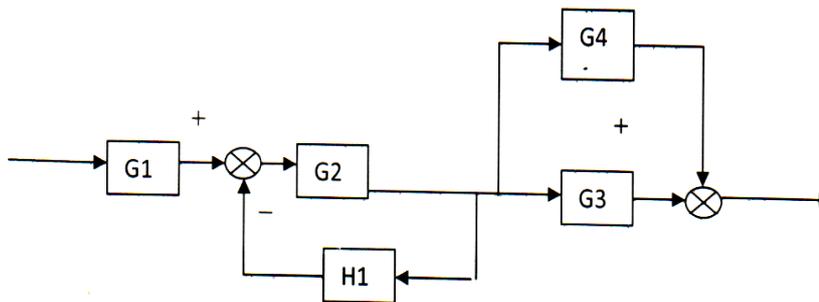
*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data, whenever necessary.*

**Q1) a) Distinguish between the following. [8]**

- i) Linear and nonlinear control systems.
- ii) Time variant and Time invariant control system.

b) Reduce the following block diagram of the system shown in following figure into a single equivalent block by block diagram reduction technique. [10]



**Q2) a) Obtain the closed loop transfer function for the above block diagram using Mason's gain formula. [10]**

b) Explain the advantage of Transfer function approach of control system. [6]

**P.T.O.**

- Q3)** a) Examine the stability by Routh's criterion for the characteristics equation.  
 $S^5 + 4S^4 + 2S^3 + 3S^2 + 3S + 4 = 0.$  [10]
- b) Describe different test signals used in control systems. [6]

- Q4)** a) The closed loop transfer function of a unity feedback control system is

$$G(S) H(S) = \frac{K}{S(S+2)(S+5)} \quad [10]$$

Sketch the root locus of the system. Determine the value K for marginal stability from the root locus.

- b) Explain the following terms. [6]
- i) State
  - ii) State variable.
  - iii) State vector.

### SECTION - II

- Q5)** a) Discuss meaning of under damped and critically damped system with respect to transient response of a system. If system has open loop transfer function as [12]

$$G(S) H(S) = \frac{25}{S^2 + 6S + 25}$$

Find the delay time, peak time, and settling time.

- b) Discuss the characteristics of integral controller and proportional controller. [6]

- Q6)** a) Write short notes on [8]

- i) Controllability
- ii) Observability

- b) Describe different composite controller modes and its features. [8]

**Q7) a)** A unity feedback control system has **[10]**

$$G(S)H(S) = \frac{80}{S(S+2)(S+20)}$$

Sketch Bode plot. Determine from it

- i) Gain crossover frequency.
  - ii) Phase crossover frequency.
  - iii) Gain margin.
  - iv) Phase margin
  - v) Stability of system.
- b) What are adaptive control systems? With block diagram explain its operation. **[6]**

**Q8) a)** What is neural control system? Explain its features with applications. **[8]**

- b) Explain the fuzzy system with the help of fuzzy logic based control system. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P3794**

[Total No. of Pages : 4

[4760] - 139

**M.E. (Mechanical - Mechatronics)**

**THEORY OF MACHINES AND MECHANISMS**

**(2008 Pattern) (Elective - II) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section I and three questions from Section II.*
- 2) *Answers to the two Sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

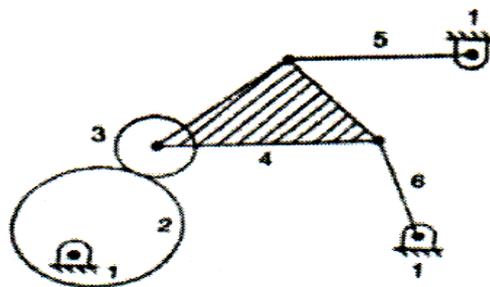
**SECTION - I**

**Q1) a)** Explain the following terms with suitable examples: **[6]**

- i) Completely constrained motion.
- ii) Incompletely constrained motion.
- iii) Successfully constrained motion.

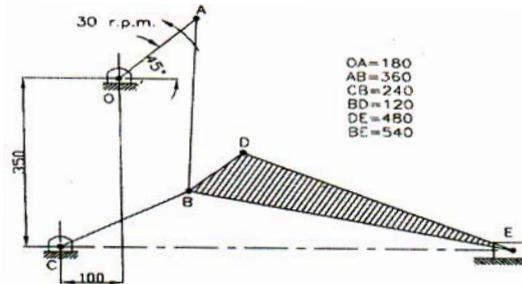
b) Define Inversion of a Mechanism? Explain with the help of neat sketches inversions of four bar chain? Give their applications? **[6]**

c) Calculate the number of degree of freedom of the mechanism as shown in fig. **[4]**

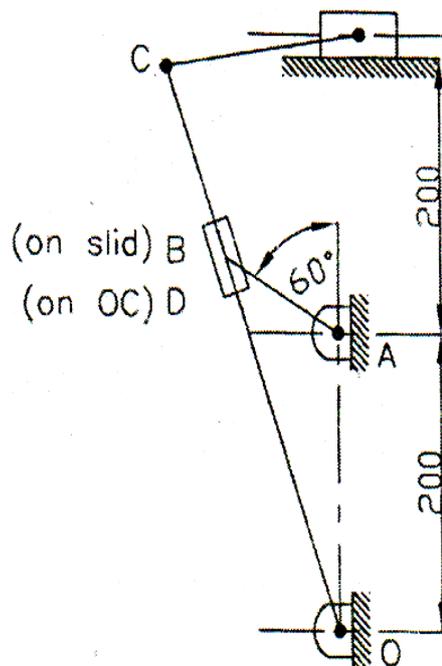


**P.T.O.**

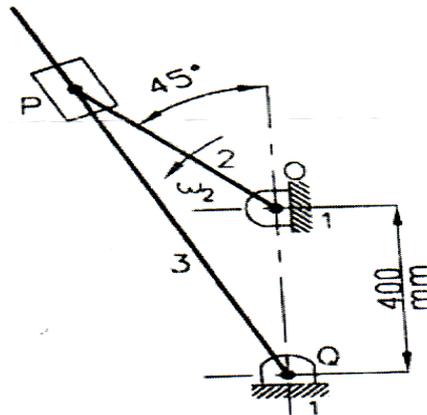
- Q2) a)** State and prove Kennedy's theorem of three centre in line. [4]
- b) In the mechanism as shown in the fig, the slider E is constrained to move along the horizontal path. Find for the position shown, the velocity and acceleration of point E and the angular velocity, the angular acceleration of the link BDE. [12]



- Q3) a)** In a slider crank mechanism, the length of the crank and connecting rod are 90 mm and 360 mm respectively. The crank rotates uniformly at 600 rpm clockwise. When the crank has turned through  $45^\circ$  from the inner dead centre, find by analytical method; i) velocity and acceleration of piston, ii) angular velocity and angular acceleration of connecting rod. [6]
- b) In the mechanism shown in the fig., link AB rotates at 600 rpm uniformly in clockwise direction. The various dimensions are  $AB = 100$  mm,  $CR = 150$  mm,  $OC = 400$  mm. Find velocity and acceleration of slider R. [12]



- Q4) a)** In an I.C. engine mechanism, the radius is 100 mm and the length of the connecting rod is 450 mm. The crank is rotating in anticlockwise direction with the angular velocity of 10 rad/sec. Using vector algebra method; determine the velocity of piston and the angular velocity of connecting rod when the crank is at  $45^\circ$  from the inner dead centre. [8]
- b)** Using the complex number method, find for the mechanism as shown in fig. the velocity of slider and the angular velocity of link PQ for given position.  $OP = 150$ ,  $\omega = 15$  r/s anticlockwise. [8]



### SECTION - II

- Q5) a)** Explain three position syntheses for slider crank mechanism by using inversion method. [6]
- b)** Using Freudenstein's equation, design a four bar mechanism to generate the function  $y = x^{1.4}$  for an interval in  $x$  from 1 to 4. The input link is to start from  $30^\circ$  and is to have a range of  $90^\circ$ , the output link is to start from  $90^\circ$  and is to have a range of  $90^\circ$ . Use three point Chebychev spacing. Take the length of fixed link AD as 50 mm. [10]
- Q6) a)** Define in short; [6]
- i) Free vibrations.
  - ii) Forced vibrations.
  - iii) Damped vibrations.
- b)** A steel shaft 1.5 m long is 95 mm in diameter for the first 0.6 m of its length, 60 mm in diameter for the next 0.5 m of the length and 50 mm in diameter for the remaining 0.4 m of its length. The shaft carries two flywheels at two ends, the first having a mass of 900 kg and 0.85 m radius of gyration located at the 95 mm diameter end and the second having a mass of 700 kg and 0.55m radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of shaft material may be taken as  $85 \text{ GN/m}^2$  [10]

- Q7) a)** Write short note on Advanced cam Curves. [4]
- b) A cam drives a flat reciprocating follower in the following manner:  
During first  $120^\circ$  rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next  $30^\circ$  of cam rotation. During next  $120^\circ$  of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next  $90^\circ$  of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. [12]
- Q8) a)** Derive equations for displacement velocity and acceleration for a tangent cam operating a radial translating roller follower when the contact with straight flank. [6]
- b) Discuss the effect of inertia on the shaft in longitudinal and transverse vibration. [6]
- c) Write short note on Euler - Savery Equation. [6]



Total No. of Questions : 8]

SEAT No. :

**P4291**

**[4760] - 14**

[Total No. of Pages :4

**M.E. (Civil) (Construction and Management)**

**OPERATION RESEARCH**

**(2008 Course) (Semester - II) (501110)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from Section - I and any three from Section - II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Write a detailed note on: **[8]**

- i) Applications of various Operation Research techniques.
- ii) Types of Operation Research models.

**b)** Solve the following by Simplex Method. **[8]**

$$\text{Maximize, } Z = 7x_1 + 3x_2 + 5x_3$$

$$\text{Subject to, } x_1 + 2x_2 + 3x_3 \leq 26$$

$$x_1 + x_2 + x_3 \leq 18$$

$$2x_1 + x_2 + x_3 \leq 22$$

$$x_1, x_2, x_3 \geq 0$$

**Q2) a)** Solve the following problem by Two-Phase method: **[8]**

$$\text{Maximize, } Z = 4x_1 + 5x_2$$

$$\text{Subject to } 2x_1 + 3x_2 \leq 6$$

$$3x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0$$

**b)** Solve by Big M Method. **[8]**

$$\text{Minimize, } Z = 40x_1 + 60x_2$$

$$\text{Subject to, } x_1 + 2x_2 \geq 80$$

$$3x_1 + x_2 \geq 75$$

$$x_1, x_2 \geq 0$$

**P.T.O.**

**Q3) a)** Describe a transportation model and assignment model. How is the assignment model is differs from transportation model? Give applications of each. [7]

b) Coarse aggregate is to be supplied from 3 quarries to 5 construction sites. The availability and requirement of the aggregate and the unit cost of transport is given in the following table. [9]

| Quarries          | Construction Sites |    |    |    |    | Quantity Available |
|-------------------|--------------------|----|----|----|----|--------------------|
|                   | 1                  | 2  | 3  | 4  | 5  |                    |
| A                 | 15                 | 10 | 7  | 9  | 12 | 50                 |
| B                 | 14                 | 17 | 11 | 6  | 18 | 70                 |
| C                 | 22                 | 23 | 21 | 13 | 20 | 80                 |
| Quantity Required | 20                 | 30 | 40 | 50 | 60 | 200                |

Use all the three methods to find the initial feasible solution.

**Q4) a)** An Engineering firm wishes to assign 5 tasks to 5 engineers. Estimates of time in days require to complete the specific tasks by each engineer is given by each engineer is given below. Determine the assignment to minimize the total time. [9]

| Engineer | Project Task |    |    |    |    |
|----------|--------------|----|----|----|----|
|          | 1            | 2  | 3  | 4  | 5  |
| A        | 3            | 5  | 10 | 15 | 8  |
| B        | 4            | 7  | 15 | 18 | 8  |
| C        | 8            | 12 | 20 | 20 | 12 |
| D        | 5            | 5  | 8  | 10 | 6  |
| E        | 10           | 10 | 15 | 25 | 10 |

- b) Explain the terms with suitable diagram: [9]
- Stationary point, point of inflection of the function.
  - Relative maxima, relative minima.
  - Global maxima, global minima.
  - Concave & Convex functions.

**SECTION - II**

- Q5) a)** Solve by using Lagrange's multiplier method. [8]  
 Minimize,  $Z = x_1 + x_2 + x_3$   
 Subject to,  $x_1 + x_2^2 = 3$   
 $3x_1 + x_2 + 2x_3 = 7$
- b) Find maximum of  $f = x(1.5 - x)$  in the interval of (0, 1) within 10% accuracy using Dichotomous search techniques. [8]

- Q6) a)** What is Dynamic programming? And State and explain Bellman's principle of optimality. [8]
- b) Write a short note on Queuing theory. [4]
- c) What is benefit - cost analysis? And explain its use in decision making in civil engineering projects. [4]

- Q7) a)** The details of various alternative proposals in water resource department scheme are given below: [8]

| Sr No. | Proposal                                    | Capital Cost in Rs. | Annual Maintenance & Operating cost | Life in years | Rate of interest |
|--------|---|---------------------|-------------------------------------|---------------|------------------|
| 1      | Large Storage Reservoir                     | 80 lakhs            | 2 lakhs                             | 75            | 8%               |
| 2      | Storage Reservoir together with pickup weir | 3 lakhs             | 3 lakhs                             | 70            | 8%               |
| 3      | Lift irrigation scheme                      | 50 lakhs            | 3.5 lakhs                           | 40            | 8%               |

Annual benefit from each of scheme is 10.3 lakhs, 10.5 lakhs & 9.5 lakhs respectively Suggest the best alternative with justification.

- b) Explain Games theory and its applications to construction management. [8]

- Q8) a)** A firm considering replacement of soil compaction machine, where cost price is Rs. 12000/- and scrap value is Rs. 200/-. The running (maintenance and operating) cost is found from experience to be as follows: **[8]**

|                    |     |     |     |      |      |      |      |      |
|--------------------|-----|-----|-----|------|------|------|------|------|
| Year               | 1   | 2   | 3   | 4    | 5    | 6    | 7    | 8    |
| Running Cost (Rs.) | 200 | 500 | 800 | 1200 | 1800 | 2500 | 3200 | 4000 |

When should be the machine be replaced?

- b)** A sample of 100 arrivals of automobiles at a toll booth is found to be according to the following distribution. **[10]**

|                               |     |   |     |    |     |    |     |   |     |   |
|-------------------------------|-----|---|-----|----|-----|----|-----|---|-----|---|
| Time between arrivals in min. | 0.5 | 1 | 1.5 | 2  | 2.5 | 3  | 3.5 | 4 | 4.5 | 5 |
| Frequency                     | 4   | 6 | 10  | 24 | 20  | 15 | 10  | 7 | 4   | 2 |

The time taken for service follows the distribution

|             |     |    |     |    |     |
|-------------|-----|----|-----|----|-----|
| Time in min | 0.5 | 1  | 1.5 | 2  | 2.5 |
| Frequency   | 13  | 22 | 37  | 20 | 8   |

Estimate the average waiting time, average % waiting time of vehicle, average idle time, and average % idle time for the server for 10 arrivals. Use the following random numbers.

Arrivals: 16, 77, 23, 02, 77, 28, 06, 24, 25, 93

Service: 56, 65, 05, 61, 86, 90, 92, 10, 79, 80



Total No. of Questions : 8]

SEAT No. :

P3795

[Total No. of Pages : 2

[4760]-141

**M.E. (Mechatronics) (Mechanical)**  
**MICROCONTROLLERS**  
**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) With neat schematic explain internal memory structure of 8051. [10]  
b) Compare microprocessor and microcontroller. [8]
- Q2)** a) Explain the flag structure of 8051 in detail. [8]  
b) Explain the following instructions of 8051. [8]  
i) SWAP A  
ii) ADD A, 0F 3H  
iii) RRC  
iv) DJNZ, Rn, lable
- Q3)** a) Write a program for LCD interfacing and explain it. [8]  
b) Explain different Timer modes of 8051. [8]
- Q4)** Write short notes on : [16]  
a) Logic Analyzer.  
b) Power saving mode.  
c) Selection criterion of microcontroller.

**P.T.O.**

**SECTION - II**

- Q5)** a) State the versions and variants of ARM processor. [8]  
b) Explain the memory organization of PIC. [8]
- Q6)** a) State the different features of PIC microcontroller. [8]  
b) Enlist the applications of ARM processor and explain any one. [8]
- Q7)** a) Compare RS 232 and RS 485. [8]  
b) Write a note on SPI bus. [8]
- Q8)** a) Compare RISC and CISC processor. [10]  
b) Explain PSW register in 8051. [8]



Total No. of Questions : 8]

SEAT No. :

P4565

[Total No. of Pages : 2

[4760]-142

**M.E. (Mechanical) (Mechatronics)**  
**INDUSTRIAL AUTOMATION**  
**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Given four push buttons (S1, and S2) of Normally Open (NO) type, two lamps namely RED (L1) and GREEN (L2). Write the PLC ladder diagram for following objectives **[12]**
- i) When S1 is Pushed and S2 is not pushed RED lamp is On
  - ii) When S1 is not Pushed and S2 is pushed GREEN lamp is On
  - iii) When both the buttons are pushed or not pushed, both the lamps are Off

Write the names of input terminals to which switches are connected as well as output terminal names to which lamps are connected.

Write the Boolean (Digital) equations with truth table of each rung you draw . Draw the ladder diagram using only Examine ON, Examine OFF and output coil symbols

- b) List three important specifications of PLC. **[6]**
- Q2)** a) Explain with a schematic diagram basic electromechanical relay with all its terminals. **[8]**
- b) Explain Examine ON and Examine OFF Conditions with two suitable examples of each in the form of ladder diagrams. **[8]**

**P.T.O.**

- Q3)** a) Explain the Timer instruction in PLC programming with types of timers. [8]  
 b) Explain Count Up Instruction w.r.t, conveyor with all status bits [8]
- Q4)** a) Significance of Boolean algebra in constructing ladder program. Explain with suitable example. [8]  
 b) Explain in brief the concept and applications of SCADA. [8]

**SECTION - II**

- Q5)** a) Principle of working and types of Position sensors used in CNC machines. [8]  
 b) Discuss in brief tool offset and wear offset in CNC programming. [8]
- Q6)** a) Discuss in brief the Flexible manufacturing Systems. [8]  
 b) Discuss in brief tool offset and wear offset in CNC programming. [8]
- Q7)** Figure Q7 shows a profile for turning job. Prepare a NC part program, mention all the assumptions including raw material dimensions. Write the program in TAB sequential format. Do not use special canned cycles. [18]

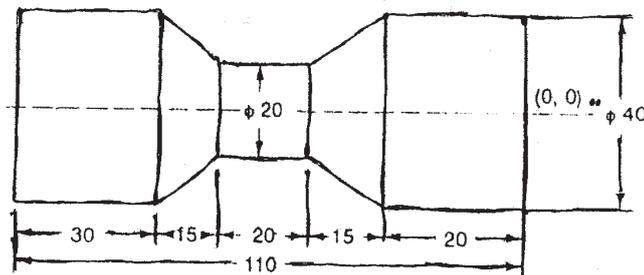


Figure Q.7

- Q8)** a) Explain Modal and Non Modal commands in NC part program with two examples each. [8]  
 b) Explain significance G94, G95, G98 and G99 with suitable examples. [8]



Total No. of Questions : 10]

SEAT No. :

**P4315**

**[4760] - 143**

[Total No. of Pages :2

**M.E. Mechanical (Mechatronics)  
DRIVES AND ACTUATORS  
(2008 Course) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from section I and three questions from section II. Q. No. 5 and Q. No. 10 is compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the rights indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the methods adopted for protection of SCR against over voltage and overcurrent. [8]  
b) Explain the single phase full wave bridge converter with DC motor load. [8]
- Q2)** a) Explain generalized treatment of speed torque conventions and multi-quadrant operation of an Electrical Drive. [8]  
b) Explain the Transfer and Switching characteristics of MOSFET. [8]
- Q3)** a) Compare AC and DC drives. [8]  
b) Explain four quadrant operation of chopper controlled DC drive. [8]
- Q4)** a) Explain Unipolar and Bipolar drive circuits for Brushless DC motor. [8]  
b) Explain with neat diagram the closed loop speed control of CSI fed induction motor drives. [8]
- Q5)** Write short note on: [18]  
a) Cycloconverter.  
b) IGBT.  
c) Two transistor analogy of SCR.  
d) Static Scherbius drive for speed control of Induction motor.

**P.T.O.**

## SECTION - II

- Q6)** a) Write a short note on stepper motors. [8]  
b) Discuss types of flow control valves with symbol and working. [8]
- Q7)** a) With hydraulic circuit, explain bleed off circuit with components used and applications of meter in circuit. [8]  
b) Enlist the advantages limitations and applications of Hydraulic Systems and Pneumatic Systems. [8]
- Q8)** a) Draw hydraulic circuit symbols used to represent sequence valve and pressure compensated pressure relief valve with working. [8]  
b) Discuss any four center positions of direction control valve with significance. [8]
- Q9)** a) With a neat sketch, describe construction and working of Pressure relief valve. [8]  
b) Explain hydraulic power steering as a hydraulic servo system. [8]
- Q10)** Attempt any three: [18]  
a) Compare Gear Pump and Vane Pump.  
b) Write a short note on Unloading Valve.  
c) Discuss application of Counterbalance Valve.  
d) Discuss important characteristics of oil used in hydraulics.



Total No. of Questions : 8]

SEAT No. :

**P4566**

**[4760]- 146**

[Total No. of Pages :2

**M.E. (Mechanical)(Mechatronics)  
AUTOMOTIVE ELECTRONICS  
( 2008 Course) (Elective-III ) (502811 C) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of Calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**SECTION-I**

- Q1)** a) Describe Automobile Battery with respect to types, recent, trends, protections. **[8]**
- b) Compare Microprocessor assisted Engine Cooling System with fan driven by crank shaft. **[8]**
- Q2)** a) Anti-fog system in Automobiles. **[8]**
- b) Electronic Fuel Injection System. **[8]**
- Q3)** a) Discuss the Battery tests. **[8]**
- b) Advantages of microprocessors used in Automobiles. **[8]**
- Q4)** Discuss Diesel Engine Control System with representative block diagram. Identify major inputs and outputs to engine control unit along with the corresponding sensors and actuators. **[18]**

***P.T.O.***

## SECTION-II

- Q5)** a) Discuss the Electronics involved in Head Lamps in modern automobiles. [9]  
b) Describe Electronic Injection advance in Compression Ignition Engines. [9]
- Q6)** a) Discuss recent trends in power windows. [8]  
b) Discuss Lane Assistance systems in Luxury Cars. [8]
- Q7)** a) Sensors used in wheel alignment and balancing of wheels. [8]  
b) Explain controls used in Automotive Heating System. [8]
- Q8)** a) Compare 8 bit microprocessors and 16 bit microprocessors in Luxury Cars. [8]  
b) Explain throttle position sensor and its advantages. [8]



Total No. of Questions : 8]

SEAT No. :

P3796

[Total No. of Pages : 2

[4760] - 147

**M.E. (Mechanical) (Mechatronics)**

**EMBEDDED SYSTEMS**

**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume suitable data, whenever necessary.*

**SECTION - I**

- Q1)** a) Define Embedded systems. Explain its characteristics. [8]  
b) What are the embedded system design challenges? Explain any four. [10]
- Q2)** a) What are the different selection criteria of microprocessor in embedded system? [10]  
b) Explain the role of interrupts in embedded systems. What is difference between polling and interrupt method? [6]
- Q3)** a) Which are the different methods of interfacing I/O devices? Explain briefly. [8]  
b) Explain the features of USB bus and communication using USB bus. [8]

***P.T.O.***

- Q4)** a) What is MODBUS protocol? Explain the data transfer using this protocol. [8]
- b) Draw a schematic arrangement for a typical CAN network containing a master and number of slaves. Explain the process of data transfer amongst them. [8]

### SECTION - II

- Q5)** a) What are the different software architectures? Explain round robin with interrupt architecture in detail. What are its disadvantages? [10]
- b) What is the difference between Real time operating systems and conventional OS? [8]
- Q6)** a) Explain how shared data problem can be solved using semaphores? [8]
- b) What are the different task states? How task states are changed? [8]
- Q7)** a) What are the functions and applications of operating systems? Explain any one. [8]
- b) Explain the function calls for creating task and task management. [8]
- Q8)** a) With the help of block diagram explain the design of system in a car. [8]
- b) Write short notes on : [8]
- i) Robot arm
  - ii) Smart card



Total No. of Questions : 8]

SEAT No. :

**P4726**

[Total No. of Pages : 2

**[4760] - 15**

**M. E. (Civil - Construction & Management)**  
**ADVANCED CONSTRUCTION TECHNOLOGY**  
**(2008 Pattern) (Elective - III) (Semester-II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** For the construction of metro, discuss the types of surveys to be conducted before finalizing the route. Also, discuss the various parameters considered for the same. **[18]**
- Q2)** a) Give the sequence of operations involved in testing of the central pier of a cable stayed bridge. Discuss the technique used. **[8]**  
b) Discuss various earth moving equipments used on a construction an Earthen Dam. Also, discuss the equipment planning involved. Use suitable data. **[8]**
- Q3)** a) Discuss advanced methods used to control seepage through concrete dam. **[8]**  
b) What do you understand by self compacting concrete? What are its applications? Also, discuss its advantages over normal concrete. **[8]**
- Q4)** Discuss the sequences followed in the strengthening of bridge piers. **[16]**

**P.T.O.**

## SECTION - II

- Q5)** What are the applications of diaphragm wall? Give with detailed sketch, the sequence of operations followed in the construction of diaphragm wall. Also, discuss the materials used as the slurry. **[18]**
- Q6)** Explain the method of calculating production for following equipments **[16]**
- a) Excavator
  - b) Compacting equipments - roller
  - c) Aggregate crushing plant
  - d) RMC plant
- Q7)** a) Discuss the challenges faced while constructing jetty. **[8]**
- b) What are the design criteria to be considered for various machine foundations. **[8]**
- Q8)** Discuss the Tunnel form construction used for high rise structures with suitable sketches. **[16]**



Total No. of Questions : 8]

SEAT No. :

P3797

[Total No. of Pages : 2

[4760] - 151

M. E. (Mechanical - Automotive Engineering) (Semester - II)

**AUTOMOTIVE ENGINE DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Q. No. 4 & 8 are compulsory.*
- 2) *Attempt any two from remaining questions in each section.*
- 3) *Answers to the two sections should be written in separate answer books.*
- 4) *Neat diagrams must be drawn wherever necessary; figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule and non-programmable electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** Explain the use principle of similitude in design of CI engines and list the benefits of the same. **[16]**
- Q2)** Explain the procedure to conduct a test on IC engine for preparation of heat balance sheet. **[16]**
- Q3)** List the requirements for selection of materials for IC engine piston? Explain the merits and limitations. **[16]**
- Q4)** A four-cylinder automotive spark-ignition square engine is being designed to provide a maximum brake torque of 85 N-m in the mid-speed range (=2600 rev/min). Estimate the required engine displacement, bore and stroke, and the maximum brake power the engine will deliver. Assume bmep at the maximum engine torque point is 795 kPa and maximum mean piston speed, 9.3 m/s. **[18]**

**P.T.O.**

## SECTION-II

- Q5)** Stresses recorded at a highly stressed point on crankshaft undergoing cyclic loading are  $\sigma_{\max} = 195$  MPa and  $\sigma_{\min} = -135$  MPa. For the material,  $S_{ut} = 530$  MPa,  $S_y = 395$  MPa, a fully corrected endurance limit,  $S_e = 235$  MPa, and  $f = 0.85$ . Estimate the number of cycles to a fatigue failure using:  
(a) Modified Goodman criterion. (b) Gerber criterion. **[16]**
- Q6)** The design diagram of a camshaft can be considered as a free two-support beam loaded where the follower exerts maximum force of 1775 N on the cam at distance of 22.5 mm from left support. Length of camshaft span is 93 mm, outer diameter of camshaft is 26 mm and inner diameter is 12 mm. Find maximum deflection of camshaft. Take  $E = 207$  GPa. **[16]**
- Q7)** A multi-cylinder engine is to run at a constant load at a speed of 800 rpm. Dimensions of the cast iron flywheel rim are, breadth = 128 mm, radial thickness = 61 mm and mass is 107 kg. The density of cast iron is  $7355 \text{ kg/m}^3$ , and its allowable stress in tension is 37 MPa. Find factor of safety considering stress due to centrifugal force. **[16]**
- Q8)** List and explain with neat sketch the steps for the force analysis of reciprocating and rotating masses of IC engine considering inertia effects. **[18]**



Total No. of Questions : 8]

SEAT No. :

**P3940**

**[4760]-153**

[Total No. of Pages : 3

**M.E. (Mechanical) (Automotive Engg.)**

**ADVANCED HEAT TRANSFER**

**(2008 Course) (Semester - I) (Elective - I) (502302 A)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Explain the concept of thermal resistance, contact resistance and overall heat transfer coefficient. **[8]**

- b) A circular pipe carries hot transformer oil at a temperature of 7°C. The temperature of the cool air surrounding the pipe is half the oil temperature. If the ratio of outside to inside diameter of the pipe is 1.25, show that the total outward heat flow per unit length of the pipe is,

$$Q/L = \pi k T / \ln (1.25) \quad \mathbf{[10]}$$

**Q2) a)** An electronic semiconductor device has a rating of 60 mW and for its proper orientation the inside temperature should not be more than 80°C. It is found that the device can dissipate about 15 mW of heat on its own when placed in an environment at 40°C. To avoid overheating of the device it is proposed to install aluminum ( $k = 190 \text{ W/mK}$ ) square fins of size 0.5 mm x 0.5 mm and 1 cm long to provide additional cooling. Find the number of fins required. Taking  $h = 12.5 \text{ W/m}^2 \text{ K}$ . **[8]**

- b) What is lumped capacity? What are the assumptions for lumped capacity analysis? Differentiate between Nusselt and Biot number. **[8]**

**P.T.O.**

**Q3)** Write notes on (Any three):

**[16]**

- a) Navier-stokes equation.
- b) Reynolds and Chilton-colburn analogies.
- c) Solution procedure solving unsteady state problems.
- d) Single phase convective heat transfer correlations.

**Q4)** a) Distinguish between differential and integral analysis of boundary layer flows. **[8]**

- b) Under forced flow conditions how does the Prandtl number affects relative thickness of thermal and velocity boundary layer? Show that velocity and temperature distribution within the boundary layer are going to similar in nature. **[8]**

### **SECTION - II**

**Q5)** a) Discuss in detail various regimes of pool boiling and explain the concept of critical heat flux along with its importance. **[8]**

- b) A vertical plate 1 m long and 0.5 m wide is maintained at 40°C and the saturated steam at 100°C and at atmospheric pressure condenses over it. calculate the following: **[10]**

- i) Heat transfer rate.
- ii) Thickness of film at 0.5 m below the top end of plate and its maximum velocity at this section.
- iii) Thickness of film at its bottom end and its maximum velocity.
- iv) Condensation rate in kg/hr.

Take at mean temperature:  $\rho = 980 \text{ kg/m}^3$ ,  $k_f = 0.664 \text{ W/mK}$ ,  $\mu = 434 \times 10^{-6} \text{ kg/ms}$ ,  $h_{fg} = 2257 \text{ kJ/kg}$ .

- Q6) a)** State and prove Wien's displacement law. Show that maximum monochromatic emissive power of black body is proportional to the fifth power of absolute temperature of the surface. [8]
- b) Consider a cylindrical furnace with outer radius and height equal to 1m. The top surface (surface 1) and the base surface (surface 2) of the furnace have emissivities  $\epsilon_1 = 0.8$  and  $\epsilon_2 = 0.4$  respectively and are maintained at uniform temperature of  $T_1 = 700$  K and  $T_2 = 500$  K. The side surface closely approximates a black body and is maintained at a temperature of  $T_3 = 400$  K. Determine the net rate of radiation heat transfer at each surface during steady operation and explain how these surfaces can be maintained at specified temperatures. [8]
- Q7) a)** Write a short note on [8]
- i) Immersion cooling
- ii) Cooling of PCs
- b) A shell and tube heat exchanger is designed with ammonia vapour entering the shell at 60°C as a saturated vapour. Water enters the single pass tube arrangement at 25°C and gets heated to 50°C. Total heat transfer rate is 250 kW. Calculate the area of heat exchanger to achieve 60% effectiveness with overall heat transfer coefficient of 1000 W/m<sup>2</sup>K. How would the heat transfer rate be affected if the water flow rate is reduced to half? It may be presumed that the heat exchanger area and heat transfer coefficient remain the same. [8]
- Q8) a)** Derive the expression of effectiveness for counter flow heat exchanger using NTU method. Write its assumptions. [8]
- b) Write a short note on [8]
- i) Radiation shields.
- ii) Film wise condensation process.

*EEE*

Total No. of Questions : 9]

SEAT No. :

P4316

[4760]-154

[Total No. of Pages : 4

**M.E. (Mechanical) (Automotive Engineering)**  
**FINITE ELEMENT METHOD**  
**(2008 Course) (Elective-I) (Semester-I)**

Time : 3 Hours]

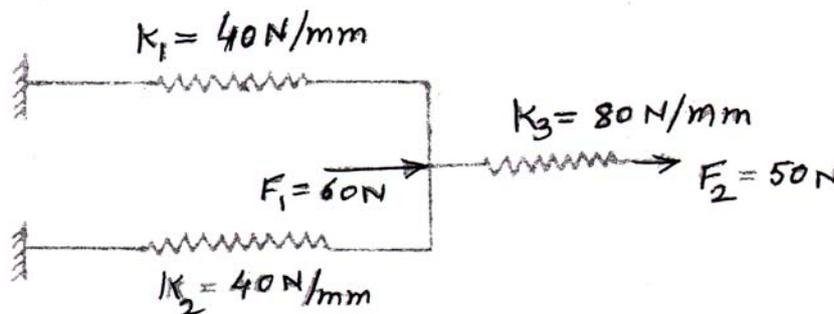
[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Figures to the right indicate full marks.
- 4) Use of electronic calculator is allowed.
- 5) Assume suitable data, if necessary.

**SECTION-I**

- Q1) a) Name three commonly used methods for deriving the element stiffness matrix and element equations. Briefly describe each method. [8]
- b) A system of spring is shown in the fig. Determine the overall stiffness matrix and deflection of each spring. [8]



- Q2) a) The Two noded 1-D element has node 1 and 2 located at a distance of 200 and 360mm respectively from Y-axis. The displacement of node 1 and 2 are 0.03 and  $-0.05\text{mm}$  respectively. At point P, located at a distance of 40mm from node 1 within the element determine: [8]
- i) natural coordinate.
  - ii) the linear shape function.
  - iii) the displacement.

P.T.O.

b) Discuss the Problem Modeling and Boundary Conditions for the following cases: [8]

- i) A hollow cylinder of length  $L$  subjected to an internal pressure, one end of the cylinder is fixed and other end is free.
- ii) Press fit of a ring of length  $L$  and internal radius  $r$  onto a rigid shaft of radius  $(r + d)$ .

**Q3)** a) Consider a thin tapered plate with 6 inches width at top and 3 inches width at bottom having a length of 24 inches and uniform thickness of 1 inch. The material of the plate is steel having Young's modulus  $E = 30 \times 10^6$  psi and weight density  $0.28 \text{ lb/in}^3$ . In addition to its self weight, the plate is subjected to point load  $P = 100 \text{ lb}$  at its midpoint. [10]

- i) Model the plate with two finite elements.
- ii) Using elimination approach, solve for the global displacement vector.
- iii) Evaluate stress in each element.

Determine the reaction force at support.

b) Explain, with suitable examples, the plane stress and plane strain condition. [6]

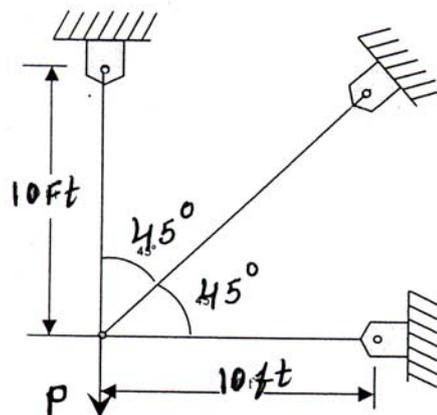
**Q4)** a) What is the transformation matrix? Obtain the transformation matrix for the two dimensional plane truss element. [6]

b) Explain shape function of CST element. Also explain the physical representation by area coordinates. [6]

c) Obtain the stress-nodal displacement relationship for the one-dimensional element. [6]

## SECTION-II

- Q5)** a) Explain impact of aspect ratio and accuracy of FEM result in FEM analysis. [6]
- b) What are the different coordinate systems used in FEM? [6]
- c) Obtain the strain matrix for CST element. [6]
- Q6)** a) What is a higher order element? Give an example. [4]
- b) What types of problems are treated as one-dimensional problems? [4]
- c) For the plane truss composed of the three elements shown in the fig, subjected to a downward force of  $P = 10,000$  lb applied at node. Determine the x and y displacement of the node and the stresses in each element. Let  $E = 30 \times 10^6$  psi and  $A = 2$  in<sup>2</sup> for all elements. [10]



- Q7)** a) Explain the elimination approach used in the finite element method. [8]
- b) Derive an expression for the element stiffness matrix of the two noded truss element. Also show the element stress calculations. [8]
- Q8)** a) A constant strain triangle element is defined by three nodes at (1.5, 2), (7, 3.5) and (4, 7). Evaluate the shape functions  $N_1$ ,  $N_2$  and  $N_3$  at the interior point P (3.85, 4.8). Also determine the Jacobian of the transformation J. [8]
- b) State and explain the advantages and limitations of Finite element method. [6]

**Q9)** Write a short note on Any Three:

**[18]**

- a) Global Stiffness Matrix.
- b) Sub and Super parametric elements.
- c) Jacobian transformation.
- d) Sum of shape function at a point.



Total No. of Questions : 8]

SEAT No. :

**P3799**

**[4760] - 155**

[Total No. of Pages :2

**M.E. (Mechanical) (Automotive Engg.)**  
**ADVANCED HYDRAULICS AND PNEUMATIC SYSTEMS**  
**(2008 Pattern) (Elective - I) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What factors are considered for selection of seals. [4]  
b) Name different components of a hydraulic brake system. What are their functions. [6]  
c) Discuss the effect of temperature on fluid properties. [6]
- Q2)** a) Explain how a particular type of accumulator is selected for an automobile application. [8]  
b) What are vane pump characteristics? What is the method of testing these characteristics. [8]
- Q3)** a) Draw and explain a regenerative circuit. State its applications. [8]  
b) Explain any two applications of pneumatics in Automobiles. [8]
- Q4)** Answer any three of the following. [18]  
a) Properties of hydraulic fluid.  
b) Efficiencies in hydraulic power pack.  
c) Center positions of direction control valves.  
d) Compressed air generation and distribution system.

**P.T.O.**

## SECTION - II

- Q5)** a) What is a pilot operated system? Explain any typical pilot operated pneumatic circuit. [8]
- b) Explain with a neat sketch working of a power operated holding device. [8]
- Q6)** a) Draw and explain with a suitable circuit how synchronizing of hydraulic rams is achieved. [8]
- b) Explain a hydraulic circuit for sequencing two actuators using roller operated valves. [8]
- Q7)** a) Explain the principles of Fluidic logic control. How Boolean algebra can be used in Fluidic logic control? [8]
- b) The feed motion for a hydraulic system has the following working cycle. [8]
- i) Fast forward approach - 200mm
  - ii) Slow forward approach - 100mm
  - iii) Return fast - 300mm

Draw a hydraulic circuit for the above conditions. Explain the working of the circuit.

- Q8)** Answer any 3 of the following. [18]
- a) FRL unit
  - b) Vacuum clamps in Fluid power systems
  - c) Fluid sensors in pneumatic systems
  - d) Twin pressure and shuttle valves.



Total No. of Questions : 8]

SEAT No. :

**P3798**

[Total No. of Pages : 2

[4760] - 157

**M.E. (Mechanical) (Automotive Engineering)**  
**AUTOMOTIVE SAFETY AND REGULATIONS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section I and three questions from Section II.*
- 2) *Answers to the two Sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What do you understand by vehicle safety? What are the objectives of it? List out various provisions of safety aspects incorporated in a modern car? [8]
- b) What do you understand by safety assessment of vehicles? What are various provisions of it? Explain. [8]
- Q2)** a) What is vehicle crashworthiness? What are various characteristics of it? [8]
- b) What is pedestrian safety? Justify need of it. Explain pedestrian accidents observed by hitting various vehicles causing fatal and non-fatal injuries. [8]
- Q3)** a) Explain with neat sketch anthropometry data for passenger compartment or modern day's car. [8]
- b) What are types of automobile seats? Explain with neat sketch construction of front seat? [8]
- Q4)** Write short note on following (Any three) [18]
- a) Indian passive safety regulatory test.
  - b) Governing material properties for vehicle crashworthiness.
  - c) Hybrid III dummy.
  - d) Seat belt system with pre-tensioner in load limiter.

**P.T.O.**

## SECTION - II

- Q5)** a) Draw approximate dimensions to the arrangement in the figure mentioned in question no.1 .calculate forces on anchorage when sudden brake is applied to vehicle running at high speed consider mass of driver 70kg. Assume deceleration at sudden braking to be equal to 20g. [8]  
b) Explain the types of safety glasses? What are the requirements of it?[8]
- Q6)** a) What testing procedure is followed for lamps and reflectors in automotive testing laboratory? Explain beam pattern and specification followed for head lamp testing as per CMVR rules. [8]  
b) Explain asymmetrical beam used in head lamp. What are merits and demerits of plastic lens head lamps? [8]
- Q7)** a) What do you mean by type approval? What are various standards and regulations for it? Explain. [8]  
b) Describe various passive safety regulations adopted in India as per IS/AIS. [8]
- Q8)** Write short note on the following (any three) [18]  
a) Door locks and retention system  
b) Adaptive front lighting system.  
c) Reflex reflector.  
d) Testing track for vehicle.



Total No. of Questions : 8]

SEAT No. :

**P3941**

**[4760] - 158**

[Total No. of Pages : 2

**M.E. (Mechanical - Automotive)  
AUTOMOBILE AIR CONDITIONING  
(2010 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section-I and three questions from Section-II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary and mention it clearly.*
- 6) *Use of logarithmic tables, slide rule, mollier charts, non programmable electronic pocket calculator is allowed.*

**SECTION - I**

- Q1)** a) Explain the following air conditioning processes : **[9]**  
i) cooling and dehumidification  
ii) heating and humidification  
iii) adiabatic humidification  
b) With neat schematic explain the air conditioning system for railway coach. **[7]**
- Q2)** a) Draw the layout and explain central air conditioning system for any application like multiplex. What are advantages and disadvantages over unitary air conditioning system? **[8]**  
b) Discuss the various types of evaporators used in air conditioning. With neat diagram explain the flooded evaporator. **[8]**
- Q3)** a) Discuss the procedure for cooling load calculation for bus air conditioner. Make appropriate assumptions. Give justification for your assumptions. **[10]**  
b) Explain outside and inside design conditions for air conditioner that used for passenger car. What are the standard rating conditions as per BIS and ASHRAE? **[6]**
- Q4)** Write short note on the following (any three) : **[18]**  
a) Types of grills and diffusers  
b) Static regain method for duct design  
c) Pressure losses in ducts  
d) AHU

**P.T.O.**

## SECTION - II

- Q5)** a) What the various sources of noise in air conditioning plants? Discuss the various noise elimination techniques. [8]
- b) What do you mean by ventilation and infiltration air? Discuss the methods to calculate cooling load due to ventilation and infiltration air. [8]
- Q6)** a) Discuss the characteristics curves for centrifugal and axial fans. [8]
- b) Explain the selection procedure for fan and blowers. Discuss applications of blowers in air conditioning. [8]
- Q7)** a) With neat diagram explain the working of the following air filters. [8]
- i) HEPA filter
- ii) Electrostatic filters
- b) Discuss the dehydration, charging and testing procedure for automobile air conditioner. [8]
- Q8)** Write short note on the followings. (any three) : [18]
- a) Types of condensers and its selection
- b) Thermostat
- c) Air refrigeration system and its applications
- d) Alternative refrigerants for automotive air conditioners



Total No. of Questions : 8]

SEAT No. :

P3800

[Total No. of Pages : 2

[4760]-159

M.E. (Mechanical) (Automotive Engg.)

**AUTOMOTIVE FUELS AND EMISSIONS**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Attempt any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) State the first law for reacting systems. What is adiabatic flame temperature. [8]  
b) What is enthalpy of combustion? How does it differ from the enthalpy of reaction? [8]
- Q2)** a) Compare 'air swirl' in C.I. Engines with turbulence' in S.I. Engines. [8]  
b) Define the terms flame development and flame propagation in engines. [8]
- Q3)** a) Discuss the change in properties of alcohol-petrol blends and their effect on the performance of the engine. [8]  
b) What are the difficulties experienced in using hydrogen as fuel for SI engines? What modifications are required to be carried out in the engine while using H<sub>2</sub> as fuel? [8]
- Q4)** Write short notes on : [18]  
a) Octane and Cetane rating.  
b) Fugacity and Activity.  
c) Chemical equilibrium.

**P.T.O.**

## SECTION - II

- Q5)** a) Specify the main emissions from a multi-cylinder passenger car C.I engine. How is the air-fuel ratio controlled so as to reduce emissions? [10]  
b) What is a driving cycle? Discuss its significance with regard to emissions. [6]
- Q6)** a) Explain the functioning of three way catalytic converter, with a sketch. Mention the limitations of a catalytic converter. [8]  
b) What are the methods to reduce particulate matter emissions? [8]
- Q7)** a) List the major pollutants from SI engines. How can we measure and control each of them. [10]  
b) What is the effect of EGR in emissions from C.I engine. [6]
- Q8)** Write notes on : [18]  
a) BS III and BS IV norms.  
b) Charcoal Canister Control for Evaporative Emission Control.  
c) Emission inventory.



Total No. of Questions : 8]

SEAT No. :

**P3926**

**[4760]-16**

[Total No. of Pages : 2

**M.E. (Civil Construction and Management)  
INFRASTRUCTURE DEVELOPMENT  
(2008 Course) (Semester-II) (Elective-III)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question no 1 and 5 are compulsory. Out of the remaining attempt any two questions from section I and two questions from section II.*
- 2) *Answers to the two sections must be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, wherever necessary*

**SECTION-I**

- Q1)** Discuss in detail the relevance and importance of projects like national highway development programme (NHDP) Enlist and explain the factors that influence the success of such projects. **[18]**
- Q2)** Explain the concept of life cycle costing of any type of power plant project. with the help of suitable sketches, enlist various components involved in such a project. **[16]**
- Q3)** Enlist and explain the measures undertaken to minimize the use of fossil fuels. With suitable examples explain in detail the reliability and sustainability aspects of the alternative source of fuel. **[16]**
- Q4)** Enlist various components of rural infrastructure. What is the scope of MGNREGA? Explain the provisions made under MGNREGA for the above mentioned components in rural infrastructure. **[16]**

**SECTION-II**

- Q5)** Explain what you mean by term PPP. Discuss in detail various modalities involved in a typical PPP project with a suitable case study. **[18]**

**P.T.O.**

- Q6)** a) Rail transport is the key for speedy movement of raw materials and rapid industrialization. Enlist and explain various measures initiated by Indian railways to achieve this objective. [8]
- b) Explain in detail the scope for development and modernization of ports and the initiatives undertaken for development of shipping in India with suitable example. [8]
- Q7)** a) Explain the provisions of 12<sup>th</sup> five year plan related to power plants. [8]
- b) Enlist and explain in detail the provisions of environmental clearances required for infrastructure projects in India. [8]
- Q8)** Write short notes on (any three): [16]
- a) Nuclear power plants.
- b) Rural electrification Project.
- c) Funding patterns for infrastructure projects.
- d) Contract systems for infrastructure projects.



Total No. of Questions : 10]

SEAT No. :

P4713

[Total No. of Pages : 2

**[4760] - 160**  
**M.E. (Mechanical)**  
**AUTOMOTIVE ENGINEERING**  
**Autotronics**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from section - I & any three from section - II.*
- 2) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain crank angle position sensor and throttle position sensor. [8]  
b) Describe four main components of engine management system. [8]
- Q2)** a) Explain with a neat block diagram multipoint injection system. [8]  
b) Define open loop & close loop system with suitable examples in Automobile. [8]
- Q3)** a) Write a note on electronic Governors. [8]  
b) Explain electronic management of chassis system. [8]
- Q4)** a) Describe in brief basic sensor arrangement in EMS. [8]  
b) Explain electronic spark timing control in petrol engines. [8]
- Q5)** a) Write down advantageous of electronic ignition system. [8]  
b) Explain working of carburetor system in petrol engines. [10]

**P.T.O.**

## SECTION - II

- Q6)** a) Explain working principle of wipers & its recent trends. [8]  
b) Write a note on Engine cooling & warm up control system. [8]
- Q7)** a) Write a note on starter motor & drive mechanism. [8]  
b) List down the warning systems & safety systems in Automotives. [8]
- Q8)** a) Discuss features of central locking & electronic windows. [8]  
b) Explain working of cruise control. [8]
- Q9)** a) Explain with neat block diagram the common Rail Diesel Injection system. [8]  
b) Explain Air bag & belt tensioners. [8]
- Q10)** Attempt any three. [18]
- a) Electronic Dash board instruments.
  - b) Automotive telematics
  - c) Digital Engine control.
  - d) ABS system.
  - e) Muvors & Sun Roofs.



Total No. of Questions : 10]

SEAT No. :

**P3801**

**[4760]-161**

[Total No. of Pages : 2

**M.E. (Mechanical-Automotive Engineering)**  
**FUNDAMENTALS OF VEHICLE DYNAMICS**  
**(2008 Pattern) (Semester-II) (502308)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain Response of idealized suspension systems to stop and sinusoidal disturbances in bounce and to wheel out of balance. [8]
- b) Explain the Generalized block diagram of Driver-Vehicle relationship. [8]

**Q2)** A vehicle is treated as two degree freedom system in bounce and pitch mode. The mass of the vehicle is 1350 kg and its radius of gyration is 1.3 m. The stiffness of the front suspension is 135 kN/m and that of rear suspension is 155 kN/m. Center of gravity of the vehicle is 1.4m from front, 1.2m from rear wheel and 0.6 m above ground. Find the natural frequencies and mode shapes. Derive the formula used. [16]

- Q3)** a) Derive the generalized equations of motion for a vehicle: stability [8]
- b) Derive an expression for the steer angle  $\delta_f$  required to negotiate a given turn with usual notations. [8]

**Q4)** What are test carried out for determining handling characteristics of-vehicle? Explain each test in detail. [16]

**Q5)** Write short notes:

- a) Sinusoidal transmissibility function. [18]
- b) Kinematic behavior of vehicles with rigid wheels and with compliant tyres.
- c) Natural frequency and damping in yaw.

**P.T.O.**

## SECTION-II

- Q6)** a) Explain Application of theory of steering of articulated and half-track vehicles. [8]  
b) Describe the Extension of two degree of freedom theory to include effects of traction and braking. [8]
- Q7)** A passenger car weighs 1.5 kN and has a wheelbase of 2.4 m. The center of gravity is 0.85m behind the front axle and 0.54m above ground level. The braking effort distribution on the front axle is 68%. The coefficient of rolling resistance is 0.03. Determine which set of the tires will lock first on two road surfaces: one with a coefficient of road adhesion  $\mu = 0.8$ , and the other with  $\mu = 0.2$ . [16]
- Q8)** a) Explain wheel hop, wheel wobble, wheel shimmy. [8]  
b) Development of equations of motion to include roll of sprung mass. [8]
- Q9)** Explain with the help of labeled sketch mechanism and handling of tracked vehicle (military vehicle). [16]
- Q10)** Write short notes: [18]  
a) Self-aligning torque.  
b) Analysis of sprocket torques and speeds.  
c) choice of damper characteristics.



Total No. of Questions : 10]

SEAT No. :

**P3802**

**[4760]-162**

[Total No. of Pages : 3

**M.E. (Mechanical - Automotive Engg.)**

**NOISE, VIBRATIONS AND HARSHNESS**

**(2008 Course) (Semester - II) (Elective - III) (502309 A)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

**Q1) a)** Explain the different effect of noise on human beings. **[8]**

b) What is the difference between FFT and CPB analysers? **[8]**

**Q2) a)** Show that as the distance from a point source doubles, the sound intensity level decreases by 6 dB. **[6]**

b) The sound pressure level measured at 10 m from an automobile horn is 110 dB. Determine the sound pressure level at distance of **[6]**

i) 20 m

ii) 80 m.

Assume that the inverse square law holds good between intensity and distance.

c) A source of sound power level 100 dB radiates into free space. The Sound pressure level at 10m and angle 30° is 85 dB. What is the directivity index for 30°. **[4]**

**P.T.O.**

- Q3)** a) Explain structure borne noise and Air borne noise in car. [8]
- b) Describe the different types of accelerometer mountings for vibration measurements with their advantages and disadvantages. Draw the frequency response characteristics of each mounting. [8]
- Q4)** a) What do you mean by sound intensity mapping? What is its significance in NVH. [8]
- b) Explain the construction and working of sound intensity probe P-P type. [8]
- Q5)** Write a short note (Any three): [18]
- a) Transverse and Longitudinal sound waves.
- b) Interior sources of noise in vehicle.
- c) Digital signal Processing.
- d) Noise control Technique.

### SECTION - II

- Q6)** a) Explain propagation of sound, reflection of sound, absorption of sound and refraction of sound? [8]
- b) What do you mean by Modal Analysis? What are the different parameters are obtained by Expt. Modal analysis and explain their significance. [8]
- Q7)** a) Explain Porous, Membrane, Cavity and Perforated Panel Absorber. [8]
- b) Explain the working of Dissipative and Reactive type muffler. [8]
- Q8)** The noise levels at 50 m from the inlet of a large forced draft fan are 110 dB in the 500 Hz band and 90 dB in the 4000 Hz band. What is the noise level in each band at a distance of 500 m on a nice summer evening with the temp. at 20°C and the relative humidity 50%? (Atmospheric attenuation coefficient =  $\alpha$ )
- $\alpha = 0.28$  at Temp. 20°C and relative humidity 50% at frequency of 500 Hz.
- $\alpha = 2.8$  at Temp. 20°C and relative humidity 50% at frequency of 4000 Hz. [16]

**Q9)**a) Explain in detail different sound fields and state its significance. [8]

b) Explain the acoustic holography technique. [8]

**Q10)** Write a short note on (Any three): [18]

a) Anechoic chamber and Reverberation chamber.

b) Pass by Noise measurement of Vehicle.

c) Windowing

d) Damping Material for vibration control.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3942**

**[4760]-163**

[Total No. of Pages : 3

**M.E. (Mech.Automotive)  
AUTOMOTIVE MATERIALS  
(2008 Course) (Semester-II)(502309)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right side indicate full marks.*

**SECTION-I**

- Q1)** a) State the effects of following alloying elements on properties of steels.
- i) Ni
  - ii) Mo
  - iii) Al
  - iv) Si [4]
- b) Explain detailed classification of cast Irons. [4]
- c) Explain annealing and its types in detail. [8]
- Q2)** a) Explain compositions, properties and applications of [8]
- i) Muntz metal.
  - ii) LM-6
  - iii) Be-bronze
  - iv) Ti-alloys.
- b) What is Hardenability? Explain jominy end quench test in detail with neat sketch. [8]
- Q3)** Write short notes on(Any three): [18]
- a) Rolling
  - b) Soldering and Brazing.
  - c) Welding.
  - d) Forging

***P.T.O.***

- Q4)** a) Explain properties and applications of. [6]  
i) PMMA  
ii) PET  
iii) PVC
- b) Explain the following. [6]  
i) FRP  
ii) Engineering ceramics
- c) What are elastomers? Explain in detail [4]

### SECTION-II

- Q5)** Write short notes on. [18]  
a) SMC& DMC.  
b) Compression molding.  
c) Reaction Injection molding.
- Q6)** Select and justify materials for (any four): [16]  
a) Cylinder head.  
b) Radiator.  
c) Connecting rod.  
d) Engine valve.  
e) Shock absorbers.
- Q7)** a) Explain the following: [6]  
i) Refractory materials.  
ii) Sealants and adhesives.
- b) Write physico-chemical properties of. [6]  
i) EngineOils.  
ii) Brake fluids.  
iii) Greases
- c) What is hydrogen brittlement? Explain in detail. [4]

- Q8)** a) Explain type of defects in metals. [4]
- b) Write a note on [6]
- i) TQM.
  - ii) OSHAS.
- c) Explain the following. [6]
- i) Need of testing and validation of components.
  - ii) Corrosion fatigue



Total No. of Questions : 8]

SEAT No. :

**P4317**

**[4760] - 164**

[Total No. of Pages :2

**M.E. (Mechanical) (Automotive Engineering)**

**VEHICLE AERODYNAMICS**

**(2008 Course) (Semester - II) (Elective - III) (502309 C)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain method of observation of drag fractions and their origins. [6]  
b) What are the objectives of analyzing drag? Explain. [6]  
c) Explain how roof design plays an important role in shape optimization of a vehicle. [6]
- Q2)** a) Classify and Explain flow phenomenon related to vehicle. [6]  
b) Explain strategies for body shape development. [4]  
c) Explain front end modifications in cars. [6]
- Q3)** a) Explain various phenomenons defining the performance of vehicle. [6]  
b) Deduce Bernoulli's equation in accordance with external flow problems related to passenger vehicles. [6]  
c) Explain flow field around cars. [4]

***P.T.O.***

- Q4)** a) Explain the role of windshield and A-pillar in shape optimization. [6]  
b) What is wind noise? Enlist various sources of wind noise and explain them. [6]  
c) Enlist and explain various resistances to motion of vehicles. [4]

## SECTION - II

- Q5)** a) Enlist various requirements of wind tunnel balances. [6]  
b) Plot the general layout of wind tunnels mainly employed for reduced scale model testing. [6]  
c) Write short note on climate tunnels. [4]
- Q6)** a) Explain method of grid generation with the help of suitable flow chart. [6]  
b) What are systematic errors in simulation? Explain. [6]  
c) What is CFD? Explain its importance in accordance with the road vehicle. [4]
- Q7)** a) Explain various limitations of simulations over wind tunnel tests. [6]  
b) Write on Optimum Aerodynamic Design Using the Navier-Stokes Equations. [6]  
c) Plot the general layout of wind tunnels mainly employed for Full scale model testing. [6]
- Q8)** a) Explain measurement of frontal area using laser technology with suitable sketch. [6]  
b) Explain methodology to measure dust accumulation on glass surfaces and vehicle body areas. [6]  
c) Enlist various methods of flow computation. [4]



Total No. of Questions : 8]

SEAT No. :

P4318

[Total No. of Pages : 2

[4760] - 165

**M.E. (Mechanical) (Automotive Engineering)**

**COMPUTATIONAL FLUID DYNAMICS**

**(2008 Pattern) (Theory)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** For a fluid flow, derive the differential form of energy equation from first principles. **[18]**

**Q2)** Explain the impact of general behaviour of different types of partial differential equations on computational fluid dynamics. **[16]**

**Q3)** a) Derive first order accurate forward difference, rearward difference expressions and second order accurate central difference expression for derivative  $df/dx$  of a function  $f(x)$ . **[10]**

b) Derive second order accurate central difference expression for derivative  $d^2f/dx^2$  of a function  $f(x)$ . **[6]**

**Q4)** Write short note on :

a) Adaptive grid. **[8]**

b) Unstructured meshes. **[8]**

**P.T.O.**

## SECTION - II

**Q5)** Explain :

- a) The space marching technique. [9]
- b) The relaxation technique. [9]

**Q6)** Derive the governing equations for quasi one dimensional compressible flow in nozzle. [16]

**Q7)** Describe implicit method for solution of Incompressible Couette Flow. [16]

**Q8)** Describe explicit finite-difference solution of the two-dimensional complete Navier Stokes equations. [16]



Total No. of Questions : 8]

SEAT No. :

P3943

[Total No. of Pages : 2

[4760] - 166

**M.E. (Mechanical-Automotive Engineering) (Semester - II)**

**AUTOMOTIVE CHASSIS DESIGN**

**(2008 Pattern) (Elective - IV(B))**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section - I and three questions from Section - II.*
- 2) *Answers to the two Sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** What do you understand by double wish bone suspension system? Give its advantages during different kinematic conditions of the vehicle. **[8]**
- b) A motor car is fitted with a mono shock suspension system i.e. only one shock absorber is mounted in front of rear wheel. The laden weight of the bike is 240 kg. selecting a suitable material and assuming appropriate deflection during rough ride, design the spring specifying no. of active / inactive coils, mean coil diameter, wire diameter, solid length, free length and types of ends. Draw a sketch showing its mounting. **[8]**
- Q2) a)** Explain with help of neat sketch active suspension. **[8]**
- b) With the help of neat sketches working of a hydraulic power steering system. List the major component of mechanism and draw a hydraulic circuit showing high pressure and return line. **[8]**
- Q3) a)** Differentiate between reversible and irreversible steering. **[8]**
- b) Explain with the help of neat sketch self-energizing disc brakes. **[8]**

**P.T.O.**

- Q4)** Write short note on the following (Any three) : **[18]**
- a) Caster and Camber.
  - b) Helper spring.
  - c) Electrical Power Steering system.
  - d) Load Conscious Valve.

**SECTION - II**

- Q5)** a) Explain with the help of neat sketch servo - power assisted braking systems. **[8]**
- b) Explain with the help of neat sketch Direct-acting vacuum servos. **[8]**
- Q6)** a) What is run flat concept? What are the design features of run flat tyre?**[8]**
- b) Draw cross section of a tyre explaining the role of various components in that. What are the factors improving road grip? **[8]**
- Q7)** a) Explain with the help of neat sketch scammell design. **[8]**
- b) With the help of neat sketch explain suspension of rigid six wheelers.**[8]**
- Q8)** Write short note on the following (Any three) : **[18]**
- a) Hydraulic braking system.
  - b) Retrading and manufacturing of tyres.
  - c) Aspect ratio.
  - d) Transmission of six- wheelers.



Total No. of Questions : 8]

SEAT No. :

**P3803**

[Total No. of Pages : 3

[4760] - 168

**M.E. (Mechanical) (Energy Engg.)**  
**ADVANCED ENGINEERING MATHEMATICS**  
**(2012 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from section - I and three questions from section - II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Use the method of Frobenius to find solution of the differential equation  
 $2x^2 y'' + x(2x - 1)y' + y = 0$  [9]

b) Express  $f(x) = x^3 - 5x^2 + x + 2$  in terms of Legendre's polynomials. [9]

**Q2) a)** Find power series solution of the differential equation. [8]

$$(1 + x^2) \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0$$

b) With usual notation prove following relation : [8]

i)  $J_{(-n)}(x) = (-1)^n J_n(x)$

ii)  $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$

**Q3) a)** State and prove Rodrigue's formula. [8]

b) Explain D'Alembert method for finding solution of wave equation. [8]

$$\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2} \text{ Subject to}$$

i)  $u(x, 0) = f(x)$

ii)  $u_t(x, 0) = g(x)$

**P.T.O.**

- Q4) a)** Find characteristic values and characteristic function of Sturm-Liouville problem for  $\lambda > 0$  real number. [8]  
 $y'' + \lambda y = 0, y(0) = 0, y'(\pi) = 0$
- b) An infinitely long plane uniform Plate is bounded by two parallel edges in the  $y$ -direction and an end at right angles to them. The breadth of the plate is  $\pi$ . This end is maintained at temperature  $u_0$  at all points and other edges at zero temperature. find the temperature function  $u(x,y)$ . [8]

**SECTION - II**

- Q5) a)** Obtain fourier series for the function  $f(x) = x^2, -\pi < x < \pi$ . Hence show that  $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$  [9]
- b) Solve  $\frac{\partial u}{\partial t} = K \frac{\partial^2 u}{\partial x^2}$ , if [9]
- i)  $u(0,t) = 0$   
 ii)  $u_x(l,t) = 0$   
 iii)  $u(x,t)$  is bounded
- iv)  $u(x,0) = \frac{u_0 x}{l}$ , for  $0 \leq x \leq l$

- Q6) a)** Find fourier sine and cosine transform of  $f(x) = \begin{cases} x & , 0 \leq x \leq 1 \\ 2-x & , 1 \leq x \leq 2 \\ 0 & , x > 2 \end{cases}$  [8]
- b) Explain with example : [8]
- i) Contravariant tensor  
 ii) Covariant tensor  
 iii) Mixed tensor

**Q7) a)** If  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$  represent the vibrations of a string of length  $l$  fixed at both ends, find the solution with boundry conditions. **[8]**

i)  $u(0, t) = 0$

ii)  $u(l, t) = 0$

iii)  $\left( \frac{\partial u}{\partial t} \right)_{t=0} = 0$

iv)  $u(x, 0) = a \sin \frac{\pi x}{l}$

b) If  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  defined by  $T(x, y, z) = (2x, 4x - y, 2x + 3y - z)$  then show that  $T$  is linear transform **[8]**

**Q8) a)** Use fourier transform to solve  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0.$  **[8]**

subject to

i)  $u(0, t) = 0$

ii)  $u(x, 0) = \begin{cases} 1 & , & 0 < x < 1 \\ 0 & , & x > 1 \end{cases}$

iii)  $u(x, t)$  is bounded

b) Prove that the contraction of the outer product of the tensor  $A^p$  and  $B_q$  is invariant. **[8]**



Total No. of Questions : 8]

SEAT No. :

P4319

[Total No. of Pages :2

[4760]-169

M.E. (Mechanical-Energy Engineering) (Semester - I)

ADVANCED THERMODYNAMICS

(2012 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.
- 5) Use of calculator is allowed.
- 6) Assume suitable data if necessary.

**SECTION - I**

- Q1)** a) Explain Law of corresponding states. [6]  
b) Discuss the generalised compressibility chart with suitable diagram? [6]  
c) State and explain Vander Waal's Equation of State [4]
- Q2)** a) Explain the phase change process from solid to gas with P-V, T-S and P-T diagram for a substance which shrinks in volume on melting and also for a substance which expands in volume on melting. [6]  
b) Explain critical point and triple point of water with sketch. [4]  
c) On mollier diagram, why do the isobars diverge from one another. [6]
- Q3)** a) Explain increase in entropy principle and entropy generation. [8]  
b) Discuss the Law of degradation of energy and availability function of closed and open system. [8]
- Q4)** Write a note on.  
a) Availability and irreversibility [6]  
b) T-ds relations [6]  
c) Exergy Destruction [6]

**P.T.O.**

**SECTION - II**

**Q5) a)** Write a note on Maxwell relations. [8]

b) Derive the relation  $(C_p - C_v) = -T \left( \frac{\partial v}{\partial T} \right)_p^2 \left( \frac{\partial p}{\partial v} \right)_T$  [8]

**Q6) a)** Explain the enthalpy of reaction with suitable example. [6]

b) Find the adiabatic flame temperature for methane-air stoichiometric mixture. [10]

Consider initially reactants are at 1 atm and 298 K. Use following data.

| Species          | Heat of formation (kJ/kmol) | Specific Heat $C_p$ at 1200 K (kJ/kmol.K) |
|------------------|-----------------------------|---|
| CH <sub>4</sub>  | -74831                      | --  |
| CO <sub>2</sub>  | -393546                     | 56.21                                     |
| H <sub>2</sub> O | -241845                     | 43.87                                     |
| N <sub>2</sub>   | 0                           | 33.71                                     |

**Q7) a)** Discuss the Amagat's Law and Kay's Rule. [8]

b) As applied to statistical thermodynamics, explain the principle of equipartition of energy. [8]

**Q8)** Write a note on.

a) The criteria for chemical equilibrium. [6]

b) Explain Inversion Curve and Joule-Thompson Coefficient. [6]

c) Clapeyron equation. [6]



Total No. of Questions : 8]

SEAT No. :

**P4552**

**[4760] - 17**

[Total No. of Pages :2

**M.E. (Civil) (Const. & Management)  
INTERNATIONAL CONTRACTING  
(2008 Pattern) (Semester -II) (Elective - III)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from Section I and any 3 questions from section II.*
- 2) Answers to the two sections must be written separately.*
- 3) Figures to the right indicate full marks.*
- 4) Make suitable assumptions as necessary and take suitable data wherever reqd.*
- 5) Use of calculator is allowed.*

**SECTION - I**

**Q1)** What are the specific Parameters which are needed to be considered in any International contract from the perspective of **[18]**

- a) Owner
- b) Consultant
- c) Contractor
- d) Resource Vendors
- e) Financiers
- f) Labour?

**Q2)** Explain the role played by the multilateral funding agencies such as the world Bank, Asian Development Bank and the IDBI on International Contracts? Discuss important stipulations prescribed by them. **[16]**

**Q3)** Elaborate on any 8 important FIDIC conditions of the New Red Book used during international bidding in the contract document. **[16]**

**P.T.O.**

**Q4)** Discuss the impact of the GATT and the GATS on the performance and sustenance of the Indian construction sector, giving relevant examples. **[16]**

## **SECTION - II**

**Q5)** Explain the methodology used in the DRB by the board members for effective resolution of disputes on International Bids. Discuss advantages and limitations of this method. **[18]**

**Q6)** Explain the provisions made in the UNICITRAL proceedings as regards the International Arbitration. How are the proceedings conducted to ensure “fairness” to both the parties? Explain. **[16]**

**Q7)** What are the reasons for disputes in any global bidding and during the contract execution? Discuss with examples. **[16]**

**Q8)** Elaborate the following:-

- a) Effect of currency changes and inflation on Performance of global contracts. **[5]**
- b) CIDC-SIAC Institutionalized Arbitration. **[5]**
- c) Basrah Housing Project- Contractual Provisions. **[6]**



Total No. of Questions : 8]

SEAT No. :

**P4320**

**[4760] - 170**

[Total No. of Pages :4

**M.E. (Mechanical - Energy Engineering)  
ENERGY CONVERSION SYSTEMS  
(2008 Course) (502503) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Write classification of energy sources. **[8]**  
b) Write a short note on pressure velocity compounding. **[8]**

**Q2)** a) At a location for a hydroelectric plant, the head available (net) was 335 m. The power availability with an overall efficiency of 86% was 15500 kW. The unit is proposed to run at 500 rpm. Assume  $C_v = 0.98$ ,  $\phi = 0.46$ , Blade velocity coefficient is 0.9. If the bucket outlet angle proposed is  $165^\circ$ . Check for the validity of the assumed efficiency. **[8]**

- b) An open cycle gas turbine is equipped with intercooling, reheat and regeneration arrangement. The H.P. turbine is used for compressor drive and L.P. turbine for output. The specific output of the installation is 150 kW/kg/s and overall thermal efficiency of 32%. The following data refer to this installation.

Pressure ratio in each compressor stage = 3, Isentropic efficiency in each compressor stage = 0.87, Isentropic efficiency in H.P. turbine = 0.87, Isentropic efficiency in L.P. turbine = 0.82, Pressure loss in air side of heat exchanger = 6% of entry pressure, Pressure loss in intercooler = 3% of entry pressure, Pressure loss in reheater = 6% of entry pressure, Turbine inlet temperature (for both) = 1030 K, Atmospheric temperature = 288 K, H.P. compressor inlet temperature = 298 K,

Calculate the permissible pressure drop on the gas side and effectiveness of heat exchanger. Also calculate the mass flow rate of the air required to produce 60 MW. **[8]**

**P.T.O.**

**Q3)** The following are the data collected for a boiler using coal as the fuel. Find out the boiler efficiency by indirect method. **[16]**

Fuel firing rate = 5599.17 kg/hr

Steam generation rate = 21937.5 kg/hr

Steam pressure = 43 kg/cm<sup>2</sup>(g)

Steam temperature = 377 °C

Feed water temperature = 96 °C

%CO<sub>2</sub> in Flue gas = 14

%CO in flue gas = 0.55

Average flue gas temperature = 190°C

Ambient temperature = 31 °C

Humidity in ambient air = 0.0204 kg / kg dry air

Surface temperature of boiler = 70 °C

Wind velocity around the boiler = 3.5 m/s

Total surface area of boiler = 90 m<sup>2</sup>

GCV of Bottom ash = 800 kCal/kg

GCV of fly ash = 452.5 kCal/kg

Ratio of bottom ash to fly ash = 90:10

Fuel Analysis (in %)

Ash content in fuel = 8.63

Moisture in coal = 31.6

Carbon content = 41.65

Hydrogen content = 2.0413

Nitrogen content = 1.6

Oxygen content = 14.48

GCV of Coal = 3501 kCal/kg

**Q4)** Attempt any three:

**[18]**

- a) The outer diameter of a Francis runner is 1.4 m. The flow velocity at inlet is 9.5 m/s. The absolute velocity at the exit is 7 m/s. The speed of operation is 430 rpm. The power developed is 12.25 MW, with a flow rate of 12 m<sup>3</sup>/s. Total head is 115m. For shockless entry determine the angle of the inlet guide vane. Also find the absolute velocity at entrance, the runner blade angle at inlet and the loss of head in the unit. Assume zero whirl at exit. Also find the specific speed.
- b) The head available at a location was 1500 m. It is proposed to use a generator to run at 750 rpm. The power available is estimated at 20,000 kW. Investigate whether a single jet unit will be suitable. Estimate the number of jets and their diameter. Determine the mean diameter of the runner and the number of buckets.
- c) In an impulse steam turbine, steam is accelerated through nozzle from rest. It enters the nozzle at 9.8 bar dry and saturated. The height of the blade is 10 cm and the nozzle angle is 15°. Mean blade velocity is 144 m/s. The blade velocity ratio is 0.48 and blade velocity coefficient is 0.97.

Find :

- i) Isentropic heat drop.
  - ii) Energy lost in the nozzles and in moving blades due to friction.
  - iii) Energy lost due to finite velocity of steam leaving the stage.
  - iv) Mass flow rate.
  - v) Power developed per stage.
  - vi) Diagram and stage efficiency. Take : Nozzle efficiency = 92%  
Blade angles at inlet = Blade angles at outlet Speed = 3000 rev/min
- d) Explain the operating principle of a heat pump with examples.

## **SECTION - II**

- Q5)** a) Explain capacity of the compressor and various efficiencies of the compressor. **[8]**
- b) Describe benefits of Waste Heat Recovery with an example. **[8]**

- Q6)** a) Write in detail compressed air distribution system. [8]  
b) Explain in brief flow control strategies in case of fans and types of fans. [8]
- Q7)** a) What is NPSH of a pump and effects of inadequate NPSH? [8]  
b) List the factors affecting cooling tower performance. And explain types of cooling towers. [8]
- Q8)** Attempt any three: [18]  
a) Differentiate between fans, blowers and compressors.  
b) Explain Steam Turbine Cogeneration systems.  
c) Factors affecting selection of Diesel Generating system.  
d) Write detail classification of pumps.



Total No. of Questions : 8]

SEAT No. :

**P4321**

**[4760]-171**

[Total No. of Pages : 2

**M.E. (Mechanical) (Energy Engineering)**  
**NUCLEAR MATERIALS AND REACTOR FUNDAMENTALS**  
**(2012 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

**Q1) a)** How to determine the type of radioactive decay that the nuclides in each region of the chart will typically undergo? Explain in detail. **[8]**

b) Why only the heaviest nuclei are easily fissioned? Explain in detail. **[8]**

**Q2) a)** A sample of material contains 20 micrograms of californium-252.

Californium-252 has a half-life of 2.638 years. **[10]**

Calculate:

- i) The number of californium-252 atoms initially present.
- ii) The activity of the californium-252 in curies.
- iii) The number of californium-252 atoms that will remain in 12 years.
- iv) The time it will take for the activity to reach 0.001 curies.

b) Why uranium-235 fissions with thermal neutrons and uranium-238 fissions only with fast neutrons? Explain in detail. **[8]**

**Q3) a)** Describe the following reactions where a neutron is absorbed in a nucleus: **[8]**

- i) Radioactive capture.
- ii) Particle ejection.

b) Explain the effect of radiation damage on nuclear materials. **[8]**

**P.T.O.**

- Q4)** a) Describe the following scattering interactions between a neutron and a nucleus: [8]
- i) Elastic scattering.
  - ii) Inelastic scattering.
- b) Explain the hardening and embrittlement of nuclear materials due to exposure of nuclear radiations. [8]

### **SECTION-II**

- Q5)** a) Define the following terms: [9]
- i) Reactor period.
  - ii) Doubling time.
  - iii) Reactor startup rate.
- b) Describe the relationship between the delayed neutron fraction, average delayed neutron fraction, and effective delayed neutron fraction. [9]
- Q6)** a) Explain the Indian scenario in nuclear waste management. [8]
- b) Explain various changes Uranium forms from mining process to fuel fabrications. [8]
- Q7)** a) Explain the following processes of nuclear fuel enrichment: [8]
- i) Gaseous diffusion.
  - ii) Centrifuge process.
- b) How nuclear fuel rods are manufactured? Explain in detail. [8]
- Q8)** a) Explain the moderators used in the nuclear reactor. [8]
- b) What is In-situ leaching? Explain in detail. [8]



Total No. of Questions : 8]

SEAT No. :

**P3804**

[Total No. of Pages : 2

[4760] - 176

**M.E. (Mechanical) (Energy Engineering)**

**NON CONVENTIONAL ENERGY SOURCES**

**(2008 Pattern) (Elective - II) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figure to the right indicate full marks.*
- 5) *Use of Logarithmic table, slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is the difference between a Pyrheliometer and a pyranometer? Describe the principle of Angstrom type pyrheliometer. [8]
- b) Explain the following terms (Any Two) [8]
- i) diffuse radiation
  - ii) reflected radiation
  - iii) total radiation
- Q2)** a) Discuss the parameter governing the performance of flat plate collectors. [8]
- b) Why orientation is needed in concentrating type collectors? Describe the different methods of sun tracking? [8]
- Q3)** a) What are the main advantages and disadvantages of sensible heat storage with water as storage media? Compare them with that of solid media storage. [8]
- b) What is principle collection of solar energy used in a non-convective solar pond? Describe a non-convective solar pond for solar energy collection and storage. [8]

**P.T.O.**

- Q4)** Write short notes on following **[18]**
- a) Solar thermal collectors
  - b) Hydrogen storage
  - c) Solar pumping

**SECTION - II**

- Q5)** a) How Biogas plants classified? Explain them briefly giving their advantages and disadvantages. **[8]**
- b) What is mean by energy plantation? What are the advantages and disadvantages. **[8]**
- Q6)** a) Describe with a neat sketch the working of wind energy system with main components. **[8]**
- b) Based on simple turbine theory, derive expression for wind power. Also obtain the value of coefficient of performance for maximum power. **[8]**
- Q7)** a) What are the prospects of geothermal field in India? Discuss nature and characteristic of Indian geothermal reservoirs and it's possible utilization. **[8]**
- b) What is the scope and limitations for Tidal energy in India? **[8]**
- Q8)** Write short notes on following **[18]**
- a) Open cycle OTEC system
  - b) Sources of geothermal pollution
  - c) Savonius rotor.



Total No. of Questions : 8]

SEAT No. :

P4322

[Total No. of Pages : 2

[4760] - 177

M.E. (Mechanical - Energy Engineering) (Semester - II)

CONVECTIVE HEAT TRANSFER

(2012 Pattern)

Time :3 Hours]

[Max. Marks :100

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of calculator is allowed.*

**SECTION - I**

- Q1)** a) Consider a  $0.6 \text{ m} \times 0.6 \text{ m}$  thin square plate in a room at  $30^\circ\text{C}$ . One side of the plate is maintained at a temperature of  $90^\circ\text{C}$ , while the other side is insulated, Determine the rate of heat transfer from the plate by natural convection if the plate is (a) vertical, (b) horizontal with hot surface facing up, and (c) horizontal with hot surface facing down. Assume approximate value of required data. [8]
- b) Using dimensional analysis establish a relation between Nusselt, Prandtl and Grashof numbers. [8]
- Q2)** a) Explain methods to find heat transfer coefficient practically in convection. [10]
- b) Explain Combined Forced and Free Convection mode of heat transfer. [6]
- Q3)** a) Derive the differential form of convection continuity equation. [8]
- b) Explain physical significance of dimensionless terms in convection. [8]

**P.T.O.**

- Q4)** Write a short note (Any three): **[18]**
- a) Combined Convection and Radiation in Flows
  - b) Single Phase Forced Convection in Micro-channels
  - c) Gas Flow in Micro-channels
  - d) Physical mechanism of boundary layer development over flat surface and circular tubes.

**SECTION - II**

- Q5)** a) Explain in detail flow boiling in vertical tube under forced convection. **[8]**  
b) Explain advantages and applications of micro-channel heat transfer. **[8]**
- Q6)** a) A horizontal steam pipe of diameter 20cm runs through a large room and is exposed to air at a temperature of 20 °C. The pipe surface temperature is 180°C. Find the flow of heat per meter length of the pipe by convection and radiation. Take emissivity of pipe surface as 0.8, Use correlation.  
$$Nu = 0.53 (Gr.Pr)^{1/4}$$
. Assume approximate value of required data. **[8]**  
b) Derive equation for counter flow heat exchanger using LMTD method. **[8]**
- Q7)** a) Explain forced convection Boiling in detail. **[8]**  
b) Explain film-wise drop-wise condensation and their correlations. **[8]**
- Q8)** Write a note (Any three): **[18]**
- a) Atmospheric and Solar radiation.
  - b) Pool Boiling Curve.
  - c) Micro - channel heat sinks.
  - d) Micro Heat Pipes and it's applications.



Total No. of Questions : 8]

SEAT No. :

P4323

[Total No. of Pages : 2

[4760]-178

M.E. (Mechanical) (Energy Engineering)

ENERGY SYSTEMS MODELING & ANALYSIS

(2012 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.
- 6) Use of Calculator is allowed.

**SECTION - I**

- Q1)** a) Explain in brief discrete and continuous system? [6]  
b) Explain any two types of system study. [10]
- Q2)** a) Explain the concept of analog model with an example. [6]  
b) Derive general formula to fit  $a + bx + cx^2$  or  $ax^2 + bx + c$  using Least square regression method. [10]
- Q3)** a) Write an algorithm to fit  $(y = ae^{bx})$  by least square method. [8]  
b) Explain different steps in simulation study. [8]
- Q4)** Write short note (any three) : [18]  
a) Interaction between models.  
b) Physical model.  
c) Necessity of system modeling.  
d) Comparison the simulation and analytical methods.

P.T.O.

## SECTION - II

- Q5)** a) A manufacturer produces three types of plastic fixtures. The time required for molding, trimming and packaging is given in Table (Times are given in hours per dozen fixtures.)

| Process   | Type A        | Type B        | Type C        | Total time available |
|-----------|---------------|---------------|---------------|----------------------|
| Molding   | 1             | 2             | $\frac{3}{2}$ | 12,000               |
| Trimming  | $\frac{2}{3}$ | $\frac{2}{3}$ | 1             | 4,600                |
| Packaging | $\frac{1}{2}$ | $\frac{1}{3}$ | $\frac{1}{2}$ | 2,400                |
| Profit    | \$11          | \$16          | \$15          | -                    |

How many dozen of each type of fixture should be produced to obtain a maximum profit? [12]

- b) The cost  $C$  per unit mass of material processed in an extrusion facility is given by the expression

$$C = 2T^2V + \frac{3T}{V^2} + \frac{2}{T}$$

Where;  $T$  is the dimensionless temperature of the material being extruded,  $V$  is the dimensionless volume flow rate, and  $C$  includes both capital and running costs. Determine the minimum cost. [4]

- Q6)** a) Write the proof of Lagrange multiplier method? [8]

- b) Explain basis, objective and example of “Pinch Analysis”. [8]

- Q7)** a) Explain Uniform Dichotomous Search technique and write its algorithm to find optimum design. [8]

- b) Find the minimum of  $f = x(x-1.5)$  using exhaustive search method in the interval (0.0, 1.00) Take  $\Delta x = 0.1$ . [8]

- Q8)** Write a short note (Any Three) : [18]

- a) Interval of uncertainty and reduction ratio.
- b) Sequential Dichotomous Search technique
- c) Fibonacci search technique.
- d) Golden section search method.



Total No. of Questions : 8]

SEAT No. :

**P4324**

**[4760] - 179**

[Total No. of Pages :2

**M.E. (Energy Engineering)  
ENERGY MANAGEMENT  
(2012 Pattern) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the various types of sources of energy in world energy market. **[8]**  
b) Explain the Scope Energy management System. **[8]**
- Q2)** a) Explain the three phases of Energy Audit in detail. **[8]**  
b) What are the functions of Energy Manager? What are the functions of Energy Auditor? **[8]**
- Q3)** a) Explain in detail with neat diagram the Steam distribution system. **[8]**  
b) What is Steam trap? List various types of steam traps. Discuss with neat labeled diagram any Thermostatic steam trap. **[8]**
- Q4)** Write a short note on (any three): **[18]**
- a) Laws of thermodynamics.
  - b) Types of thermal insulation materials.
  - c) Condensate recovery.
  - d) Energy conservation plan for a dairy.

**P.T.O.**

## SECTION - II

- Q5)** a) What possible improvement measures you would have taken for a general lighting system? [8]  
b) What are different Energy Conservation opportunities in HVAC System. [8]
- Q6)** a) Explain the waste heat recovery systems used in boiler and Explain how the efficiency of the plant increases. [8]  
b) What are topping and bottoming cycles of Co-generation? Explain with neat sketch. [8]
- Q7)** a) Explain the fundamental processes for the evaluation of Waste Management System. [8]  
b) Explain Regulations and policy issues of Nuclear Waste Management. [8]
- Q8)** Write a short note on (any three): [18]  
a) Heat pipe.  
b) Recuperators.  
c) System distribution losses.  
d) Automatic power factor controller.



Total No. of Questions : 8]

SEAT No. :

**P4553**

**[4760]-18**

[Total No. of Pages : 2

**M.E. (Civil) (Const. & Mgmt.)**

**THRUST AREAS IN PROJECT MANAGEMENT**

**(2008 Course) (Semester - II) (Open Elective)**

*Time : 4 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from section - I and any 3 questions from section - II.*
- 2) *Answers to the two sections must be written separately.*
- 3) *Figures to the right indicate full marks.*
- 4) *Make suitable assumptions as necessary and take suitable data wherever reqd.*
- 5) *Use of calculators is allowed.*

**SECTION - I**

- Q1)** Perform SWOT analysis of the Indian construction sector and recommend measures to convert the weaknesses to the strengths. **[18]**
- Q2)** Draw diagrammatic representation of the fast track construction projects. Discuss advantages and limitations of the same. **[16]**
- Q3)** With case studies explain how “partnering” of projects help in preventing construction disputes and complete the projects as per their specified requirements. **[16]**
- Q4)** Detail out with examples the 8, ISO principles of the 9001:2008 series. **[16]**

**SECTION - II**

- Q5)** Explain project leadership styles with proper examples of the construction sector. Differentiate between a leader and a manager with examples. **[18]**

***P.T.O.***

**Q6)** Differentiate between an “entrepreneur” and “entrepreneurial qualities”. In construction organisations what qualities are required of the employees? How these qualities can be mapped, assessed and improved? Elaborate with examples. **[16]**

**Q7)** What is project pre-planning? What are its advantages? Explain role of PDRI in project pre-planning. Draw project influence-cost relationship and explain its significance. **[16]**

**Q8)** What is a pre-engineered construction? What are the challenges in these type of constructions? What are the merits of this construction over other types? Explain with any case study. **[16]**

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4325**

**[4760] - 180**

[Total No. of Pages :2

**M.E. (Mechanical) (Energy Engineering)  
RADIATION SAFETY AND SHIELDING  
(2012 Course) (Elective - III) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of calculator is allowed.*

**SECTION - I**

- Q1)** a) Explain reactor effluent and its release into environment. [4]  
b) Explain ALARA and BAT principle. [6]  
c) Explain the needs of radioactive shielding and its characteristics. [6]
- Q2)** a) What is radiation and explain ionizing radiation? [8]  
b) Explain different kind of radiation interactions with matter. [8]
- Q3)** a) Write a note on environmental impacts of nuclear power plant. [8]  
b) What are control methods for ionizing radiation? [4]  
c) What to do in a radiation hazard situation? [4]
- Q4)** Write short notes on (Any Three): [18]  
a) Reasons for Fukushima Nuclear Disaster.  
b) Equivalent dose and effective dose.  
c) Measurement of radiation.  
d) Committed equivalent and committed effective dose.

**P.T.O.**

## SECTION - II

- Q5)** a) What are the different ways to protect against radiation exposure? [8]  
b) Write note on Standards of Radiation Protection. [8]
- Q6)** a) Explain emergency preparedness for nuclear power plant. [8]  
b) What do you mean by 'Contamination'. What are different ways to control contamination? [8]
- Q7)** a) Write note on "Principal technical requirements" for radiation safety design. [8]  
b) Write note on the IAEA standards for safety design. [8]
- Q8)** Write notes on: (Any Three) [18]  
a) Criteria for safety design  
b) Kerma (K)  
c) Safety principles  
d) Dose Equivalent



Total No. of Questions : 8]

SEAT No. :

P4326

[Total No. of Pages : 2

[4760] - 185

**M.E. (Mechanical) (Energy Engineering)**

**PROCESS STORAGE AND DISPOSAL OF NUCLEAR WASTE**

**(2012 Pattern) (Semester - II) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain reactor effluent and its release into environment. [8]  
b) Which are the sources of nuclear waste? Explain any four. [8]
- Q2)** a) Write note on disposal of radioactive waste. [8]  
b) Explain Long-term behaviour of wastes and containers [8]
- Q3)** a) Explain process of Low Level waste Handling. [8]  
b) Explain different kind of radiation interactions with matter. [8]
- Q4)** Write short note on (Any Three) : [18]  
a) Ground water and radionuclide movement around repositories.  
b) Safety assessment of geological disposal.  
c) Treatment and conditioning of liquid waste.  
d) Committed equivalent and committed effective dose.

**P.T.O.**

## SECTION - II

- Q5)** a) What are the different ways to protect against radiation exposure? [8]  
b) Explain effect of nuclear waste on human body. [8]
- Q6)** a) What are Pre-Treatment of Radioactive wastes before disposal. [8]  
b) What do you mean by 'Contamination'. What are different ways to control? [8]
- Q7)** a) Which are the challenges in nuclear waste management? [8]  
b) What are Principal technical requirements for radiation safety design. [8]
- Q8)** Write note on (Any Three) : [18]  
a) Radioactive Waste Recycling  
b) Nuclear Waste Regulations  
c) Dose Equivalent  
d) Surface Contamination



Total No. of Questions : 10]

SEAT No. :

**P3805**

[Total No. of Pages : 3

[4760] - 187

**M.E. (Mechanical) (CADME)**  
**ADVANCED MACHINE DESIGN**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) Explain in brief the state of strain at a point. [8]

b) Derive the expression for Airy's stress function in rectangular coordinate. [8]

**Q2)** a) Explain the maximum elastic strain theory. [6]

b) Determine the strain energy release rate for a double cantilever beam with  $a \gg 2h$  and  $l \gg 2h$  (Shown in Fig. 1), where P is the applied load and B is the width of the beam. [10]

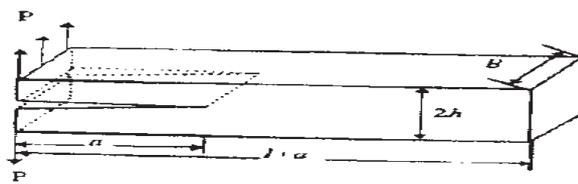


Fig. 1 Double cantilever beam

**Q3)** a) Explain Castigliano's theorems. [8]

b) Explain the concept of energy balance during crack growth? [8]

**Q4)** a) Explain the significance of theory of failure. [8]

b) Explain the Mohr's theory in detail. [8]

**P.T.O.**

**Q5) Write Short Notes on :**

**[18]**

- a) octahedral shearing stress theory
- b) theory of virtual work and energy
- c) generalized Hooke's Law

**SECTION - II**

**Q6) a)** What is true stress and true strain? Assuming exponential relation for true stress and true strain, derive the expression to estimate time of rupture. **[8]**

b) Following creep data at a certain temperature is known. **[8]**

$$S_1 = 10.5 \text{ MPa} \quad \epsilon_1 = 0.012 \text{ percent per 1000 hrs}$$

$$S_2 = 14 \text{ MPa} \quad \epsilon_2 = 0.025 \text{ percent per 1000 hrs}$$

Determine the constants of the hyperbolic sine law and calculate the creep rates for stresses 20 MPa and 28 MPa.

**Q7) a)** Two 10 teeth gears are to mesh without undercutting. The gears are generated using standard hob with 20° pressure angle. Module is 4 mm while clearance is 0.2 mm. Using extended centre distance method, Find **[10]**

- i) Hob shift
- ii) Blank diameter and depth of cutter setting
- iii) Actual pressure angle.

Take usual notations.

$$\theta = \text{inv} \phi$$

$$\phi = v - \frac{2}{15}v^3 + \frac{3}{175}v^5 \quad \text{Where } v = \sqrt[3]{3\theta}$$

$\theta$  and  $\phi$  are in radians.

b) Explain interference, undercutting **[6]**

- Q8)** a) Discuss the loading and deflection of rubber springs used for simple and cylindrical shear loads. [8]
- b) Discuss load deflection characteristics for "Belleville spring". State the advantages of these springs. [8]

**Q9)** a) For a graphite epoxy unidirectional lamina, find the following : [10]

- i) Compliance matrix.
- ii) Minor Poisson's ratio.
- iii) Strains in the 1–2 coordinate system, if the applied stresses are  $\sigma_1 = 2 \text{ Mpa}$ ,  $\sigma_2 = - 3 \text{ MPa}$ ,  $\tau_{12} = 4 \text{ MPa}$ .

The engineering elastic constants of the unidirectional graphite/epoxy lamina are  $E_1 = 181 \text{ GPa}$ ,  $E_2 = 10.3 \text{ GPa}$ ,  $V_{12} = 0.28$ ,  $G_{12} = 7.17 \text{ GPa}$ .

- b) List out and explain any one Fatigue strength improvement techniques. [6]

**Q10)** Write short notes on : [18]

- a) Transverse shear effects in composite laminates.
- b) Low cycle and high cycle fatigue.
- c) Surge in springs.



Total No. of Questions : 8]

SEAT No. :

P3806

[Total No. of Pages : 3

[4760] - 188

M.E. (Mechanical) (CADME)  
MATHEMATICAL MODELING  
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any Three questions from each section.
- 2) Section I & II should be written on separate answer book
- 3) Draw Diagrams wherever necessary.
- 4) Use of scientific calculator is allowed.
- 5) Assume suitable data where ever necessary

SECTION - I

Q1) a) Find the extremals of the isoperimetric problem  $I[y(x)] = \int_{x_0}^{x_1} y^2 dx$  given that  $\int_{x_0}^{x_1} y dx = c$ , a constant. [8]

b) Using given matrix reduce the following matrix to the tridiagonal form

$$A = \begin{bmatrix} 5 & 2 & 4 \\ 4 & 5 & 4 \\ 2 & 5 & 5 \end{bmatrix}. \quad [8]$$

Q2) a) Solve the boundary value problem by Galerkins Method. [10]

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 2x^2, \quad y(0) = 1, y(1) = 1.$$

b) Solve the Laplace equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  Subjected to the condition  $u(0, y) = D$ ,  $u(u, y) = 16 + 4y$   $Y(x, 0) = x^2/4$ ,  $u(x, u) = x^2$  with  $\Delta x = \Delta y = 1$  in  $u < x < 4, u, y, 4$ . [6]

P.T.O.

**Q3) a)** A tightly stretched string with fixed end points  $x = 0$  and  $x = 1$  is initially in a position given by  $y = y_0 \sin^3 [\pi x/l]$ . If it is released from rest from this position, find displacement  $y(x,t)$ . [6]

b) Using Jacobis method to find eigen values of the matrix. [10]

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

**Q4) a)** Find the smallest eigen value by inverse iteration method. [8]

$$\begin{bmatrix} 4 & -2 & 0 & 0 \\ -2 & 4 & -2 & 0 \\ 0 & -2 & 4 & -2 \\ 0 & 0 & -2 & -2 \end{bmatrix} [x] = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \text{ Using starting vecto } \{x\}^T = \langle 1111 \rangle$$

b) Find the number of real and complex root of polynomial equation  $8x^4 + 4x^2 - 2 = 0$  using Sturn sequences. [10]

### SECTION - II

**Q5)** The weight of the calf taken at weekly interval are given below. Fit a straight line using the method at least square and find the average rate of growth for a week [16]

|        |    |    |    |    |    |    |    |    |     |     |
|--------|----|----|----|----|----|----|----|----|-----|-----|
| Age    | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  |
| Weight | 48 | 54 | 63 | 71 | 75 | 83 | 89 | 95 | 100 | 106 |

**Q6) a)** Find the deflection of the vibrating string of unit length having fixed ends with initial velocity zero and initial deflection  $f(x)=K(\sin x - \sin 2x)$ . [8]

b) The following table gives the values of  $f(x)$  at the equal interval of  $x$  [8]

|      |      |      |      |      |      |
|------|------|------|------|------|------|
| x    | 0    | 0.5  | 1    | 1.5  | 2    |
| F(x) | 0.49 | 0.42 | 0.32 | 0.29 | 0.14 |

**Q7) a)** Using Laczos method calculate two smallest eigen values and eigen

vectors of 
$$\begin{bmatrix} 2 & -1 & 0 & 0 \\ -1 & 2 & -1 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & -1 \end{bmatrix} [x] = \lambda \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
 using starting vecto

$\{x\}^T = \langle 11111 \rangle.$  **[8]**

b) What are the approaches in determining the sample size? Explain. **[8]**

**Q8) a)** Weight of the 10 students is as follows : **[10]**

|        |    |    |    |    |    |    |    |    |    |    |
|--------|----|----|----|----|----|----|----|----|----|----|
| Sr.    | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
| Weight | 22 | 43 | 49 | 57 | 49 | 42 | 58 | 51 | 56 | 51 |

Can we say that the variance of the distribution of weight of all students from which the above sample of 8 students was drawn is equal to 20 Kg? Test this at 5% and 1% level of significance

b) Determine the size of the simple for estimating the true weight of the serial containers for the universe with  $N = 5000$  on the basis of the following information

- i) the variance of weight = 4 Dunces on the basis of past record
- ii) Estimate should be within 0.8 Dunces of the true average weight within 99% probability. **[8]**



Total No. of Questions : 8]

SEAT No. :

P4720

[Total No. of Pages : 2

[4760] - 189

M.E. (Mechanical) (Computer Aided Design, Manufacturing & Engg.)

**COMPUTER AIDED DESIGN**

**(2012 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right indicates full marks*

**SECTION - I**

**Q1)** What is significance of synthetic curves? Explain Hermetic cubic spline curve and Bezier curve with its characteristics and applications. **[16]**

**Q2)** What is parametric representation of surface? Where it is recommended? How ruled surface and Blending surface is represented parametrically? **[16]**

**Q3)** Represent Bezier surface. What are its properties? Explain:Displaying Segmentation. **[16]**

**Q4)** What is tabulated surface? Explain its significance. Represent 2D & 3D orthogonal transformations. **[18]**

**P.T.O.**

## SECTION - II

**Q5)** Brief the following concepts about solid modeling. **[16]**

- a) Representation technique --- any two
- b) Mechanical tolerances and Mass property calculations.

**Q6)** What is evaluation of data? List data exchange formats. Explain IGES & STEP. **[16]**

**Q7)** Explain: **[16]**

- a) Algorithm for shading and rendering.
- b) Variational modeling and tolerance modeling.

**Q8)** Brief the concepts with its features. **[18]**

- a) AI in design
- b) Collaborative Design --- Principles & Approach



Total No. of Questions : 8]

SEAT No. :

P4531

[Total No. of Pages : 3

[4760] - 19

M.E. (Civil - Hydraulics)

COMPUTATIONAL METHODS IN HYDRAULICS

(2008 Pattern)

Time :3 Hours]

[Max. Marks :100

*Instructions to the candidates:*

- 1) *Answer any three questions from each Section.*
- 2) *Answers to the two Sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule and non- programmable electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) What is the classification of second order partial differential equations?[4]

b) Write down the finite difference analogue of the equation,

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y). \quad [6]$$

Classify the equation  $\frac{\partial^2 u}{\partial x^2} + 3\frac{\partial^2 u}{\partial x\partial y} + \frac{\partial^2 u}{\partial y^2} = 0$ .

c) Explain the applications of finite difference method in Hydraulic Engineering. [6]

**Q2)** a) Solve the Laplace equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  at the pivotal points of the grid shown in the fig 2.a [9]

**P.T.O.**

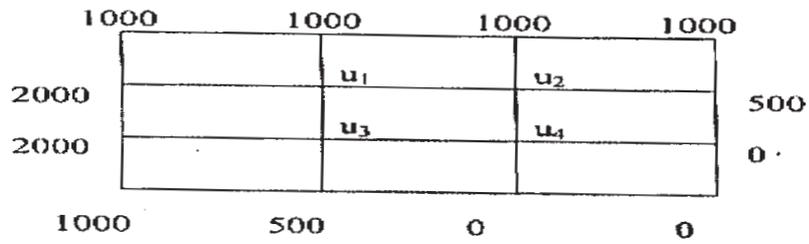


Fig.2.a

- b) Solve the poisson equation  $\nabla^2 u = -81xy, 0 < x < 1, 0 < y < 1$  given that  $u(0, y) = 0, u(x, 0) = 0, u(1, y) = 100, u(x, 1) = 100$  and  $h = 1/3$ . [8]

- Q3) a) Explain how you would test the goodness of fit of a distribution to the observed data by Chi-square test. [8]

- b) The temperature ' $\theta$ ' of a vessel and cooling time ' $t$ ' in minutes since the beginning of observations are connected by the law of the form  $\theta = ae^{bt}$ . [9]

Develop this regression equation.

|          |      |      |    |      |      |
|----------|------|------|----|------|------|
| $t$      | 0    | 1    | 2  | 3    | 5    |
| $\theta$ | 52.8 | 48.3 | 46 | 43.5 | 39.7 |

- Q4) a) Fit a Poisson distribution of the following data and test for its goodness of fit at level of significance 0.05. [8]

|     |     |     |     |    |    |
|-----|-----|-----|-----|----|----|
| $x$ | 0   | 1   | 2   | 3  | 4  |
| $f$ | 419 | 352 | 154 | 56 | 19 |

- b) Explain : [8]
- Markov Chain
  - Markov process
  - Simple and multiple regressions
  - Beta  $\beta$  and Gamma  $\gamma$  distribution.

## SECTION - II

**Q5) a)** Discuss the transformation  $z = z^2$ . [5]

b) Find the transformation which will map the interior of the infinite strip bounded by the lines  $v = 0, v = \pi$  on to the upper half of the  $z$ -plane:[6]

c) Use trapezoidal rule to evaluate  $\int_0^2 e^{-x^2}$  considering ten sub intervals.[6]

**Q6) a)** Use Simpsons 1/3 rule to find  $\int_0^{0.6} e^{-x^2} dx$  using seven ordinates. [8]

b) Explain Newton-Cote's quadrature formula and hence how you obtain different numerical integration rules. [8]

**Q7) a)** Use Cauchy's integral formula to evaluate  $\oint \frac{\cos \pi z}{z^2 - 1} dz$  around a rectangle with vertices  $2 \pm i, -2 \pm i$ . [8]

b) Solve the following system of simultaneous equations by relaxation method. [8]

$$3x + 9y - 2z = 11; 4x + 2y + 13z = 24; 4x - 4y + 3z = -8.$$

**Q8) a)** A river is 24m wide. The depth  $d$  in meter at a distance  $x$  meter from one bank is given by the following table: [10]

|     |   |      |      |      |      |      |      |      |      |
|-----|---|------|------|------|------|------|------|------|------|
| $x$ | 0 | 3    | 6    | 9    | 12   | 15   | 18   | 21   | 24   |
| $d$ | 0 | 1.22 | 2.13 | 2.74 | 3.66 | 4.57 | 4.27 | 2.44 | 0.91 |

Find approximately the area of the cross section. Use Simpson's 3/8 th rule.

b) Use Gauss Quadrature three point formula to evaluate

$$I = \int_0^1 \frac{1}{x} \sin\left(\frac{1}{x}\right) dx \quad [7]$$



Total No. of Questions : 8]

SEAT No. :

**P3944**

**[4760]-191**

[Total No. of Pages : 3

**M.E. (Mechanical CADME)**  
**ADVANCED MANUFACTURING PROCESS**  
**(2012 Course) (Semester - I) (Elective-I B)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Question no 1 and 8 are compulsory.*
- 2) *Solve any two questions out of rest questions in each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Derive an expression for total energy consumed per unit volume for an orthogonal Cutting. **[10]**
- b) How cutting forces are measured? Explain the different types of dynamometers used in metal cutting. **[8]**
- Q2)** a) Explain in detail about mounting & balancing of Grinding wheel. **[8]**
- b) Discuss the selection of Grinding wheel based on following elements:**[8]**
- i) Type of Abrasive
  - ii) Grain Size
  - iii) Structure
  - iv) Bond

**P.T.O.**

**Q3) a)** Explain the various Centreless Grinding arrangements. [8]

b) The following equation is given for Tool Life in Turning Operation:

$$VT^{0.13} f^{0.77} d^{0.37} = C$$

A 60 minute tool life was obtained while cutting at  $V = 30$  m/min,  $f = 0.3$  mm/rev and  $d = 2.5$ mm. Determine the change in tool life if the cutting speed, feed and depth of cut are increased by 20% individually and also taken together. [8]

**Q4) a)** Explain the parameter which governs the Sintering Process. [8]

b) Describe the various Powder injection molding techniques in detail. [8]

### SECTION - II

**Q5) a)** Give the classification of unconventional machining process in detail and discuss the significance of same. [8]

b) Describe the following process parameters of AJM in detail: [8]

i) Grain size

ii) Mixing ratio

iii) Stand of Distance

iv) Nozzle Diameter

**Q6) a)** Write a detail note on construction, Material and Tool Design for USM process. [8]

b) Write a detail note on Historical Perspective & Economics of High Speed Machining. [8]

**Q7) a)** Discuss the core issues involved in rapid Prototype technology. [8]

b) Explain in detail layer by layer and fused deposition modeling techniques. [8]

**Q8)** Write a short note on any three of the following:

**[18]**

- a) Material properties at high strain rate.
- b) Aerospace Al-Ti alloys and applications.
- c) Chemical Machining Process.
- d) Process parameters of EDM.
- e) Significance of CAD and GMP in Rapid Prototyping.

*EEE*

Total No. of Questions : 8]

SEAT No. :

P4743

[Total No. of Pages : 2

[4760] - 193

**M.E. (Mechanical) (CADM&E)**  
**CAD/CAM PRACTICES IN METAL FORMING**  
**(2012 Pattern) (Semester - I)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** Explain the following terms in the context of metal forming. **[18]**
- a) Strain Hardening Coefficient.
  - b) Normal Anisotropy Coefficient.
  - c) Lofted Bends.
  - d) Flat Pattern.
  - e) Bend Angles.
  - f) Break Corner.
- Q2)** a) Explain the role of temperature in Metal Forming. **[8]**  
b) Explain the role of Friction and Lubrication in hot and cold working. **[8]**
- Q3)** a) Discuss various steels used in Metal Forming. **[8]**  
b) Discuss the construction and working of Hydraulic Press with neat sketch. **[8]**
- Q4)** a) Define Formability. Describe different properties of metal which has significant effect on formability. **[8]**  
b) What is Forming Limit Diagram? Explain in detail. Discuss the importance in Metal Working. **[8]**

**P.T.O.**

## SECTION - II

- Q5)** What are the factors to be considered while selecting a press for Metal Forming? Discuss in Detail. Compare performance of Mechanical and Hydraulic Press. **[18]**
- Q6)** a) Explain the construction and working of Hydro Forming Presses. **[8]**  
b) What is workability and Residual Stresses in Metal Forming? Elaborate. **[8]**
- Q7)** a) Discuss the procedure for calculation of clearance in Metal Forming. Elaborate its importance. **[8]**  
b) With suitable sketches discuss various press forming operations. **[8]**
- Q8)** a) Discuss the effect of Blank Holder Force and Forming Load on Uniform Strain Distribution. **[8]**  
b) Explain detailed Die Design for Deep Drawing Process. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P3945**

**[4760] - 195**

[Total No. of Pages : 2

**M.E. (Mechanical) (CADM&E)**  
**INTEGRATED PRODUCT DESIGN AND DEVELOPMENT**  
**(2012 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any Three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Discuss various stages of Product Life Cycle Model in detail. [9]  
b) Explain the transition of EDM to PDM and into PLM. [9]
- Q2)** Define customer need? State and Discuss various needs in detail. Elaborate the concept of Market Segmentation. [16]
- Q3)** What is Concurrent Engineering? Explain in Detail. Elaborate the concept of House of Quality with suitable example. [16]
- Q4)** a) Discuss Technology S Curve with suitable example. State advantages of Technology Forecasting. [8]  
b) Discuss Product Design versus Product Development in detail. [8]

**SECTION - II**

- Q5)** Define Benchmarking. Enlist objectives and advantages. Discuss the detailed procedure for Benchmarking with suitable example. [18]
- Q6)** a) Explain C-sketch method in detail with example. [8]  
b) Define Prototype. What are different types of prototypes? Elaborate advantages. [8]

**P.T.O.**

- Q7)** a) Explain Taguchi Design of Experiments in detail. [8]  
b) What is Design for Robustness? Explain in detail. [8]
- Q8)** a) Discuss in detail establishing engineering specifications. [8]  
b) Discuss Fused Deposition Modeling with neat sketch. [8]



Total No. of Questions : 10]

SEAT No. :

**P4567**

**[4760] - 197**

[Total No. of Pages :3

**M.E. (Mechanical - CADM & E)**

**ROBOTICS**

**(Elective - II) (502405-D) (2012 Course) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use pocket non programmable calculator is allowed.*

**SECTION - I**

- Q1)** a) Define Repeatability, Resolution & work volume and explain with suitable sketches. [6]
- b) In one degree of freedom robot, it has one sliding joint with full range of 6 mts. The robots control memory has a 32 bit storage capacity. Determine CR. [6]
- c) Explain briefly the classification based on robot motion. [6]
- Q2)** a) Explain Euler angle representation. [8]
- b) Determine homogenous transformation matrix to represent the following sequence of operation. [8]
- i) Rotation of 60° OX-axis
  - ii) Translation of 4 unit along OX-axis
  - iii) Rotation of 30° about OB-axis
- Q3)** a) Explain the steps involved in DH Convension for 3-axis articulated arm robot. [8]
- b) Explain Kinematic parameters of Joints & link of manipulators. [8]

***P.T.O.***

- Q4) a)** Describe in brief different robot applications in industries. [8]  
 b) Explain the role of trajectory planning. [8]

- Q5) a)** Using the link parameter for a SCARA robot shown in table 1. Compute individual & total transformations for each link. [8]

| Link $i$ | $a_i$    | $\alpha_i$ | $d_i$    | $\theta_i$ |
|----------|----------|------------|----------|------------|
| 1        | $L_{11}$ | 0          | $L_{12}$ | $\theta_1$ |
| 2        | $L_2$    | 0          | 0        | $\theta_2$ |
| 3        | 0        | $90^\circ$ | $d_3$    | 0          |
| 4        | 0        | 0          | $L_4$    | $\theta_4$ |

Table 1. Q5(a)

- b) Derive forward kinematics equation for 2DOF planar manipulator. [8]

### SECTION - II

- Q6) a)** Explain geometric approach to inverse kinematics. [8]  
 b) Determine the singularities of the RPY wrist by the link joint parameter shown in table 2. [10]

| Link $i$ | $a_i$ | $\alpha_i$ | $d_i$ | $\theta_i$            |
|----------|-------|------------|-------|-----------------------|
| 1        | 0     | $45^\circ$ | 0     | $\theta_1$            |
| 2        | 0     | $90^\circ$ | 10    | $\theta_2 + 90^\circ$ |
| 3        | 0     | 0          | 0     | $\theta_3$            |

Table 2. Q6(b)

- Q7)** Lagrange-Eulers formulation used for describing the rigid body dynamics. [16]

- Q8)** a) Explain PD controller with the help of neat block diagram. [8]  
b) Compare between NE and LE formulations. [8]
- Q9)** a) Explain 5 basic functions of machine vision system with the help of neat block diagram. [10]  
b) Explain velocity and acceleration sensors. [6]
- Q10)** a) Explain lead through programming and requirement of good programming language. [8]  
b) With neat sketch explain force & proximity sensors. [8]



Total No. of Questions : 8]

SEAT No. :

P4328

[Total No. of Pages : 2

[4760] - 198

M.E. (MECHANICAL) (CADM&E) (Semester - II)

MANAGEMENT OF TECHNOLOGY

(2012 Pattern)

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any Three questions from Each Section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

**SECTION - I**

- Q1)** a) Discuss Significance of Technology Management. [8]  
b) Discuss in detail the Technology Cycle. [8]
- Q2)** a) Discuss Human dimensions of Technology and concepts of the entrepreneur. [8]  
b) Explain Technology Forecasting Approaches. [8]
- Q3)** a) Discuss the Technology Performance Parameters. [8]  
b) Discuss Integration of Technology Strategy and Business Strategy for success. [8]
- Q4)** Write Short Note on ANY Three of the following: [18]  
a) Holistic Model of Management of Technology  
b) Elements and formulation of Technology Strategy  
c) Classification of Technology  
d) S-Curve of Technology Forecasting

**P.T.O.**

## SECTION -II

- Q5)** a) Discuss issues in Technology Transfer in Public and Private Enterprises. [8]  
b) Discuss the challenges in commercializing Research work. [8]
- Q6)** a) Discuss the concepts of Invention and Innovation with suitable case studies. [8]  
b) Discuss any one Model of Technology Transfer. [8]
- Q7)** a) Explain Analytical Hierarchical Process (AHP) applied to Machine Tools. [8]  
b) Discuss Technology Transfer in the context of New Product Development. [8]
- Q8)** Write Short Note on ANY THREE of the following: [18]  
a) Government Schemes for Innovation  
b) Classification of Research and Development  
c) National Innovation System (NIS)  
d) Success and failure factors in Technology Transfer



[4760] - 199

M.E. (Mechanical) (CADM&amp;E) (Semester - II)

COMPUTER AIDED MANUFACTURING

(2012 Pattern)

Time : 3 Hours]

[Maximum Marks : 100

*Instructions to the candidates:*

- 1) Answers to the two sections should be written in separate answer books.
- 2) Attempt any three questions from each section.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of Electronic pocket Calculator is allowed.
- 6) Assume Suitable data, if necessary and mention it clearly.

**SECTION - I**

- Q1)** a) Explain with suitable example smart automation [6]  
 b) Explain advanced automation functions in detail [6]  
 c) Explain the modern maintenance and diagnostics systems used in automated systems [6]
- Q2)** a) Explain different NC motion control modes and interpolations [8]  
 b) Explain with neat block diagram the configurations of computer numerical control [8]
- Q3)** a) Differentiate between open loop and closed loop control systems [6]  
 b) Write a complete NC part program for the component shown in Fig. 1, Draw the tool path and take raw material MS blank of 100 mm × 50φ, spindle speed 600 RPM and feed 0.1 mm/rev. all dimensions are in mm [10]

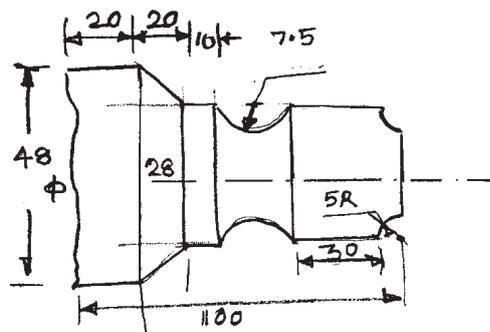


Fig. 1, Q. No. 3(b)

- Q4)** a) Explain the engineering analysis of NC positioning systems [6]  
 b) Write a complete APT part program to generate end profile for the component shown in Fig. 2. Use post processor call statement MACHINE MILL, Draw the tool path and take raw material stainless steel blank of 160 mm × 100 mm, spindle speed 800 RPM and feed 0.15 mm/rev. all dimensions are in mm. [10]

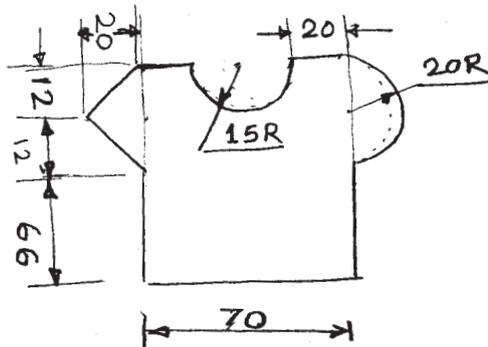


Fig. 2, Q. No. 4(b)

- Q5)** a) Explain the principle functions of CNC [8]  
 b) Explain the major features and elements of CNC machines [8]

**SECTION - II**

- Q6)** a) Explain product flow analysis in detail [10]  
 b) Explain GT applications in manufacturing processes [8]

- Q7)** a) Explain planning and implementation issues of FMS [10]  
 b) Explain FMS optimization in detail [6]

- Q8)** a) Explain Siemens concept CIM with neat block diagram [8]  
 b) Explain NIST – AMRF Hierarchical CIM model [8]

- Q9)** a) Explain in brief types of process planning and discuss their merits over each other. [10]  
 b) Enlist and describe in brief CIM hardware and software. [6]

- Q10)** a) Write short notes on MRP- I [6]  
 b) Explain the principle of PDM & PLM . [5]  
 c) Write short notes on JIT concept [5]



Total No. of Questions : 8]

SEAT No. :

**P4546**

[Total No. of Pages : 2

**[4760] - 2**

**M.E. (Civil) (Construction Management)**

**MANAGEMENT AND PROJECT PLANNING IN CONSTRUCTION  
(2008 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from Section - I and any three questions from section - II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Discuss Project Life Cycle. Justify its shape at different stages with examples. According to the different phases of project explain various curves related to creativity, resources, project uncertainty and project stake. [10]
- b) Explain the importance and necessity of resource leveling and scheduling. [8]
- Q2)** a) Define "Project". Discuss the characteristic of project in detail. [8]
- b) Kumbhnagri Nashik is to be developed as Smart City. Discuss the contents of pre feasibility study for the project. [8]
- Q3)** a) How will you mobilize the site for a Smart City Project? [8]
- b) What are the various relationships in a precedence Network? What are the advantages of a precedence network over a CPM network? [8]
- Q4)** a) What are the various software available for construction project planning? Along with applications also discuss their advantages and disadvantages. [8]
- b) Describe the contribution made by Elton Mayo and Megregor. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain with suitable examples, the necessity of training in construction industry. [8]
- b) Why is a rating factors used in Time Study? Give a suitable example of its use. [5]
- c) Define work study, Method Study and Work Measurement. State the advantages and limitations of work study when applied to construction field. [5]
- Q6)** a) What do you mean by PMC? Explain its role in case of construction of waste water treatment plant. [8]
- b) What is construction Productivity? How productivity can be improved by “Work Study”. Explain with the suitable example of construction activity. [8]
- Q7)** a) What are the techniques involved for “Method Study”? Explain any one in detail with suitable example. [8]
- b) Discuss process chart with example of construction activity. [4]
- c) Explain direct and indirect cost included on a construction project. [4]
- Q8)** a) Write a short note on:- [12]
- i) Repetitive Project Modeling
- ii) Matrix Structure of organization.
- iii) Incentive schemes for Construction industry workers
- b) How performance appraisal of a construction Manager is done explain with suitable example? [4]



Total No. of Questions : 8]

SEAT No. :

P3739

[Total No. of Pages :2

[4760]-20

M.E. (Civil) Hydraulics (Semester - I)

WATER RESOURCE PLANNING AND MANAGEMENT

(2008 Pattern) (Theory)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) State and explain briefly various steps involved in planning of water resource project. [9]  
b) Briefly explain different objectives of water resource project. [9]
- Q2)** a) What data is required for planning of a water resource project? [8]  
b) What do you mean by multi-objective analysis? Explain its use in planning the models for water resources projects. [8]
- Q3)** a) Explain the role of water users cooperative societies in water distribution. [8]  
b) What do you mean by an integrated approach to manage water resource? List out its salient features. [8]
- Q4)** a) Two reservoirs A and B are planned to be constructed at the cost of Rs. 30 million and 60 million respectively. Annual maintenance and operation costs of these projects are Rs. 7 lakh and 16 lakh. The annual benefits from the projects are 4.6 million Rs. and 9.7 million Rs. respectively. Which of the two projects is more economical if the rate of interest is 10% and useful life of the project A is 45 years and that of project B is 75 years? [8]

**P.T.O.**

- b) Write short notes on : [8]  
i) Technological options for water resources development.  
ii) Social and Engineering aspects of water resources planning.

**SECTION -II**

- Q5)** a) Explain "National water policy". [8]  
b) Describe "Necessity of water resources planning and management". [8]

- Q6)** a) Explain the term "State water disputes" with suitable examples. [8]  
b) Describe the role of different bodies in water resources planning. [8]

- Q7)** a) Explain the procedure adopted for the preparation of feasibility reports with reference to the following. [12]  
i) Site conditions  
ii) Investigations into resources  
iii) Legal issues and all other factors bearing upon the design of engineering works.  
b) Explain in brief "Global water Partnership". [4]

- Q8)** Write short note on (Any three) [18]  
a) ICOLD  
b) ICID  
c) State of art integrated water resources management  
d) Irrigation management policy



Total No. of Questions : 8]

SEAT No. :

**P4568**

**[4760]-200**

[Total No. of Pages : 2

**M.E. (Mechanical) (CADM &E)**  
**COMPUTER INTEGRATED MANUFACTURING**  
**(2012 Course) (Semester - II) (502410)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain different types of Manufacturing in detail. **[9]**
- b) Discuss the concept of Engineering Data Management. **[9]**
- Q2)** What is the role of Material Handling in Manufacturing? Discuss various types of Material Handling Equipments in detail. **[16]**
- Q3)** What is Flexible Manufacturing? What is the need of FMS? Elaborate in detail various elements of FMS. **[16]**
- Q4)** a) Discuss in detail need of Collaborative Engineering in Competitive Environment. **[8]**
- b) Discuss the hardware elements in CIM. **[8]**

**SECTION - II**

- Q5)** What is the role of Japanese Management System in enhancing Productivity? Discuss JIT and KANBAN in detail. **[18]**

***P.T.O.***

- Q6)** a) What is Materials Resource Planning? Elaborate. [8]  
b) Explain the concept of manufacturing capacity planning. [8]
- Q7)** a) Explain the concept of Supply Chain Management. [8]  
b) Explain the application of web based engineering for Casting. [8]
- Q8)** What is Lean Manufacturing? State and explain need and principles of lean manufacturing in detail. List advantages. [16]

EEE

Total No. of Questions : 8]

SEAT No. :

**P4759**

[Total No. of Pages : 2

**[4760] -202**

**M.E. (Mechanical) (CADM & E)**

**AUTOMATED MANUFACTURING SYSTEM MODELING**

**(2012 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Discuss Performance Modeling Tools in detail. **[9]**
- b) Explain Continuous Time Markov Chain Model with suitable example.**[9]**
- Q2)** Define Queuing Network? Discuss in detail the M/M/1 Queue and M/M/m Queue with suitable example. **[16]**
- Q3)** What is Birth & Death Process in Manufacturing Environment? Explain with suitable example and detailed analysis. **[16]**
- Q4)** a) Elaborate the concept of Stochastic Processes in Manufacturing. **[8]**
- b) Describe Semi-Markov Processes in Manufacturing. **[8]**

**P.T.O.**

## SECTION - II

- Q5)** Define Flexible Manufacturing System. Explain in detail all the elements of FMS. List advantages. [18]
- Q6)** a) What is Classical Petri Nets? Explain. [8]  
b) Explain different types of Plant Layouts. [8]
- Q7)** a) Discuss Product Form Queuing Networks. [8]  
b) Explain Extended Classes of Timed Petri Nets. [8]
- Q8)** a) Elaborate the concept of Semi-Markov Processes in Manufacturing. [8]  
b) Explain Modeling of Kanban Systems. [8]

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4753**

[Total No. of Pages : 2

**[4760] - 203**

**M.E. (Mechanical) (CADM & E)**

**SIMULATION & MODELING**

**(2012 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any Three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** a) What is simulation? Describe application areas in Mechanical Engineering. **[9]**

b) Describe Kolmogorov-Smirnov test in simulation. **[9]**

**Q2)** Define random number. How are they generated? What is role of random numbers in simulation? What are the advantages? Explain in detail any two techniques for random number generation. **[16]**

**Q3)** Discuss in detail Erlang Distribution, Discrete Uniform Distribution Empirical Continuous Distribution and Geometric Distribution with suitable examples. **[16]**

**Q4)** a) Discuss the systematic procedure for simulation model building. **[8]**

b) Describe the chi-square test in detail. **[8]**

***P.T.O.***

## SECTION - II

- Q5)** a) Describe Rejection Technique for Poisson Distribution. [8]  
b) Explain the concept of Machine Downtime with case study. [8]
- Q6)** a) Perform run tests on following sequence. [8]  
0.05 0.04 0.0185 0.27 0.86  
b) Describe importance of Verification and validation of simulation models.[8]
- Q7)** a) Elaborate the role of data collection in Input modeling. [8]  
b) Enlist and Elaborate Objectives and performance measures of Simulation.[8]
- Q8)** Discuss various properties of random numbers in detail. What kind of errors can be occurring during random number generation? Elaborate. [18]



Total No. of Questions : 8]

SEAT No. :

**P4760**

[Total No. of Pages : 2

**[4760] - 204**

**M.E. (Mechanical) (CADM & E)**

**OPTIMIZATION TECHNIQUES**

**(2012 Pattern) (Elective - III) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data. if necessary.*

**SECTION - I**

- Q1)** a) Discuss classification of optimization problems. **[6]**
- b) Find the dimensions of a cylindrical (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to  $A_0 = 24\pi$ . **[10]**
- Q2)** a) Explain post optimality analysis in linear programming. **[6]**
- b) Solve by applying simplex method **[10]**

Minimize :

$$F = 4X + 5Y$$

Subjected to

$$10X + Y \geq 10$$

$$5X + 4Y \geq 20$$

$$3X + 7Y \geq 21$$

$$X + 12Y \geq 12$$

$$X \geq 0 \text{ and } Y \geq 0$$

**P.T.O.**

- Q3)** a) Explain Golden section search method. [6]  
 b) Minimize the function using exhaustive search method [10]  
 $F(X) = X^2 + (54/X)$

- Q4)** Write short notes on (any three) [18]  
 a) Cubic search method  
 b) Newton Raphson method  
 c) Karmarkars method  
 d) Bounding phase method

**SECTION - II**

- Q5)** Minimize the constrained Himmelblau's function using variable Elimination method.  
 $F(x_1, x_2) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2$  Subject to  $26 - (x_1 - 5)^2 - x_2 = 0$ ,  
 $x_1, x_2 \geq 0$  [16]

- Q6)** a) Explain the concept of optimality criterion in multi objective optimization. [6]  
 b) It has been decided to shift grain from a ware house to a factory in an open rectangular box of lengths  $x_1$  meters, width  $x_2$  meters and height  $x_3$  meters. The bottom, sides, and the ends of the box cost respectively Rs. 100/m<sup>2</sup>, Rs. 60/m<sup>2</sup> and Rs. 47/m<sup>2</sup>. It costs Rs. 6 for each round trip of the box. Assuming that the box will not have any salvage value, find the minimum cost of transporting 80m<sup>3</sup> grain using geometric programming. [10]

- Q7)** a) What is Evolutionary Optimization? Explain genetic algorithm in detail. [8]  
 b) What is simulated annealing? Elaborate the algorithm. [8]

- Q8)** Write short notes on any three [18]  
 a) Generalized Reduced Gradient Method  
 b) Cauchy's method  
 c) Random search method  
 d) Kuhn tucker condition



Total No. of Questions : 8]

SEAT No. :

**P4755**

**[4760] - 205**

[Total No. of Pages : 2

**M.E. (Mechanical) (CADM & E)**

**PRODUCT LIFECYCLE MANAGEMENT**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any Three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**SECTION - I**

**Q1)** Explain in detail CAD, CAM, EDM and PDM of product Life Cycle Management. **[18]**

**Q2)** What is PLM Strategy? Explain the concept with its importance. Discuss any four characteristics of PLM. **[16]**

**Q3) a)** Discuss key management issues in Product Data and Product Work Flow in PLM. **[8]**

b) Explain the concept of Computer Integrated Management. **[8]**

**Q4) a)** Define and Explain any four characteristics of PLM. **[8]**

b) Elaborate the concept of Collaborative Engineering. **[8]**

**SECTION - II**

**Q5)** Discuss Different phases of Product Life cycle and corresponding technologies applied in it. **[18]**

**Q6) a)** What is Distributed Database? Explain. **[8]**

b) Explain Product Organization structure in detail. **[8]**

**P.T.O.**

- Q7)** a) What are Information Authoring Tools? Explain. [8]  
b) Describe Document and Hardware Management in PLM. [8]
- Q8)** Discuss in detail change Management and Configuration Management. How they are related? Elaborate their role in PLM with importance. [16]



Total No. of Questions : 8]

SEAT No. :

**P4742**

**[4760] - 206**

[Total No. of Pages : 2

**M.E. (Mechanical) (Computer Aided Design, Manufacturing & Engineering)**

## **RAPID PROTOTYPING**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Attempt any three questions from each section.*
- 2) *Figures to the right indicate full marks.*

### **SECTION - I**

**Q1)** Explain types of prototypes with three important aspects of interests. Discuss advantages of rapid prototyping in different areas. **[16]**

**Q2)** What is solid ground curing? Explain process, working principle and application with case study. **[16]**

**Q3)** Explain FDM process with respect to: **[16]**

- a) principles, process, model & specification.
- b) Application, Advantages.

**Q4)** Discuss process of selective laser sintering with.

- a) Principles, model & specification, process.
- b) Advantages, Application, case study. **[18]**

### **SECTION - II**

**Q5)** Define rapid tooling. What is its need? Differentiate direct and indirect rapid tooling Explain significance of spray metal deposition and EOS process. **[16]**

**Q6)** Explain. **[16]**

- a) DTM rapid tool process
- b) Key steps to use RP software with application.

**P.T.O.**

**Q7)** Comment on significance of STL file. What are its features? How and when STL file is repaired? **[16]**

**Q8)** How rapid technology is applied in: **[18]**

- a) Design & Material relationship.
- b) Coin industry & GIS application.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

**P3740**

**[4760] - 21**

**M.E. (Civil Hydraulics)**

**FLUID MECHANICS**

**(2008 Course) (Semester - I) (501303)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate answer booklet.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Your answer will be valued as a whole.*
- 6) *Use of electronic pocket calculator is allowed.*
- 7) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Derive 3-D continuity equation in cylindrical polar coordinate system. **[10]**  
b) A source of strength  $10 \text{ m}^2/\text{s}$  located at  $(-1, 0)$  is combined with a sink of strength  $14 \text{ m}^2/\text{s}$  located at  $(1, 0)$ . Find the stream function and velocity potential. **[8]**
- Q2)** a) Derive equation for laminar flow past an oscillatory plate. **[8]**  
b) Oil with density  $800 \text{ kg/m}^3$  and viscosity  $0.16 \text{ N-s/m}^2$  flows between two horizontal parallel plates  $20 \text{ mm}$  apart. A constant pressure gradient of  $-1000 \text{ Pa/m}$  drives the flow. The upper plate is moving with a uniform speed, while the lower one is kept stationary. Find the velocity of the upper plate so that **[8]**  
i) the flow rate is zero  
ii) the shear stress at the upper plate is zero
- Q3)** a) Derive Boundary Layer equations. **[10]**  
b) Explain Boundary Layer Separation describing causes, effects and methods to reduce the thickness. **[6]**

***P.T.O.***

**Q4)** Write short notes on (any four): **[16]**

- a) Conformal Mapping.
- b) Relaxation technique.
- c) Hydrodynamically smooth and rough boundaries.
- d) Creeping flow.
- e) Boundary layer over a flat plate.

**SECTION - II**

**Q5)** a) Derive Reynold's equations of motion. **[10]**

b) Water at 20°C is flowing through a Hydrodynamically smooth pipe of diameter 20 cm at the rate of 80 lit/s. The average height of roughness projections on the pipe surface is 0.2 mm. Determine the **[8]**

- i) friction factor
- ii) shear stress at the pipe surface
- iii) shear velocity
- iv) maximum velocity.

The density and kinematic viscosity of water at 20°C are 1000 kg/m<sup>3</sup> and 1 × 10<sup>-6</sup> m<sup>2</sup>/s respectively.

**Q6)** a) Discuss Reynold's rules of averages. **[8]**

b) Write short note on probability density function and distribution function of a continuous random variable. **[8]**

**Q7)** a) Discuss Isothermal and adiabatic processes. Derive equations for Bulk modulus of elasticity in each case. **[8]**

b) Derive equation for stagnation temperature in compressible flow. **[8]**

**Q8)** a) Derive energy equation for compressible flow. **[8]**

b) Define Mach angle, transonic flow, hypersonic flow, shock wave. **[8]**



Total No. of Questions : 12]

SEAT No. :

**P3807**

[4760] - 210

[Total No. of Pages : 2

**M.E. (Electrical Control System) (Semester - I)**

**ADVANCE MATHEMATICAL TECHNIQUES FOR CONTROL SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer Q.1 or 2, Q.3 or 4, Q.5 or 6, Q.7 or 8, Q.9 or 10, Q.11 or 12.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Use the Lagrange multiplier approach to minimize the function [16]

$$F(x) = 4x_1^2 + 5x_2^2 \quad \text{subjected to } g(x) = 2x_1 + 3x_2 - 6 = 0.$$

**Q2)** a) Explain what do you understand by Lagrange Function. [8]

b) Explain what do you understand by relative and global maximum. [8]

**Q3)** Use analytical method to investigate for extremum point [16]

$$F(x) = -3x^4 + 10x^3 - 20.$$

**Q4)** Use analytical method to investigate for extremum points. [16]

$$f(x) = x_1^3 + x_2^3 + x_3^3 + 2x_1^2 + 6x_2^2 + 9x_3^2$$

**Q5)** Maximize the function and also find the maximum value of the function. [18]

$$F(x) = 20X_1 + 26X_2 + 4X_1X_2 - 4x_1^2 - 3x_2^2.$$

**Q6)** a) Write & Explain Simplex method for solving LPP. [9]

b) Write and explain the conjugate gradient method of obtaining the extremum. [9]

**P.T.O.**

## SECTION - II

**Q7)** Find the maximum of the function **[16]**

$$f(x) = x/2 \text{ for } x \leq 2$$

$$= -x + 3 \text{ for } x > 2$$

by using the unrestricted search method. Initial guess point  $x_1 = -1.0$  and  $S = 0.4$

**Q8)** Find the maximum of  $f = X(1.5 - X)$  in the interval  $0 - 1$  within 10% of exact value by Dichotomous search method. **[16]**

**Q9)** Explain method of conversion of non serial system to serial system problem. **[16]**

**Q10)** Explain the computational procedure in dynamic programming. **[16]**

**Q11)** Find condition for minimization of the following condition by classical method. **[18]**

$$F(x) = 0.5k_2x_1^2 + 0.5k_3(x_2 - x_1)^2 + 0.5k_1x_2^2 - Px_2$$

**Q12)a)** Explain the Gomory's cutting plane method. **[9]**

b) Explain the integer nonlinear programming. **[9]**



Total No. of Questions : 6]

SEAT No. :

P4329

[Total No. of Pages :2

[4760]-211

M.E. (Electrical Control System) (Semester - I)

PROCESS CONTROL MANAGEMENT

(2008 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** Solve any two .

- a) Give detail classification of motives and explain with suitable example. [9]
- b) Explain Leadership-definition, its importance. Explain leadership style - models and theories of leadership styles. [9]
- c) Explain the stress management. [9]

**Q2)** a) Explain Mathematical Modeling and it's principles. [8]

b) Explain Process reaction curve with diagram. [8]

**Q3)** a) Explain PID Controller and its tuning for Dynamic Performance. [8]

b) Explain Ziegler-Nichols method. [8]

**P.T.O.**

## SECTION - II

**Q4)** Solve any two.

- a) With proper block diagrams, differentiate between feedback and feed forward control systems. [9]
- b) Why we need to convert continuous time signals to discrete time signals & vice versa? Give physical example for this need. [9]
- c) Explain temperature control system using feedback control method in detail. [9]

**Q5)** a) Write short on discrete PID Controller. [8]

- b) Explain with neat diagram, the temperature control of jacketed CSTR by [8]
  - i) Conventional Feedback and
  - ii) Cascade control.

**Q6)** a) What is one way decoupling of two control loops? Why could it be acceptable? [8]

- b) Explain the Relative Gain array (RGA) for a process with two inputs and two out-puts. [8]



Total No. of Questions : 12]

SEAT No. :

**P3808**

**[4760]-212**

[Total No. of Pages : 3

**M.E. (Electrical) (Control System)  
NONLINEAR CONTROL SYSTEM  
(2008 Course) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) State and explain different nonlinearities observed in physical control system. [8]
- b) Explain in brief the following terms in connection with nonlinear control systems. [9]
- i) Hysteresis.
  - ii) Critical jump resonance.
  - iii) Limit cycle.

OR

- Q2)** a) Explain in details isocline method to draw phase plane trajectory. [8]
- b) Consider the system described by
- $$\ddot{x} + 0.3\dot{x} - x = 0$$
- Evaluate the phase trajectory for initial conditions  $\dot{x} = 0$   $x = 1$  [9]

- Q3)** a) Explain in details Delta method to draw phase plane trajectory. [9]
- b) State and explain different types of singular points, also draw phase potrait for the same. [8]

OR

**P.T.O.**

**Q4)** A unity feedback control system has forward transfer function  $G(s) = \frac{1}{s(s+1)}$  in cascade with relay whose output equal to  $\pm 2$ . For unit step input using isocline method construct phase plane trajectory. Also comment on stability. [17]

- Q5)** a) Derive the describing function for ON-OFF relay. [8]  
 b) Explain describing function method for stability analysis of nonlinear control system. [8]

OR

**Q6)** A unity feedback control system having  $G(s) = \frac{2}{s(s+1)}$  is driven by relay having output equal to  $\pm 2$  and dead 2 one  $\pm 1$ . Determine amplitude, frequency and stability of possible limit cycle. [16]

### SECTION-II

- Q7)** a) Explain Lyapunov stability criterion. [9]  
 b) Explain: [8]  
 i) Stability.  
 ii) Asymptotic stability.  
 iii) Global asymptotic stability.  
 iv) Instability.

OR

**Q8)** a) Apply Lyapunov direct method to determine stability of the system given below [9]

$$\dot{x}_1 = -x_1 - 2x_2$$

$$\dot{x}_2 = -2x_2$$

- b) Test the following function for positive definiteness

$$2x_1^2 + 2x_2^2 + x_3^2 + 2x_1x_2 - x_2x_3 + 3x_1x_3. \quad [8]$$

**Q9) a)** Select

i)  $V = x_1^2 + x_2^2$

ii)  $V = 2x_1^4 + 2x_2^2$

as Lyapunov function and investigate the stability for each case given by  
 $\dot{x}_1 = x_2$      $\dot{x}_2 = -x_1 + x_2$ . [9]

b) Explain briefly: [8]

i) Positive definite.

ii) Positive semidefinite.

iii) Negative definite.

iv) Negative semidefinite.

OR

**Q10)a)** Explain Krasovskii's method for determination of Lyapunov method. [9]

b) For autonomous state equation of linear time invariant system derive equation  $A^T P + PA = -Q$

Where P is real symmetric matrix and Q is positive definite matrix. [8]

**Q11)** Write short notes on: [16]

a) Notion of sliding mode control.

b) State feedback linearization.

OR

**Q12)** Explain: [16]

a) Input - output Linearization.

b) Input state Linearization.



Total No. of Questions : 12]

SEAT No. :

**P3809**

**[4760] - 213**

[Total No. of Pages :2

**M.E.(Electrical) (Control System)  
AUTOMATION & ROBOTICS  
( 2008 Course)(Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section I and 3 questions from Section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Give Definition of Robotic/s given by various organization including ISO [9]  
b) Explain historical theory of robot. [9]  
OR
- Q2)** a) Compare NC and CNC machines? Also explain automation. [6+3]  
b) Explain degree of freedom,yaw,pitch and roll. [3+6]
- Q3)** a) Explain Robot classification [8]  
b) Write various End Effectors used in Robot. [8]  
OR
- Q4)** a) Explain various types of links.Draw sketches. [8]  
b) Explain various actuators and their selection criteria. [8]
- Q5)** a) What are the various actuators required in robot applications.And what are their selection criteria. [8]  
b) Explain PUMA robot with neat sketches [8]  
OR
- Q6)** a) Explain teach pendent and its importance in robot programming. [8]  
b) Explain programming language in robot [8]

***P.T.O.***

**SECTION - II**

**Q7)** The coordinates of the point 'P' on the body are given by  $\{1, 1.5, 2\}^T$ . The point is rotated about z axis by  $30^\circ$  and then about x axis by  $60^\circ$  and then y axis by  $90^\circ$ . Find the final coordinates of the point 'P' w.r.t. the fixed frame.

Continue the travel of final point 'P' in x direction by 5 unit. **[10+8]**

OR

**Q8) a)** Explain KE and PE equations. Derive Newton Euler Equations using KE and PE **[4+5]**

b) Explain single prismatic joint working against gravity and single revolute joint using Lagrangian technique. **[9]**

**Q9) a)** Explain transformation matrix required in robot dynamics. **[8]**

b) Explain Geometric approach with co-ordinate transformation **[8]**

OR

**Q10) a)** Explain DH criteria in detail **[8]**

b) Write Rules for establishing link co-ordinate frames. **[8]**

**Q11) a)** Explain JPC used in robot system **[8]**

b) Explain RMRC used in robot system **[8]**

OR

**Q12) a)** Explain Jacobian for prismatic joint control which is used in Cartesian type of robot. **[8]**

b) Explain PID control system used in robot manipulator **[8]**



Total No. of Questions : 6]

SEAT No. :

**P3947**

**[4760]-214**

[Total No. of Pages : 3

**M.E. (Electrical) (Control System)**  
**MODELING OF DYNAMIC SYSTEM**  
**(2008 Course) (Semester - I) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any Two questions from each section.*
- 2) *Answers to the Two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) State and explain least square methods for modeling of dynamic system. **[9]**
- b) Discuss briefly the following generalized modeling methods: **[8]**
- i) Parameter tracking method.
  - ii) Random signal testing method.
- c) Explain with suitable example the method of sub system coupling for modeling. **[8]**
- Q2)** a) Compare analog simulation with digital simulation method. **[5]**
- b) Enumerate the various digital simulation techniques. Explain any one specific digital simulation technique for finding generalized response of the system. **[10]**
- c) Define convolution integral. Explain the method for obtaining response to arbitrary inputs with known impulse response. **[10]**

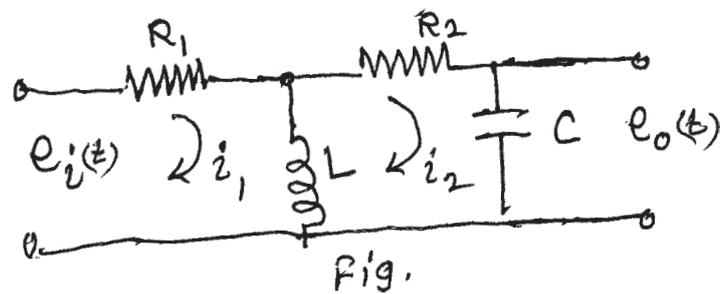
**P.T.O.**

- Q3)** a) Discuss in detail the lumped parameter approximations for vibration of a rod. [7]
- b) Obtain the distributed parameter model in case of heat translation by conduction in an insulated bar. [8]
- c) What is magnetic levitation? Explain magnetic levitation system for an experimental rail vehicle considering it as distributed parameter model. [10]

## SECTION - II

- Q4)** a) State various static thermal systems and explain any one static thermal system. How to carry out the circuit analysis of such a system? [9]
- b) Define and explain the following concepts: [8]
- i) Thermal capacitance
  - ii) Thermal resistance. [8]
- c) Explain the effect of following properties of fluids on the dynamics of the fluid systems:
- i) Density
  - ii) Viscosity
  - iii) Propagation of speed and
  - iv) Temperature (thermal properties)
- Q5)** a) What are the techniques used for system modeling? Give the classification of models of dynamic system in general. [8]
- b) Define a dynamic system. explain with suitable example a typical dynamic system and define the terms associated with dynamic system. [7]
- c) State the D' Alembert's principle and explain with an example its application in system modeling and analysis. [10]

- Q6)** a) State the various standard inputs used for system analysis. Discuss the important steps in system simulation. [8]
- b) Explain the concept of analogy between electrical and mechanical systems for mathematical modeling. [7]
- c) Consider the electrical system shown in the figure obtain the mathematical model (differential equations form) relating  $E_i$  and  $E_o$  (i.e. Transfer function  $E_o(s) / E_i(s)$ ) [10]



EEE

**M.E. (Electrical) (Control System)**  
**ADVANCED TOPICS IN CONTROL SYSTEMS**  
**(2008 Pattern) (Elective - II)**

Time : 3 Hours]

[Max. Marks : 100

*Instructions to the candidates:*

- 1) Answer any Two questions from each section.
- 2) Answers to the Two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) State the pole-placement theorem. Explain the pole-placement method using Linear state variable feedback. Draw the appropriate block diagram. [10]
- b) A linear time-invariant control system is represented by

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -24 & 4 & 1 \end{bmatrix} x(t) + \begin{bmatrix} 0 & 0 \\ 1 & -2 \\ 0 & 1 \end{bmatrix} u(t)$$

Design the linear state variable feedback to place the poles at desired locations  $S = -3, -2 + j3, -2 - j3$  [15]

- Q2)** a) What do you mean by Adaptive control? Draw the block diagram of a typical adaptive system and explain the function of each block. [10]
- b) Explain Model Reference Adaptive Control (MRAC) system. State and explain the different methods generally being used in connection with 'MRAC'. [8]
- c) Explain with diagrams the various adaptive scheme. [7]
- Q3)** a) Explain clearly with suitable example the terms : [8]
- i) Dynamic sliding surface
  - ii) Sliding surface
- b) State and explain the concepts of variable structure control and sliding mode control. [10]
- c) Under what conditions the sliding mode control is preferred over the other controls. [7]

**P.T.O.**

## SECTION - II

- Q4)** a) What is Neural Network? State the reasons for using neural networks. [8]  
b) Explain with suitable diagram the deterministic model of a Neuron. Discuss the activation functions using mathematical formula and graphical representation. [8]  
c) State the typical applications of Artificial Neural networks. [9]
- Q5)** a) Draw Recurrent network and explain supervised unsupervised, Reinforced and Hebbian learning. [8]  
b) Give the classification of Artificial Neural Networks. Explain clustering and pattern recognition. [8]  
c) Sketch multiple input neuron model and derive its activation function. Explain Generalization of neural network. [9]
- Q6)** Explain with suitable examples the following :
- a) Periodic Output Feedback control. [9]  
b) Fast output sampling feedback [8]  
c) Multirate output control. [8]



Total No. of Questions : 12]

SEAT No. :

**P3949**

**[4760] - 216**

[Total No. of Pages : 4

**M.E. (Electrical) (Control System)**  
**COMPUTER AIDED CONTROL SYSTEM DESIGN**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer three questions from section-I and three questions from section-II.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Under what conditions the compensation is required? [4]  
b) Explain the measures of 'Relative stability' using polar plot and Bode diagrams. [6]  
c) Derive the transfer function of simple phase-lag-lead compensating network and draw the corresponding Bode diagrams. [6]

OR

- Q2)** a) Compare cascade compensation with feedback compensation. State the conditions under which feedback compensation is preferred. [6]  
b) A certain unity feedback control system has [10]

$$G(s) = \frac{k}{s(1+0.1s)(1+0.2s)}$$

Design a suitable compensator to satisfy the following design specifications:

- i) Phase margin  $\phi_m \geq 45^\circ$
- ii) Velocity error constant  $k_v \geq 8\text{sec}^{-1}$

Justify the choice of compensator and draw the Bode diagrams for compensated and uncompensated system.

- Q3)** a) Explain the computer method for obtaining the transient response of a typical second-order control system to a unit step input. Draw the flow chart and give its algorithm. [12]

**P.T.O.**

- b) Explain how to reshape this transient response plot to obtain the optimum parameters for desired performance. [4]

OR

**Q4)** a) Discuss the importance of computer as an aid in the analysis and design of control system. [4]

- b) Describe the computer method for obtaining the polar plot of a typical linear control system with open-loop transfer function  $G(s)H(s)$ . Draw the flow chart and write its algorithm. How to reshape this polar plot to obtain the optimum performance. [12]

**Q5)** a) Define singular point and explain the various singular points in phase-plane method. [6]

- b) Explain with suitable example the phase-plane technique for simulating the non-linear control system with dead-zone as non-linear element. Give its algorithm or flow chart. [12]

OR

**Q6)** a) Compare critically the 'Phase-plane method' and 'Describing function method' for the design of nonlinear control system. [6]

- b) Explain with algorithm the computer method for simulating the non-linear control system containing ON-OFF (Ideal Relay) non-linearity using the describing function method. Discuss the stability analysis of nonlinear control system using DF method. [12]

## SECTION - II

**Q7)** a) Explain with an example the relation between controllability, observability and pole-zero cancellation. [4]

- b) Outline the procedure for determining the stability of a control system represented in state space form, using computer method. Give its algorithm. [6]

c) Explain the computer method for obtaining the time response of the following system. [6]

$$\dot{x}(t) = Ax(t) + Bu(t)$$

$$y(t) = Cx(t)$$

With usual notation, Draw the flow chart or give its algorithm.

OR

- Q8) a)** Outline the procedure of determining the controllability and observability of a linear control system using computer method. Give its algorithm. [6]  
b) Investigate the controllability and observability of the following system. [10]

$$\dot{x}(t) = \begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix} x(t) + \begin{bmatrix} 1 & 1 \\ 2 & 2 \\ 0 & 0 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} x(t)$$

- Q9) a)** State the pole-placement theorem. Explain the pole-placement design method using linear state variable method. Draw the appropriate block diagram. [8]  
b) A certain linear control system given by : [10]

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -10 & -1 & 0 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

Design the linear state feedback gain matrix 'k' to place the poles at desired locations.

$$S = -2, -3 + j2 \text{ and } -3 - j2$$

OR

- Q10) a)** State the merits and demerits of an observer system. [6]  
b) Outline the procedure for designing a full order observer. Draw the block diagram showing the structure of a full order observer system. [12]
- Q11) a)** Explain the standard structure of P, PI and PID controller. [6]  
b) For a process control plant with plant transfer function [10]

$$G_p(s) = \frac{64}{s^3 + 14s^2 + 56s + 64}$$

Use Ziegler-Nichol's method to design a tunable PID controller for this system

OR

- Q12)**a) Discuss the advantages of digital control system over the continuous-time control system. **[4]**
- b) Explain briefly the effect of sampling period 'T' on the stability of digital control system. **[4]**
- c) Explain the method of obtaining equivalent digital controller from the analog controller. **[8]**

❧❧❧❧

Total No. of Questions : 6]

SEAT No. :

**P4736**

**[4760] - 217**

[Total No. of Pages : 1

**M.E. (Electrical Engineering) (Control System)  
SCADA SYSTEMS AND APPLICATIONS  
(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with the help of block diagram SCADA system in detail. [15]  
b) Explain the various communication technologies used in SCADA systems. [10]
- Q2)** a) Explain with the help of block diagram Programmable Logic controller (PLC). List the programming Languages for PLC. [15]  
b) Explain various SCADA Architectures along with advantages and disadvantages of each system. [10]
- Q3)** a) Explain in detail various SCADA Protocols. [15]  
b) Explain with a block diagram Intelligent Electronic Devices and its use. [10]

**SECTION - II**

- Q4)** a) Explain in detail open systems interconnection reference model and their functions. [15]  
b) Explain wired and wireless industrial communication methods. [10]
- Q5)** a) Explain in detail the use of SCADA in substation automation. [15]  
b) Explain the use of SCADA in Oil and Gas industries. [10]
- Q6)** a) Explain the use of SCADA in Energy management system in power system. [15]  
b) Explain different system operating states in power system. Write a note on State estimation. [10]



Total No. of Questions : 12]

SEAT No. :

P3810

[Total No. of Pages : 3

[4760]-218

M.E. (Electrical) Control System

MULTIVARIABLE AND OPTIMAL CONTROL SYSTEM

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answers to the two sections should be written in separate books.
- 2) Answer any three questions from each section.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Write short note on structure of a multivariable control system with any industrial example of Multivariable Control System. [6]
- b) The transfer function of a closed loop unity feedback control system is given by

$$T(s) = \begin{bmatrix} \frac{1}{s+2} & \frac{1}{s+1} \\ \frac{1}{s+1} & \frac{1}{s+3} \end{bmatrix} \quad [12]$$

Find :

- i) The state space model of the system.
- ii) The characteristic equation of the system.

OR

- Q2)** a) Explain the following presentation of MVCS. [6]
- i) Transfer matrix form.
  - ii) State space form.

**P.T.O.**

b) Multivariable Control System is represented in state space form [12]

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & -2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} \quad E = [0]$$

Obtain the transfer matrix form of the system.

**Q3)** State and explain condition for full state controllability . Also investigate controllability of the system given below. [16]

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 1 & 3 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

OR

**Q4)** State and explain condition for full state observability. Also investigate observability of the system given below : [16]

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 1 & 3 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

**Q5)** a) Discuss in detail the pole placement using Linear State Variable Feedback (LSVF). [8]

b) A linear time-invariant control system is represented in state space form

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -3 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Design the linear state variable feedback to place poles at desired locations  $S = -2$  and  $(-1 \pm 2j)$  [8]

OR

**Q6)** a) With reference to the multivariable control system define and explain the following concept [6]

- i) Stability.
- ii) Reproducibility.

- b) Explain clearly the following design aspects for multivariable control system. [10]
- i) Non-interactive control
  - ii) Model Matching Control

**SECTION - II**

- Q7)** a) Explain the factors to be considered in the formulation of an optimal control problem using quadratic performance criterion. [8]
- b) State and explain the infinite time State linear regulator problem outline the procedure for obtaining the optimal control law for infinite time linear state regulator problem. [8]

OR

- Q8)** Define Hamiltonian, also explain the procedure for solving optimal control problem using Hamiltonian method. [16]

- Q9)** State the Pontryagin's minimum principle. Discuss step by step procedure of solving optimal control problem using Pontryagin's minimum principle. [16]

OR

- Q10)** Consider the linear time invariant.

- a) First Order Control System.

$$\dot{x}(t) = u(t) + x(t)$$

Using Hamiltonian method find the optimal control law  $u^*(t)$  which

$$\text{minimizes the performance index } J = \frac{1}{2}x^2(2) + \frac{1}{2} \int_0^2 u^2 dt$$

$$\text{Given: } x(0) = 1 \quad x(2) = -1. \quad [10]$$

- b) State merits and demerits of optimal control. [6]

- Q11)** a) Explain the Bang-Bang Control strategy and state its advantages. [10]

- b) Define and explain the singular control solution. [8]

OR

- Q12)** a) Discuss briefly the relation between Dynamic programming and Pontryagin's minimum principle. [8]

- b) Explain optimization by dynamic programming based on [10]

- i) The imbedding principle.

- ii) The Optimality principle.



Total No. of Questions : 9]

SEAT No. :

**P4709**

**[4760] - 219**

[Total No. of Pages : 3

**M.E. (Electrical Control System)**

**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question 4 is compulsory.*
- 2) *Answer any two from Questions 1 to 3.*
- 3) *Answer any two from questions 5 to 7. Choose Q.8 or Q.9.*

**SECTION - I**

**Q1) a)** With the help of a neat diagram explain the procedure for system identification. **[8]**

b) What do you understand by persistently exciting signal? What is the order of the following signals. **[8]**

- i) White noise
- ii) Step signal
- iii) Sum of Sinusoids

**Q2) a)** Explain Nonparametric methods of system identification. In detail explain the various methods. **[10]**

b) Compute the QR factorization of the matrix **[6]**

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 2 \\ 0 & 0 & 3 \end{bmatrix}$$

**Q3) a)** Discuss the various model structures used for system identification. **[9]**

b) Consider that a set of data satisfy the model  $y(t) = \phi^T(t)\theta + e(t)$ ; where  $e(t)$  is a white noise with variance given by  $\lambda^2$ . Derive the least square estimate  $\hat{\theta}$  and prove that the covariance matrix is given by  $\text{cov}(\hat{\theta}) = \lambda^2(\phi^T\phi)^{-1}$  **[7]**

**P.T.O.**

- Q4)** Write notes on any three : **[18]**
- Instrument Variable Method
  - Bayesian Learning
  - Recursive Estimation
  - Choice of Input
  - Pattern Recognition

### SECTION - II

- Q5)** a) What are the various adaptive schemes and how are they implemented? **[8]**  
 b) Explain the pole placement design of an STR and derive the Diophantine equation. **[8]**

- Q6)** a) Prove the Matrix Inversion Lemma:  $[A+BCD]^{-1} = A^{-1} - A^{-1}B[C^{-1}+DA^{-1}B]^{-1}DA^{-1}$ . **[6]**  
 b) An ideal relay with saturation levels  $\pm 1$  unit is connected in series with a system having a transfer function  $G(s) = \frac{10}{s(s+1)(s+10)}$ , in a unity feedback control system. Calculate the ultimate gain  $K_u$  and the ultimate period  $T_u$  using the Describing function method. **[10]**

- Q7)** a) Discuss in detail the "Ship Steering Dynamics". **[8]**  
 b) Explain the working of gain scheduling scheme. Give two applications of this scheme. **[8]**

- Q8)** Using both the MIT rule and Lyapunov theory, design an MRAS for a system describe by  $G(s) = \frac{b}{s+a}$ , where  $a$  and  $b$  are unknown. The controller is given by  $u(t) = \theta_1 u_c(t) + \theta_2 y(t)$ , and the desired closed loop model is  $\frac{dy_m}{dt} = -a_m Y_m + b_m u_c$ . Draw the simulation diagram and compare the two methods.

$$\text{Assume } V(\theta) = \frac{1}{2} \left[ e^2 + \frac{1}{by} (b\theta_2 + a - a_m)^2 + \frac{1}{by} (b\theta_1 - b_m)^2 \right]. \quad \mathbf{[18]}$$

OR

- Q9)** a) Derive the MIT rule and explain the sign–sign algorithm. [6]  
b) Consider a position servo described by

$$\frac{dv}{dt} = -av + bu \text{ and } \frac{dy}{dt} = v; \text{ where } a \text{ and } b \text{ are unknown.}$$

Assume the control law  $u = \theta_1(u_c - y) - \theta_2v$  is used and that it is desired to control the system in such a way that the transfer function from

command signal to process output is given by  $G_m(s) = \frac{\omega^2}{s^2 + 2\xi\omega s + \omega^2}$ .

Determine an adaptive control law that adjusts the parameters so that the desired objective is obtained. [12]



Total No. of Questions : 8]

SEAT No. :

**P3741**

[4760]-22

[Total No. of Pages : 2

**M.E. (Civil) (Hydraulics)**  
**REMOTE SENSING AND G.I.S. IN WATER RESOURCES**  
**ENGINEERING**  
**(2008 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *All questions are compulsory.*

**SECTION-I**

- Q1)** a) Discuss the principles of photogrammetry and its applications in water resources. **[5]**
- b) Write an essay on Fundamentals of Remote Sensing System. **[5]**
- c) Write a note on Electromagnetic Spectrum. **[3]**
- Q2)** a) State and explain the Displacement Law. **[4]**
- b) Discuss in detail the interaction of EMR with 'Atmosphere'. **[4]**
- c) Describe the stages of Remote Sensing with neat sketch. **[3]**
- Q3)** a) Discuss the important advantages of vertical and oblique aerial photographs. **[3]**
- b) State the elements of image interpretation in short. **[5]**
- c) What are FCC images? Write its advantages. **[5]**

**P.T.O.**

- Q4)** a) Discuss various characters of IR images. [3]  
b) Discuss the ORTHO rectification method. [5]  
c) Write a note on Concept of Analog and Digital System. [5]

**SECTION-II**

- Q5)** a) Describe in brief Geographical Information System (GIS). [5]  
b) Write in brief the Components of GIS. [5]  
c) Discuss in short buffering. [3]

- Q6)** a) What are Map Projections? [4]  
b) Write a note on Raster Data Structure. [4]  
c) Describe Supervised and unsupervised classification. [3]

- Q7)** a) Describe Spatial and Attribute Database. [3]  
b) Discuss Errors in GIS. [5]  
c) Write an essay on Data collection and input processing in G.I.S. [5]

- Q8)** a) Explain RS application in Open Canal Conduit with flow chart. [3]  
b) Write in short the software's used in GIS for Water Resources. [5]  
c) Explain in brief 'DEM'. [5]



Total No. of Questions : 10]

SEAT No. :

P4330

[4760] - 220

[Total No. of Pages :2

**M.E. (Electrical) (Control System)**  
**ADVANCED DIGITAL CONTROL TECHNIQUES**  
**(2008 Course) (Semester -II) (503110)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data wherever necessary.*
- 4) *Answers to the two sections should be written in separate answer books.*
- 5) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

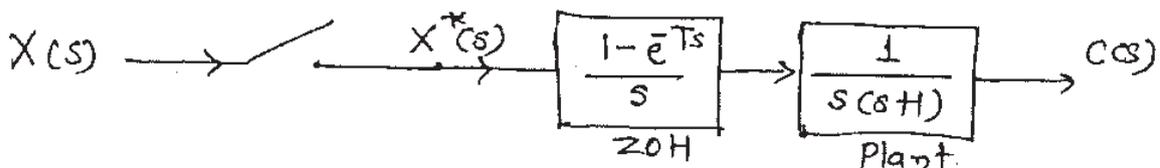
**Q1) a)** Write advantages of digital control system over analogue control with example. **[8]**

b) Explain numerical integration method for digital modeling. **[8]**

**Q2) a)** Elaborate with equations partial matching of states. **[8]**

b) Write a short note on digital re-design. **[8]**

**Q3) a)** Obtain the pulse transfer function of following system for  $T= 1$  sec. **[8]**



b) Enlist different steps required to design a digital phase lead compensator using root locus technique. **[10]**

**P.T.O.**

- Q4)** a) For the following  $G(z)$ , draw the block diagram for: [10]  
i) Direct digital programming  
ii) Cascade digital programming  
iii) Parallel digital programming.

$$G(z) = \frac{10(1 + 0.5z^{-1})}{(1 - z^{-1})(1 - 0.5z^{-1})}$$

- b) Explain full order state observer. [6]

- Q5)** a) Write a short note on state regulator design. [8]  
b) Explain finite word length effect in digital filters. [8]

### SECTION - II

- Q6)** a) What are different methods of design of FIR filter? Explain any one in brief. [8]

- b) Write a short note on fixed and floating point DSP. [8]

- Q7)** a) Draw and explain in detail architecture of TMS 320C5X processor. [10]

- b) Explain instruction pipe line in DSP. [8]

- Q8)** a) State any four key features of TMS 320C54X DSP. [8]

- b) Explain discrete wavelet transform in detail. [8]

- Q9)** a) State and explain various criteria for selection of DSP. [8]

- b) Explain different addressing modes in TMS320C5X. [8]

- Q10)** a) Explain the internal memory organization of TMS320C54X DSP. [8]

- b) Explain sampling rate conversion in DSP. [8]



Total No. of Questions : 6]

SEAT No. :

**P3950**

**[4760]-221**

[Total No. of Pages : 3

**M.E. (Electrical) (Control System)**

**ROBUST CONTROL SYSTEMS**

**(2008 Course) (Semester-II) (Elective-III) (503111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a)** Define and explain the concepts of controllability, observability and stability of linear time-invariant control system. **[9]**

b) For the system represented in state space form

$$A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}; B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}; C = [0 \quad 1]$$

Investigate the controllability and observability of the system. **[10]**

c) Discuss feedback structure mentioning the necessity of the same. **[6]**

**Q2) a)** Define and explain the method of finding: **[9]**

- i) Vector norm.
- ii) Matrix norm.
- iii) Positive - Definite matrix.

b) If  $\|A\| < 1$ , show that

$$[I - A]^{-1} = I + A + A^2 + \dots \quad \mathbf{[6]}$$

**P.T.O.**

- c) State and explain the assumptions made for the realization of the transfer matrix  $G(s)$  given by

$$G(s) = \left[ \begin{array}{c|cc} A_1 & B_1 & B_2 \\ \hline C_1 & 0 & D_{12} \\ \hline C_2 & D_{21} & 0 \end{array} \right]$$

with usual notations. [10]

- Q3)** a) Define  $H_2$  and  $H_\infty$  spaced and state the norms induced on them. [6]
- b) Outline the procedure of computing  $RL_\infty$  norm. [6]
- c) Explain well posedness and internal stability of the system. State the conditions for internal stability for plant 'p' and controller 'k'. [6]
- d) Evaluate the internal stability for the system.

$$P = \begin{bmatrix} \frac{1}{s-2} & 0 \\ 0 & \frac{1}{s+2} \end{bmatrix} \text{ and } K = \begin{bmatrix} \frac{1-s}{1+s} & -1 \\ 0 & -1 \end{bmatrix}. \quad [7]$$

## SECTION-II

- Q4)** a) Explain Linear Fractional Transformation, state the condition for well defined LFT. [10]
- b) Explain briefly the following: [8]
- i) Robust performance.
- ii) Model uncertainty.
- c) Explain the conditions for output feedback stabilizability in context with Luenberger Observer. [7]

**Q5) a)** Define and explain the following: **[10]**

i) Nominal and Robust performance.

ii) Nominal and Robust stability.

b) State and explain Bode's Gain and phase relation and show them on the diagrams. **[5]**

c) Consider the plant P having state space form as

$$\dot{x} = Ax + Bu$$

$$y = Cx + Du$$

With usual notation. Explain feedback control interpretation for coprime factorization of a transfer matrix of this system. **[10]**

**Q6) a)** State and explain algebraic Riccati Equation associated with the Hamiltonian matrix H. **[8]**

b) Find the eigenvalues and eigenvectors for the matrix

$$M = \begin{bmatrix} 1 & 3 & 4 \\ 1 & 4 & 3 \\ 1 & 2 & 1 \end{bmatrix} \quad \text{[10]}$$

c) Diagonalize the following matrix using suitable method,

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 7 & 5 & 7 \\ 8 & 4 & 9 \end{bmatrix}. \quad \text{[7]}$$



Total No. of Questions : 6]

SEAT No. :

**P3951**

**[4760]-222**

[Total No. of Pages : 3

**M.E. (Electrical) (Control System)**  
**STOCHASTIC DYNAMICAL SYSTEMS**  
**(2008 Course) (Elective-III) (Semester-II) (503111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain clearly the nonlinear filtering and control. **[6]**
- b) Discuss the distributed parameter stochastic systems. **[6]**
- c) Outline the procedure to determine the response of a linear discrete-time Stochastic system given by:

$$x(k + 1) = F(k) x(k) + G(k) w(k)$$

to a Zero-mean white noise as input. Where  $x(k)$  is  $n \times 1$  state vector;  $F(k)$  is  $n \times n$  characteristic matrix;  $G(k)$  is  $n \times p$  control distribution matrix; and  $\{w(k); k = -1, 0, 1, 2, \dots, p\}$  is  $p \times 1$  discrete Zero-mean white noise vector. (stochastic process). **[13]**

- Q2)** a) State the merits and demerits of Dynamic programming and explain its application in the solution of linear stochastic control problem. **[7]**
- b) Give the statement of optimal stochastic linear regulator problem and explain the procedure for solving this problem. **[8]**
- c) Draw the appropriate block diagram and explain how the 'Separation Principle' can be applied for the combined design of optimal feedback controller and estimation in stochastic control system. **[10]**

**P.T.O.**

- Q3)** a) Explain with algorithm the continuous time Kalman filter. [10]  
b) A stochastic dynamical system is represented by

$$\dot{x}(t) = x(t) + w(t)$$
$$y(t) = x(t) + v(t)$$

$$Q = 4\alpha; R = 3\alpha; \alpha = \text{constant.}$$

Where  $w(t)$  is state excitation noise and  $v(t)$  is observation noise. Both  $w(t)$  and  $v(t)$  are Zero-mean white noise processes with intensities  $Q$  and  $R$  respectively. Find the time-invariant optimal filter (Kalman filter) for this system. Further show that the answer is independent of  $\alpha$ . [15]

### SECTION-II

- Q4)** a) Explain with suitable example the orthogonal increments process. [8]  
b) State and explain the general properties of orthogonal increments process. [8]  
c) With reference to stochastic system explain briefly: [9]  
i) Brownian motion and white noise.  
ii) Wiener integrals.
- Q5)** a) Explain the method of developing the Stochastic Transitional Probability matrix for a system. [8]  
b) Discuss the geometrical structures of linear estimation in stochastic system. [7]  
c) With reference to stochastic processes, explain the terms: [10]  
i) Hilbert space,  
ii) Spaces of square and Integral variables.

**Q6)** a) How a stochastic process is characterized? In this context explain the terms: **[10]**

- i) Variance matrix,
- ii) White noise process and
- iii) Covariance matrix.

b) A linear continuous-time stochastic system is given by,

$$\dot{x}(t) = A(t) x(t) + B(t) w(t)$$

Where  $x(t)$  is a  $n \times 1$  state vector;  $A(t)$  is  $n \times n$  characteristic matrix;  $B(t)$  is  $n \times p$  control distribution matrix and  $w(t)$  is  $p \times 1$  mean white noise (vector stochastic process). Explain the method to find the response of this system to a Zero-mean white noise as input. **[15]**



Total No. of Questions :6]

SEAT No. :

**P3952**

**[4760]-223**

[Total No. of Pages : 2

**M.E. (Electrical) (Control System)**  
**LARGE SCALE SYSTEM**  
**(2008 Course)(Elective-III) (Semester-II) (503111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 2 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks*
- 5) *Your answer will be valued as a whole.*
- 6) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*

**SECTION-I**

- Q1)** a) Discuss improved Davison's technique for model order reduction. Does it take care of accuracy in steady state error? **[13]**
- b) Discuss and explain the reduce order model using chidambara technique. **[12]**
- Q2)** a) Discuss the basic concept of aggregation of the system. **[10]**
- b) Find the reduced order model by model reduction. **[15]**

$$X = \begin{bmatrix} 0.5 & 0.9 & 0 \\ 0 & 1 & 0 \\ 1 & -2 & -0.5 \end{bmatrix} X + \begin{bmatrix} 0.5 \\ 1 \\ 2 \end{bmatrix} u$$

- Q3)** Explain the technique of moment matching and apply it to the following system to obtain the order reduce model for **[25]**

$$G(s) = \frac{s^2 + 4s + 4}{s^3 + 4s^2 + 6s + 5}$$

**P.T.O.**

## SECTION-II

**Q4) a)** Explain the pole placement technique & explain how to choose poles. [12]

b) Explain the pade approximation method for SISO system for model reduction. [13]

**Q5)** Consider the system. [25]

$$A = \begin{bmatrix} -2 & 0 \\ 1 & -1 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, R = \begin{bmatrix} 1 & 0 \\ 0 & 5 \end{bmatrix}, \lambda_1 = -2, \lambda_2 = -1$$

The eigen values of optimal closed loop systems are specified as

$$s_1 = -8, s_2 = -5$$

**Q6)** Explain the technique of singular value decomposition along with its properties. [25]



Total No. of Questions : 6]

SEAT No. :

P3811

[Total No. of Pages : 2

[4760] - 224

**M.E. (Electrical) (Control System)**

**INTELLIGENT CONTROL**

**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain neuron model with neat sketch also explain biological inspiration in development of artificial neural network. [12]
- b) Explain various transfer functions used in neural network also find activation function for each transfer function for input  $P = [1 \ -1 \ 2]^T$ ,  $W=[0.5 \ 1 \ 0.5]$ ,  $b = 0$ . [13]
- Q2)** a) Explain various Learning rule used in neural network. Explain Back propagation learning method. [13]
- b) Explain MLP using neat sketch also explain hopefield network. [12]
- Q3)** a) Explain ART network with neat sketch also explain BAM theory in detail. [13]
- b) Explain recurrent learning network in detail. [12]

**P.T.O.**

## SECTION - II

- Q4)** Explain various fuzzy and crisp operators. Explain Fuzzy Logic system. Explain different inference systems used in fuzzy logic. **[25]**
- Q5)** Explain different types of functions used in fuzzy logic. Explain Mamdani Inference system with neat sketch. What is fuzzy Quantifier? Explain in detail max-min composition rule used in fuzzy theory. **[25]**
- Q6)** a) Explain Air conditioner controller using Fuzzy logic. **[12]**  
b) Explain Process control example by neural network treatment. **[13]**



Total No. of Questions : 12]

SEAT No. :

**P4738**

**[4760] - 225**

[Total No. of Pages : 3

**M.E. (Electrical) (Control System)**  
**ADVANCED DRIVES AND CONTROL**  
**(2008 Pattern) (Elective - IV)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right side indicate full marks.*

**SECTION - I**

**Q1) Compare AC Drives and D.C. Drives on the basis of following : [16]**

- a) Range of speed control.
- b) conditioning of supply available.
- c) Solid state controllers role in the drive.
- d) Torque abilities over the speed range.

OR

**Q2) Explain the starting transient as well as steady state performance of the electric drive when the load torque is varying with the square of speed, under variable speed (below normal) requirement. State the type of solid state controller. If the motor is a d.c. motor, state the solid state type of controller to drive 50% load torque at double the normal speed. Mention in brief the salient points of every controller above. [16]**

**Q3) a) Three phase. SCR converters are commonly used in the control of dc motors for speed below rated speed. Explain the torque pulsation and effect of wave form of armature voltage and current. [8]**

- b) Develop the system model and the transfer function of the converter fed separately excited dc motor. [8]

OR

**Q4) a) Write short note on "Discontinuous conduction" mode of the armature current in the chopper fed d.c. motor comment on the remedies. [8]**

- b) With the help of detail block diagram of the field controlled dc motor, derive the transfer function of a variable speed drive. How is the field weakening achieved? Draw the modified speed-torque characteristics of the motor for selected various voltages [8]

**P.T.O.**

- Q5) a)** Compare the performance of VSI fed Induction motor with CSI fed Induction motor. Also discuss the following in each case. [9]
- i) Magnitude variation and control of voltage/current as well as frequency.
  - ii) Circuit complexity of the controller
- b)** The P.W.M. Inverter is supplying the variable speed drive induction motor delivering constant torque load. Explain the necessity of [9]
- i) Volts to frequency ratio control for speeds below normal.
  - ii) Pulse width control
  - iii) Harmonic control

OR

- Q6) a)** Draw the simplified equivalent circuit diagram of a 3 $\phi$  Induction motor running at steady state, offered to the seventh harmonic voltage of the Inverter. Write down equations for the currents and corresponding torques developed by the motor. Comment on the performance of the motor. [9]
- b)** Explain with the help of circuit diagram, control strategy, the technique of the reversal of direction of rotation, complexities, number of power components used in voltage source Inverter. [9]

## SECTION - II

- Q7)** Explain any two control methods in detail with reference to control of Induction motor. [16]
- a) Direct torque and flux control
  - b) Direct and indirect vector control
  - c) Sensor less vector control
  - d) Voltage and current fed scalar control

OR

- Q8)** Explain the effect of variation of waveform of stator currents supplied to the windings of Induction motor by [16]
- a) PWM Inverter with constant volts to frequency ratio.
  - b) Solid state variable voltage controller.

**Q9)** With reference to synchronous motor drives, explain any two of the following. **[16]**

- a) D-q axis equivalent circuit
- b) Flux weakening operation the control strategy
- c) Trapezoidal spm drive

OR

**Q10)** Explain with reference to synchro motor. **[16]**

- a) Permanent magnet motors with solid state controllers.
- b) Wound field machine drive.

**Q11)** Explain with reference to phase locked loop (PLL) **[18]**

- a) The principle of phase lock.
- b) Design procedure of current controller.
- c) Application of closed loop controlled drives

OR

**Q12)a)** Explain the industrial application of P.I.D. controller. **[6]**

b) Explain the effect of RMS voltage variation on the behaviour of electric drive. **[6]**

c) Explain modern trends in drive control. **[6]**



Total No. of Questions : 6]

SEAT No. :

**P3812**

[Total No. of Pages : 2

[4760] - 227

**M.E. (Electrical) (Power System)**

**COMPUTER APPLICATIONS IN POWER SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any two questions from each section.*
- 2) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain the multivariable optimization with equality constraints by the method of constrained variation. [12]
- b) Explain the optimization problem based on nature of equations involved. [8]
- c) Find the solution of following problem by constrained variation method. [5]
- Minimize  $f(x,y) = 2x^2 + 3y - 4$   
subject to  $g(x,y) = 3x - y + 5 = 0$
- Q2)** a) Explain random work method for unconstrained minimization. Draw flow chart. [12]
- b) Explain algorithm for unrestricted search elimination method with a limited step size. [13]
- Q3)** a) Explain the decoupled load flow method. State the assumptions. [12]
- b) Explain the Newton Raphson method of load flow analysis (Rectangular form) [13]

***P.T.O.***

## SECTION - II

- Q4)** a) Derive transmission loss formula in terms of transmission loss coefficients. [13]  
b) Explain economic dispatch using Newton Raphson method. Draw flow chart. [12]
- Q5)** a) Explain : [12]  
i) DC load flow  
ii) Power loss in a line  
iii) Generation shift distribution factor with reference to loss coefficients using sensitivity factors.  
b) Explain three phase load flow method. [13]
- Q6)** a) Explain formulation of sequence impedance matrix in terms of self & mutual impedances using transformation matrix. [13]  
b) What is admittance matrix? Explain the step by step method to form y-bus matrix. [12]



Total No. of Questions : 6]

SEAT No. :

P3813

[Total No. of Pages : 3

[4760] - 228

**M.E. (Electrical) (Power System) (Semester - I)**  
**POWER SECTOR ECONOMICS, MANAGEMENT &**  
**RESTRUCTURING**  
**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *All questions carry equal marks.*
- 6) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1) a)** The cost and estimated savings data for modification in existing project to improve energy performance is given in table below.

| Project modification cost | Energy & demand savings                        | Maintenance cost savings                           |
|---------------------------|--|--|
| Rs. 1,50,000              | 6500 kWh/year & Rs.3800/year as demand charges | Annual maintenance cost savings will be Rs. 5000/- |

The electricity tariff is Rs 5.00/kWh. Assume that there is no tariff escalation for 10 years. The expected life of project is 10 year life. Calculate NPV for the up-gradation with 12% discount rate. [9]

- b) Explain role of Central Electricity Authority and Planning Commission. [8]
- c) Explain regulatory process in India. Also discuss performance based regulation. [8]

**P.T.O.**

- Q2)** a) Why electric utility services are restructured and deregulated? [8]
- b) With reference to tariff, explain following. [9]
- i) Interruptible tariff
- ii) Multi year tariff
- iii) Subsidy and cross subsidy
- c) Discuss various key parameters used by regulators to evaluate performance of different electricity service providers [8]

- Q3)** a) Explain functions of state electricity regulatory commission and central electricity regulatory commission. [8]
- b) What are the challenges before Indian Power Sector under deregulated regime? How to overcome them? [9]
- c) Discuss guidelines for determination of tariff for renewable energy and captive power. [8]

### **SECTION-II**

- Q4)** a) What are Forward contracts and Contracts for Differences? [8]
- b) Explain features of regulatory reforms in Nordic Pool. [8]
- c) What are different transmission pricing methods? Also mention cost components involved in transmission pricing. [9]

- Q5)** a) Explain following terms related to power and energy markets. [8]
- i) Market clearing price, market settlement
- ii) Nodal and Locational marginal pricing
- b) Explain retail competition, wholesale competition models and single buyer model. [9]
- c) What is congestion? How it can be managed? [8]

- Q6)** a) What are transmission rights? Explain effect of physical transmission rights on congestion management. [8]
- b) Explain operation of day ahead market. Also explain option contract. [8]
- c) Explain reason for market inefficiencies, strategic bidding and compare bidding and auction. [9]



Total No. of Questions : 6]

SEAT No. :

**P3814**

**[4760]-229**

[Total No. of Pages : 2

**M.E. (Electrical) (Power Systems)  
POWER SYSTEM MODELING  
(2008 Course) (Semester-I) (503203)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*

**SECTION-I**

**Q1)** What is the need for modeling of a power system. Explain with the help of suitable example the systematic procedure to develop mathematical model of physical system. What is the simulation in power system? **[25]**

**Q2)** What is the use of Park's transformation in power system modeling? State Clarke's transformation and Kron's transformation and write about their applicability. Also write down the relationship of these transformations with Park's transformation. **[25]**

**Q3)** Draw the block diagram and explain working of excitation control system of alternator using **[25]**

- i) a.c generator.
- ii) d.c generator.

***P.T.O.***

## SECTION-II

**Q4)** Explain simple models of governor, turbine and boiler. **[25]**

**Q5)** Write down the ways in which static load modeling can be represented. Discuss about the assumptions and approximations involved in it. Also write down the model of Induction machine with assumptions. **[25]**

**Q6)** Derive the stator and rotor voltage and torque equations in dq0 frame of reference for a synchronous machine of model 2.2. Write down assumptions involve in it. **[25]**



Total No. of Questions : 12]

SEAT No. :

**P4554**

[4760]-23

[Total No. of Pages : 3

**M.E. (Civil-Hydraulics)**

**DAM ENGINEERING**

**(501304) (2008 Course)(Semester-I) (Elective-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat sketches wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of calculators allowed.*
- 5) *All questions are compulsory.*
- 6) *Answers to the two sections must be written separately.*

**SECTION-I**

- Q1)** a) What is the pressure due to earthquake? Explain design methodology for seismic design of a gravity dam. [10]
- b) State various modes of failure of dam. Explain overturning and sliding with neat sketches. [8]

OR

- Q2)** a) What are basic principles of dam design? Explain step by step procedure for design of gravity dam. [9]
- b) Explain reservoir operation policy in case of gravity dam. [9]

- Q3)** a) State design method for arch dam. Explain the concepts of thin cylinder theory for design of arch dam. [8]
- b) Explain various forces acting on arch dam with neat sketch. [8]

OR

- Q4)** a) Define arch dam. Prove that the most economical central angle for a constant radius arch dam is  $133^{\circ} 34'$ . [9]
- b) What are the various situations to which various types of dams are most suitable. [7]

***P.T.O.***

- Q5) a)** A homogeneous dam is 43m high. The free board provided is 3 m. A 30 m long horizontal filter is also provided on the downstream end. A flow net was drawn for the dam section. The flow net comprised of 5 flow channels and 15 potential drops. If the permeability of the material in the dam is  $3 \times 10^{-5}$  m/sec. Calculate the seepage flow per meter length of earth dam. If the dam is 500m long calculate the total discharge through the body of dam. [4]
- b) Draw typical section of earth dam and explain the functions performed by component briefly. Explain various investigations to be carried out for construction of earthen dam. [12]

OR

- Q6) a)** Explain how  $C$  and  $\phi$  values, Permeability of soil and sudden drawdown of the reservoir effect the design of an earthen dam. [8]
- b) Discuss causes and control of seepage in earthen dam. [8]

### **SECTION-II**

- Q7) a)** What is buttress dam? State the classification of buttress dam and explain any one. What is the necessity of this type of dam? [8]
- b) Explain various types of rock fill dams and draw the sketches of each of them. Explain components of rock fill dam and state advantages and disadvantages of rock fill dams. [10]

OR

- Q8) a)** Give the general design principles of design of rock fill dams and their method of construction and compaction. [10]
- b) Explain the advantages of buttress dam over other types of dam. [8]

- Q9) a)** State various types of spillways and explain any four. [10]
- b) A discharge of  $1750 \text{ m}^3/\text{sec}$  has to be passed over an ogee spillway with a coefficient of discharge of 2.25 at a head of 3.8 m. What should be the effective length of the spillway. [6]

OR

- Q10)** a) Explain protection of stream bed below spillway. [6]  
b) Explain design criterion for hydraulic jump type stilling basin. [10]

- Q11)** a) Explain step by step procedure for design of ogee spillway. [10]  
b) Explain automatic gates. [6]

OR

- Q12)** a) Explain drum gates and vertical lift gates. [8]  
b) State advantages of gated spillway and explain radial gates. [8]





- Q3)** a) What are the advantages of digital filter over analog filters? [6]  
b) Obtain direct form, cascade form realization of the following FIR filter.[9]  
$$H(z) = (1 + 3z^{-1} - 10z^{-2})(1 + 2z^{-1} - 7z^{-2})$$
  
c) Explain how FIR filters are designed using Hamming window. [10]

### SECTION - II

- Q4)** a) Explain the steps involved in designing discrete low pass Chebyshev filter. [9]  
b) Compare the method of bilinear transformation with impulse invariance for obtaining digital filter from analog filter. [8]  
c) Explain different realizations of IIR filters. [8]
- Q5)** a) Explain various Architectures used in Digital Processors. [9]  
b) Explain following. [16]  
i) Addressing modes  
ii) Effect of finite word length  
iii) Multiple Access Memory  
iv) Data Address Generator
- Q6)** a) With the help of functional block diagram, explain the features of DSP 320C50 Processor. [16]  
b) Write a detailed note on 'DSP based Power transformer protection'. [9]



Total No. of Questions : 12]

SEAT No. :

**P4569**

**[4760]-231**

[Total No. of Pages :3

**M.E. (Electrical Power Systems)  
ADVANCED POWER ELECTRONICS  
(2008 Course) (Semester-I) (Elective-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer-books.*
- 2) *Answer three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

- Q1)** a) Explain the constructional features, characteristics and specifications of SCR and Explain why it is suitable for various applications in power electronics? [8]
- b) Explain constructional details of MCT to explain its capability in comparison to SCR. [8]

OR

- Q2)** a) Why IGBTs are better suited for high power applications than MOSFETs? Explain wrt characteristics and constructional details. [8]
- b) What is SOA.? Draw and compare MOSFET and BJT SOA. [8]
- Q3)** a) Explain operation of 3phase full bridge converter feeding highly inductive load. Comment on the range of control with continuous load current. [10]
- b) How PWM control is used for harmonic control? What is SHE(Selective Harmonic Elimination)? Explain. [8]

OR

- Q4)** a) What are various transformer connections used for obtaining 12 pulse operations? Write expressions for ac harmonics. What is the advantage of using 12 pulse converter over 6 pulse converter?. [10]
- b) Explain 3level voltage source converter(VSC) operation and comment on harmonics in output voltage. [8]

**P.T.O.**

- Q5)** a) Draw neat circuit and explain working of self commutated CSC. [8]  
b) Compare CSC with VSC with help of circuit diagram, devices used and applications. [8]

OR

- Q6)** a) Explain working of line commutated CSC. [8]  
b) What are the advantages of CSC compared to VSC? Explain with help of circuit diagram, and control techniques. [8]

### **SECTION-II**

- Q7)** a) What are advantages of multi level inverters? What are different configurations? [8]  
b) Draw neat circuit for 3level diode clamped multilevel inverter and explain how harmonic control is achieved? What are the limitations? [8]

OR

- Q8)** a) Explain working of capacitor clamped multilevel inverter What are advantages in comparison with other types? [8]  
b) What is the control technique for cascading operation of multilevel inverters to generate stepped output? [8]

- Q9)** a) What is the need for energy storage systems? What are various types of energy storage available? [10]  
b) Explain working principle of superconducting magnetic energy storage system.(SMES). [8]

OR

- Q10)a)** What is active filter? What are types? Compare series and shunt types. **[10]**  
b) Explain working principle of flywheel energy storage system. **[8]**

- Q11)a)** Explain the need for transformations using d-q transformations? **[8]**  
b) What is active and reactive power expressions of 3 phase 4 wire system using Akagi's instantaneous power(pq) theory? **[8]**

OR

- Q12)a)** What are  $\alpha\beta$  transformations? Write relations for 3 phase balanced voltage systems to obtain  $\alpha\beta$  components. **[8]**  
b) How Akagi's instantaneous power(pq) theory is used for reactive compensation? **[8]**



Total No. of Questions : 6]

SEAT No. :

**P3816**

[Total No. of Pages : 2

[4760] - 232

**M.E. (Electrical-Power Systems)**

**ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS IN  
POWER SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume Suitable data, if necessary.

**SECTION - I**

- Q1)** a) Explain with examples the suitability of applying artificial intelligent tools such Fuzzy logic and Artificial Neural network for solving problems in power system. **[10]**
- b) Write short note on following with examples; **[15]**
- i) Fuzzy relations and operations on fuzzy sets.
  - ii) Height of a fuzzy logic
  - iii) Normalization of a fuzzy set.
- Q2)** Explain following methods of associating crisp set with a given fuzzy set. **[25]**
- a) Core of a fuzzy set
  - b) Support of a fuzzy set
  - c) Level set associated with a fuzzy set
  - d)  $\alpha$  - cuts of a fuzzy set
- Q3)** Explain 'Propositional Logic' PL(1) with reference to following points giving appropriate examples. **[25]**
- a) Syntax of PL (1)
  - b) Semantics of PL (1)
  - c) Semantic Properties
  - d) Derivation
  - e) Resolution in PL (1)

**P.T.O.**

## SECTION - II

- Q4)** a) Explain in short the operational as well as functional properties of Artificial Neural Network (ANN). [10]
- b) Explain basic McCulloch Pitts' non linear model of a neuron with diagram and mathematical relations. Explain the analogy between biological neuron and artificial neuron. [8]
- c) Explain linear as well as non-linear transfer functions used to map input-output relation while training ANN. [7]
- 
- Q5)** a) Define learning of artificial neural network. Compare supervised and unsupervised learning. [15]
- b) Explain algorithm of 'Perceptron learning Rule'. Explain 'learning rate' and 'momentum coefficient'. [10]
- 
- Q6)** a) With neat diagram explain the architecture of Multi-Layer Perceptron (MLP). [5]
- b) Explain basic rules of signal flow graph. [5]
- c) Explain the error back propagation algorithm with mathematical formulae. [15]



Total No. of Questions : 6]

SEAT No. :

**P3817**

[Total No. of Pages : 2

[4760] - 233

**M.E. (Electrical) (Power System)**  
**RENEWABLE ENERGY SOURCES**  
**(2008 Pattern) (Elective - II) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Highlight on worldwide potentials of conventional and nonconventional energy resources and comment on same. [10]  
b) Write a note on IRP. [5]  
c) Describe the factors favoring and against renewable energy sources.[10]
- Q2)** a) Write a note on solarcells and its cell technologies. [10]  
b) Explain the control system and its design features for wind power system.[10]  
c) Explain characteristics of PV cells. [5]
- Q3)** a) High light on wind distribution and wind speed predictions. [10]  
b) Explain the wind and Solar combination for standalone and grid connected system. [10]  
c) Discuss different types of solar collector. [5]

**SECTION - II**

- Q4)** a) Write a note on conversion of Biomass in other form of energy such as solid, liquid and gases. [10]  
b) Write a note on minihydel plant. [7]  
c) Explain the ocean-thermal energy conversion systems. [8]

**P.T.O.**

- Q5)** a) Explain the flywheel energy relation its components and its benefit over battery. [10]  
b) Write a note on fuel cell energy storage systems. [10]  
c) Write a note on Battery management. [5]
- Q6)** a) Explain the hybrid system combined with diesel. [10]  
b) Discuss different parameters which affects power quality of system and how they can be controlled. [10]  
c) Highlight on concept of load scheduling. [5]



Total No. of Questions : 6]

SEAT No. :

P3818

[Total No. of Pages : 2

[4760]-234

**M.E. (Electrical) (Power Systems)**  
**POWER SYSTEM DYNAMICS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any two from each section.*
- 2) *Answers to the two sections should be written on separate answer books.*
- 3) *Assume suitable data if necessary.*
- 4) *Write down all the assumptions made.*

**SECTION - I**

- Q1)** Explain in detail analysis of transient stability using numerical and graphical approach. State the criterions involved in it. **[25]**
- Q2)** a) Write down the characteristic equation for single machine system with static exciter and discuss the dynamic stability using coefficient of different power of 's' applying Routh's criterion. **[13]**
- b) Considering field flux decay, discuss the stability of single machine system neglecting AVR by the application of Routh's criterion. **[12]**
- Q3)** Discuss about system stability with the concept of Synchronizing Torque ( $T_s$ ) and Damping Torque ( $T_D$ ) for the system
- a) without AVR **[13]**
- b) with exciter **[12]**

**P.T.O.**

## SECTION - II

- Q4)** What is power system stabilizer (PSS)? Explain it with the help of neat block diagram. Explain the working of each component of PSS in detail. [25]
- Q5)** a) Derive stator and rotor equation of synchronous generator represented by model 1.1 to analyze the dynamics of it. [13]
- b) Explain the SVC model and its inclusion in the dynamics of SMIB. [12]
- Q6)** a) Describe the steps and assumptions involved in investigation of dynamic stability of multi-machine system. [13]
- b) Explain with the help of suitable example, the objectives and various methods of islanding. [12]



Total No. of Questions : 6]

SEAT No. :

**P3819**

**[4760] - 235**

[Total No. of Pages : 2

**M.E. (Electrical) (Power System)**

**POWER SYSTEM PLANNING & RELIABILITY**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is whether sensitive load forecasting? Also explain adequacy and security terms used in reliability. [13]
- b) What is Power system planning? Explain various planning methods. [12]
- Q2)** a) Explain short term, medium term and long term planning. [12]
- b) Explain various loads, their characteristics and hence explain reliability indices. [13]
- Q3)** a) Explain Momentary indices. What is different between momentary interruptions and sustained interruptions? [13]
- b) Briefly discuss on probability methods required in reliability and planning study. Hence explain various probability methods. [12]

***P.T.O.***

## SECTION - II

- Q4)** a) Explain factors affecting interconnection under emergency assistance. **[13]**
- b) Explain Integrated resource planning for reliability improvement. Draw a neat sketch of transmission planning and explain transmission planning functions. **[12]**
- Q5)** a) Explain role of reconfiguration in reliability improvement? What is reliability cost? What are the parameters affected on reliability cost? **[13]**
- b) What is the effect of bus-bar failure in evaluation of distribution system reliability? Also discuss on planning codes. **[12]**
- Q6)** a) Explain transmission planning to enhance reliability indices specially system point and load point indices. **[13]**
- b) Explain LOLE in detail with neat sketch. **[12]**



Total No. of Questions : 06]

SEAT No. :

**P3820**

**[4760] - 236**

[Total No. of Pages :2

**M.E.(Electrical -Power Systems)  
HIGH VOLTAGE POWER TRANSMISSION  
( 2008 Course) (Semester- II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data,if necessary.*

**SECTION - I**

**Q1)** Write the concept of over-voltage in power system. What are the ill-effects of it? Also explain the occurrence of overvoltage due to lightening phenomenon and occurrence of switching over voltage. Write six the means to minimize these over voltages. **[25]**

**Q2) a)** What is the necessity of reactive power support/compensation. Also explain the methods of compensation of reactive power. Explain the effects of variation of reactive power on system behavior. **[15]**

b) Explain the reasons of occurrence of radio interference. What are the effects of radio interference on working of power systems? What are the factors to be considered in designing a line. **[10]**

**Q3) a)** State the methods of voltage control. Explain any two methods to control voltage. **[12]**

b) What are the biological effects of electric field and how it is dangerous for living being if not followed proper clearance. State the safe values of electric field. What are the safety measures to avoid accidents under high voltage/fields **[13]**

**P.T.O.**

## SECTION - II

- Q4)** a) Explain the evolution of HVDC transmission system. Compare between EHV AC and HVDC Transmission system. State the merits and demerits of both systems. [12]
- b) Explain the connections of three phase six pulse and twelve pulse converter bridges. Draw and explain the voltage and current waveforms [13]
- Q5)** Write short note on following HVDC concepts; [25]
- a) Bipolar HVDC terminal, the sequence of switching operations.
- b) Multi-terminal HVDC systems along with their control characteristics, configurations.
- Q6)** Write short note on following; [25]
- a) Pole-wise segregation
- b) Clearing of DC line faults
- c) Re-energizing
- d) Protection of converters



Total No. of Questions : 6]

SEAT No. :

**P3821**

**[4760]-237**

[Total No. of Pages : 2

**M.E. (Electrical) (Power System)**  
**DIGITAL POWER SYSTEM PROTECTION**  
**(2008 Pattern) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer 2 questions from section I and 2 questions from section II.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

**SECTION - I**

- Q1)** a) What are the advantages of digital protection over analog protection. **[5]**
- b) State and explain sampling theorem. **[5]**
- c) Explain least error squared (LES) technique. **[15]**
- Q2)** a) Using travelling wave phenomenon, explain how EHV transmission line is protected digitally. **[15]**
- b) Explain percentage differential protection scheme used for synchronous generator. **[10]**
- Q3)** a) What are the probable faults in a synchronous generator. **[10]**
- b) Explain digital protection of synchronous generator using second harmonic current injection. **[15]**

**P.T.O.**

**SECTION - II**

- Q4)** a) Explain digital protection of transformer with digital filtering schemes. **[15]**  
b) Explain Buchholtz relay. **[10]**
- Q5)** a) Explain **[10]**  
i) Man machine interface subsystem  
ii) Application of computer graphics  
b) Explain directional multizone distance relay. **[15]**
- Q6)** a) Derive algorithm for S.C. studies. **[13]**  
b) Derive transformation to symmetrical components. **[12]**

*EEE*

Total No. of Questions : 12]

SEAT No. :

P4570

[4760]- 238

[Total No. of Pages :3

**M.E.(Electrical) (Power Systems)**  
**POWER ELECTRONICS APPLICATIONS IN POWER**  
**SYSTEMS(PEAPS)**  
**( 2008 Course) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION-I**

- Q1)** a) What is the need for reactive power compensation in power system operation? Classify different types of static power converter topologies used. Comment on the output, harmonic control in a transmission line. [8]
- b) Compare Series Compensation and Shunt Compensation? Explain any one method for shunt compensation in detail along with diagram. [8]

OR

- Q2)** a) Explain TSC TCR topology with neat diagram and characteristics. [8]
- b) Draw Impedance Vs delay angle characteristics of TCSC and explain its operation. [8]

- Q3)** a) What is the most suitable location for shunt compensation placement ? Why? [8]
- b) With neat figure explain the principle of operation of Thyristor Controlled Reactor (TCR). Obtain the expression for effective reactive admittance and RMS value of fundamental and nth harmonic current [8]

OR

**P.T.O.**

**Q4) a)** How SSSC can be used for active and reactive power flow control of transmission network? Compare characteristics and features of TSSC with SSSC. [10]

b) Draw hybrid compensation scheme of SSSC + FC. What are the merits of this scheme? [6]

**Q5) a)** Draw and explain internal control scheme for TCSC based on prediction of capacitor voltages zero crossing. [10]

b) Draw V-I characteristics of TSC TCR and Explain its modes of operation. [8]

OR

**Q6) a)** Comment on control range and VA rating of SSSC using V-I characteristics in Voltage control and reactive control mode of operation. [10]

b) Draw and explain switching converter type series compensator functional diagram. [8]

### SECTION-II

**Q7) a)** What are the various functional capabilities of UPFC? Draw phasor diagram and explain. [8]

b) Explain functional control of shunt and series converter in UPFC. What are the operational constraints in UPFC? [8]

OR

**Q8) a)** What is UPFC? Draw diagram to explain basic principle of operation of UPFC. [8]

b) Explain performance of UPFC for power flow control with operation under power system oscillations. [8]

**Q9) a)** Explain working principle of Voltage and Phase Angle Regulator (PAR). Explain its modes of operation. [8]

b) Draw circuit and explain operating features of DVR. [8]

OR

- Q10)** a) What is TCPAR? Draw circuit diagram and explain its working modes. **[8]**  
b) Compare different FACTS controllers used for reactive compensation. **[8]**

- Q11)** a) What are various control strategies used in various FACTS devices ?  
Discuss their comparative merits. **[10]**  
b) Compare Hysteresis and Fuzzy logic controls. **[8]**

OR

- Q12)** a) What is ANN control? Explain. **[10]**  
b) Comment on importance of coordination between different FACTS controllers. **[8]**



Total No. of Questions : 6]

SEAT No. :

P3822

[Total No. of Pages : 2

[4760] - 239

**M.E. (Electrical) (Power System)**  
**POWER QUALITY ASSESSMENT & MITIGATION**  
**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *All question carry equal marks.*
- 6) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is power quality? Define power quality as per IEEE standard 1159. Also characterize power quality events. [9]
- b) What is RMS voltage variation? What are different power system events result deviation of RMS voltage. What are different principles to control voltage variation? [8]
- c) Explain effect of location of fault and fault level and type of fault on voltage sag. [8]
- Q2)** a) Explain sources which introduces voltage flicker. Also highlight various mitigation techniques. [9]
- b) Explain economic impacts of voltage sag. Also explain equipment sensitivity to sag. [8]
- c) Differentiate between Voltage sag and interruption also enlist differences between harmonics and transients. [8]

**P.T.O.**

- Q3)** a) How voltage sag is analyzed? How voltage sag can be mitigated? [9]  
b) How power quality and grounding are interrelated? What special precautions are taken for maintaining quality supply for critical equipment? [8]  
c) How transients are classified? Explain effect of surge impedance and line termination on Transient voltages. [8]

## SECTION - II

- Q4)** a) Explain harmonic resonances and effect of these on system operation. [9]  
b) Explain objectives of power quality monitoring and monitoring requirements. [8]  
c) Explain need of power quality state estimation and advantages of it. [8]
- Q5)** a) Explain various approaches of power quality monitoring. [9]  
b) Explain effect of harmonics on rotating machines, power capacitors and on transformers. [8]  
c) Explain following power quality indices [8]  
i) THD  
ii) TDD  
iii) Flicker factor and  
iv) Percent Negative sequence voltage
- Q6)** a) Explain different types of transducers used for power quality monitoring along with specific requirements. [9]  
b) Explain various methods for reducing harmonic components from load currents. [8]  
c) Write in details about selection of power analyzer, measurement location and interval between consecutive measurement so as to correctly power quality. [8]



Total No. of Questions : 6]

SEAT No. :

P3823

[Total No. of Pages : 2

[4760] - 240

**M.E. (Electrical) (Power Systems)**

**PARTIAL DISCHARGES IN ELECTRICAL POWER APPARATUS**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the phenomenon of internal discharge. [5]
- b) Explain the phenomenon of surface discharge. [5]
- c) Explain the phenomenon of external discharges. [5]
- d) What are the reasons are occurrence of partial discharge in dielectric material. State methods to detect the partial discharge. [10]
- Q2)** a) Explain the necessity of calibration of Partial Discharge (PD) measuring setup. [6]
- b) Explain in detail, the procedure of calibration of PD measuring unit. [6]
- c) Explain the reasons for uncertainty of measurement. [6]
- d) Compare the working of straight and balanced detection system [7]

**P.T.O.**

- Q3)** a) Explain the working of completely enclosed screen. What are the materials used for screening and Screen interruptions. [15]
- b) Explain the technique and procedure of measurement of screening efficiency. [10]

### SECTION - II

- Q4)** Explain the effects of Partial Discharge on following type of dielectrics. Also explain the allowable magnitude of discharge. [25]
- a) Gaseous insulating materials
- b) Liquid insulating materials
- c) Solid insulating materials
- Q5)** a) With mathematical relation explain the difference between measured and actual charge [15]
- b) Explain the occurrence of pulses of time-dependent Partial Discharge. Draw diagrams of time varying pulses. [10]
- Q6)** a) What is the standard procedure of conducting partial discharge test on cables? [5]
- b) Explain the problems during Partial Discharge measurement on long cables. [5]
- c) What is the significance of knowing location of partial discharge? Explain the methods to locate PD. [15]



Total No. of Questions : 8]

SEAT No. :

**P3824**

[4760] - 242

[Total No. of Pages : 2

**M.E. (Electrical) (Power Electronics & Drives)**  
**MODELING AND ANALYSIS OF ELECTRICAL MACHINES**  
**(2008 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from section - I and three questions from section - II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Draw sketches of basic two-pole machine and respective primitive machine of the following machines : **[10]**  
i) Synchronous machine  
ii) Single phase induction motor  
iii) Induction machine  
b) Explain also the term 'Invariance of power as applied to transformation theory in Electrical machines. **[6]**
- Q2)** a) Explain 2-phase to 3-phase transformation using voltage equation matrix. **[8]**  
b) Explain modeling of modeling of 3-phase induction motor in synchronously rotating reference frame. **[10]**
- Q3)** a) Derive Park's transformation relating the three phase currents of a synchronous machine to its corresponding d-q axes currents. **[10]**  
b) Explain how a differential equation for an AC machine is converted to a phasor equation? Illustrate your answer. **[6]**
- Q4)** a) Derive the equation for the electrical torque of the primitive machine. Explain significance of various terms of obtained torque equation. **[8]**  
b) A 3-ph, 4 pole, 50 Hz induction motor develops a torque of 250 Nm at rated phase voltage of 230 V. The three phase stator winding now replaced by 2 phase winding keeping number poles, number of turns and conductor size same. Will the motor able to operate? If so, compute. **[8]**  
i) Rated phase voltage of induction motor.  
ii) The torque, if the rated voltage supplied is same as obtained in (i) from a 2-phe Hz supply.

***P.T.O.***

## SECTION - II

- Q5)** a) Derive the expression for the steady state torque of a induction motor when balanced polyphase supply is impressed on the stator. Use dynamic model of a induction machine. [8]
- b) Derive equations for armature mutual inductances of a Salient pole synchronous machine from a consideration of its basic parameters. [8]
- Q6)** a) Prove that maximum electromagnetic torque in a polyphase induction motor is independent of rotor-circuit resistance. [8]
- b) Starting from the impedance matrix of a 3-phase salient pole synchronous machine, derive the phase voltage equation under balanced steady state operation. Hence draw the phasor diagrams for the motor. [8]
- Q7)** a) A 3-phase star connected 4-pole 50 Hz alternator gives an open circuit voltage of 11 kV when applied field voltage is 220 V. For a circuit resistance of  $0.2 \Omega$ , calculate the amplitude of armature to field mutual inductance and motional inductance. [10]
- b) Discuss machine inter-connection matrices for DC motor coupled with DC generator system. [8]
- Q8)** Write short notes on : [2 × 8 = 16]
- a) Linearization of synchronous machine model.
- b) Small displacement stability : Eigen values of typical induction machine.



Total No. of Questions : 6]

SEAT No. :

**P3953**

[Total No. of Pages :2

**[4760]-243**

**M.E. (Electrical) (Power Electronics & Drives) (Semester - I)  
ENERGY MANAGEMENT AND POWER QUALITY IN  
ELECTRICAL DRIVES  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Solve any two questions from Section I and two questions from Section II.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain VFD controlled operation of Blowers and pumps. [10]  
b) Explain loss model optimal control of induction motor. [15]
- Q2)** a) Explain capacitor size and location fixation criteria and cause of power losses. [15]  
b) Which are different power quality issues present. [10]
- Q3)** a) Explain energy conservation measures in cooling towers. [10]  
b) Explain cogeneration and its types and need. [15]

***P.T.O.***

**SECTION - II**

- Q4)** a) Explain the term harmonics and corrective measures to be applied. [15]  
b) Explain different Power quality reliability indices. [10]
- Q5)** a) Explain the harmonics reduction techniques in transformer. [15]  
b) Explain the high power factor pre-regulator. [10]
- Q6)** a) Explain PWM converter as a current source active filter. [15]  
b) Explain shunt type Active power filter. [10]



Total No. of Questions : 6]

SEAT No. :

**P4571**

**[4760] - 248**

[Total No. of Pages :2

**M.E. (Electrical) (Power Electronics & Drives)**

**FACTS AND HVDC**

**(2008 Pattern) (Semester - I) (Elective - II) (503305)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 2 questions from each section.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

**(Facts)**

- Q1)** a) With the help of neat diagram explain the working of static VAR compensation. [13]
- b) Explain the working of TCSC & TCR. [12]
- Q2)** a) Why reactive power compensation is required in power system? Explain different methods used for reactive power compensation. [15]
- b) Explain the principle of operation of Thyristor Switched Capacitors (TCS). [10]
- Q3)** a) Write a short note on Unified Power Flow Controller. [12]
- b) What is need of FACTS controllers? Explain the working of STATCOM as a FACTS controller along with neat diagram. [13]

**SECTION - II**

**(HVDC)**

- Q4)** a) Discuss the role of HVDC in modern power system. [12]
- b) Explain the different types of HVDC systems along with neat diagrams and their merits and demerits. [13]

*P.T.O.*

- Q5) a)** Draw the diagram of a typical HVDC substation. Also explain the function of different parts of it. **[15]**
- b) Explain the working of 6 pulse bridge converter along with waveform. **[10]**
- Q6) a)** Discuss in brief the power flow control in HVDC link. **[13]**
- b) What are the different faults occurred in HVDC link? Also explain how to provide protection against it? **[12]**



Total No. of Questions : 6]

SEAT No. :

**P3954**

**[4760] - 249**

[Total No. of Pages : 1

**M.E.(Electrical) (Power Electronics and Drives)**

**HARMONICS AND THEIR MITIGATION (Elective - II)  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Solve any two questions from Section - I and two questions from Section - II .*
- 2) *Use separate answer book for both the sections.*

**SECTION - I**

- Q1)** a) Discuss different sources of harmonic Distortion. [15]  
b) Explain different power quality issues present. [10]
- Q2)** a) Explain the effect of power quality problem on equipments with remedy. [15]  
b) Enlist different harmonic elimination techniques. [10]
- Q3)** a) What are Effects of harmonic distortion. [15]  
b) Explain steps for passive Harmonic filter design. [10]

**SECTION - II**

- Q4)** a) Explain power quality monitoring methods & equipments. [15]  
b) Explain different Power quality reliability indices. [10]
- Q5)** a) Explain different harmonics reduction techniques. [10]  
b) Explain different devices used to control harmonics in the system. [15]
- Q6)** a) Explain shunt type Active power filter. [15]  
b) Explain operating characteristics of SPS. [10]



Total No. of Questions : 12]

SEAT No. :

**P4555**

**[4760] - 25**

[Total No. of Pages :3

**M.E. (Civil) (Hydraulic Engineering)**

**CLOSED CONDUIT FLOW AND HYDRAULIC TRANSIENT  
(501305) (2008 Course) (Elective - II) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat sketches wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of calculators allowed.*
- 5) *All questions are compulsory.*
- 6) *Answers to the two sections must be written separately.*

**SECTION - I**

- Q1) a)** What are pump characteristics? Explain with neat sketches applications of pump characteristics. **[8]**
- b) A pump delivers water at  $Q = 300$  l/s and a head  $D_h = 40$  m through a DN 400 discharge pipe measuring  $L = 5000$  m into an overhead tank;  $a = 1000$  m/s. The inertia moments of pump and motor are negligible. Is there a risk of liquid column separation, i.e. macro-cavitation, following pump trip? If so, what is the anticipated pressure increase? **[10]**

OR

- Q2) a)** What do you understand by static head Manometric head and total head of a centrifugal pump? Explain Manometric, Mechanical and overall efficiencies of centrifugal pumps. **[9]**
- b) Derive the expression for specific speed of centrifugal pump. **[9]**
- Q3) a)** Explain Water hammer theory (elastic and rigid) for pipeline flow for hydroelectric project. **[8]**
- b) Illustrate with the help of sketch variation in hydraulic gradient in a penstock with change of load. **[8]**

OR

*P.T.O.*

**Q4) a)** What do you understand by a surge tank? Illustrate with sketches its different types. [8]

b) Do we need surge tanks in tailrace tunnel? Illustrate various types with suitable sketches. [8]

**Q5) a)** A rectangular power channel 20 m wide and 3 m deep supplies 120 cumecs discharge to a power plant with four turbines. Two turbines are suddenly closed. Determine magnitude and speed of surge developed. [8]

b) A penstock 2000m long and m in diameter has a surge tank 20 m diameter for a discharge of 30 cumecs. Friction factor is 0.018. Normal reservoir level is 500 m. Determine maximum and minimum water levels in the tank. [8]

OR

**Q6) a)** What are the functions of surge tanks? Determine the pressure rise due to sudden closure of the valve at the end of steel penstock pipe 500 m long carrying water at a velocity of 5 m/s. Assume  $\sigma = 102$ . [8]

b) Explain in detail differential surge tanks with expanded chambers. [8]

### SECTION - II

**Q7) a)** What are various components of water distribution system? Explain with sketches. [8]

b) Explain in detail method of pipe network analysis. [10]

OR

**Q8) a)** Explain use of PIPE2000(KYPIPE) for design of pipeline. [9]

b) Explain in detail contribution of computer science in planning and management of water supply. [9]

**Q9) a)** Explain use of SURGE program. [8]

b) State basic equations of transient flow analysis in closed conduits and explain terms involved. [8]

OR

**Q10)a)** Explain use of HEC\_RAS(HEC2) program in managing water resources. [8]

b) Explain use of Pipe2000-SWMM program. [8]

**Q11)a)** Explain classification of open channel flows. [8]

b) What are gradually varied flows explain with sketches various GVF profiles. [8]

OR

**Q12)a)** What are rapidly varied flows (RVF) explain with sketches RVF. [8]

b) Explain use of floodplain hydraulics in design of various civil engineering structures. [8]



Total No. of Questions : 8]

SEAT No. :

P3825

[Total No. of Pages : 2

[4760]-250

M.E. (Electrical) (Power Electronics & Drives)

CONTROLLED ELECTRICAL DRIVES

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates :

- 1) Answer three questions from Section - I and three questions from Section - II.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data if necessary.

**SECTION - I**

- Q1)** a) Explain the performance of a semi-converter fed separately excited dc motor under discontinuous and continuous modes of operation. [8]
- b) A 210V, 1400 rpm, 12A separately excited dc motor has armature resistance and inductance of 0.7  $\Omega$  and 16 mH respectively. This motor is controlled by a full converter having input of 230 V, 50 Hz supply. Identify the modes and calculate torques for [10]
- i)  $\alpha = 60^\circ$  and speed = 450 rpm
  - ii)  $\alpha = 60^\circ$  and speed = 1500 rpm
- Q2)** a) Discuss two quadrant chopper fed DC drive, controlling armature voltage with constant excitation. What are the demerits of chopper output on the overall performance of the motor. [8]
- b) A 230 V, 20 A, 1200 rpm separately excited dc motor has an armature resistance of 2  $\Omega$ . The motor is controlled by a chopper with frequency of 300 Hz and source voltage of 230 V. Calculate the duty ratio for rated torque and speed of 500 rpm. [8]
- Q3)** a) Explain four quadrant operation in a dual converter fed dc drive for both circulating and non-circulating current operation. [8]
- b) Derive the output voltage and speed equation in a semi converter fed dc separately excited motor. Discuss maximum and minimum values of currents in continuous conduction mode. [8]

**P.T.O.**

- Q4)** a) Discuss in detail the speed control strategy 'constant volts/Hertz' for 3 phase induction motor. Also, explain drive operating regions with the help of torque-speed curves at variable voltage and frequency up to field weakening region. [8]
- b) Draw and explain a control schematic block diagram for closed loop control of a VSI fed induction motor drive. [8]

### SECTION - II

- Q5)** a) What is the principle of slip power recovery method of speed control? With necessary sketches, explain Static Kramer drive. State the merits of this method of speed control. [8]
- b) A Y-connected squirrel cage induction motor has following ratings and parameters: [10]  
 400 V, 50 Hz, 4-pole, 1370 rpm,  $R_s = 2\Omega$ ,  $R_r' = 3\Omega$ ,  $X_s = X_r' = 3.5\Omega$ ,  $X_m = 55\Omega$ .  
 It is controlled by a current source inverter at a constant flux. Calculate  
 i) Motor torque, speed and stator current when operating at 30 Hz and rated slip speed.  
 (ii) Inverter frequency and stator current for rated motor torque and motor speed of 1200 rpm.
- Q6)** a) With necessary diagrams explain the principle of field oriented control. Discuss and compare the philosophy of scalar control and vector control. [8]
- b) Explain the method of rotor flux estimation in vector control scheme using voltage model and hence derive the estimating equations of rotor flux and rotor angle. [8]
- Q7)** a) Draw and explain a schematic block diagram for implementation of direct vector method. Write all transformation equations. [8]
- b) Discuss the dynamic model of separately excited dc motor and derive the transfer function for speed as output and the armature voltage as input. [8]
- Q8)** With necessary diagrams explain: construction, Principle of operation, drive circuit, performance characteristics, equations and advantages of: [2 × 8 = 16]  
 a) Switched reluctance motor drive.  
 b) Stepper motor drive.



Total No. of Questions : 6]

SEAT No. :

P4572

[Total No. of Pages : 2

[4760]-251

**M.E. (Electrical) (Power Electronics and Drives)**

**POWER ELECTRONIC APPLICATIONS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answer two questions from Section I and two questions from Section II.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Discuss the role of power electronics in hybrid vehicle. [12]
- b) How the power electronics is used in battery charging. [13]
- Q2)** a) What is electric traction system? How to provide control to traction Motors. [15]
- b) Explain the working of 3phase full bridge converter along with its application. [10]
- Q3)** a) Discuss different utility applications of power electronics. [15]
- b) With the help of neat diagram explain the working of Air conditioning system. [10]

**P.T.O.**

## SECTION - II

- Q4)** a) Explain the working of UPS? How power electronics is used in it. [12]  
b) With the help of neat diagram explain the working of wind power system. [13]
- Q5)** a) How power electronics is useful in solar power system. [10]  
b) Write a short note on SMPS. [15]
- Q6)** a) Write a short note on Industrial applications of power system. [12]  
b) What is HVDC link? How power electronics is useful in it? [13]



**P3826**

Total No. of Questions : 6]

**[4760]-252**

**M.E. Electrical(Power electronics and drives)**  
**DESIGN OF POWER ELECTRONIC SYSTEMS**  
**503310(2008Course) (Semester-II)**

*Time : 3 Hours]**[Max. Marks : 100**Instructions to the candidates:*

- 1) *Answer any two questions from Section-I and any two questions from Section-II.*
- 2) *Answers to the two sections should be written in separate answer sheets.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**SECTION-I**

- Q1)** a) Explain with energy flow equation the different ways of heat transfers that are considered when designing a heat sink and explain the process of selection of a proper heat sink for a device. **[15]**
- b) Explain thermal resistance and its components. **[10]**
- Q2)** a) Derive steady state equivalent circuit from the dynamic equation of the induction motor. **[15]**
- b) Derive transfer function of voltage control SMPS. **[10]**
- Q3)** a) Find the heat sink ambient thermal resistance  $R_{\theta_{sa}}$  for the following data surface temperature  $T_s = 120^\circ\text{C}$ , ambient temperature  $T_a = 20^\circ\text{C}$ , dimensions of heat sink  $A_1 = 0.075 \times 0.063 \text{ m}$ ,  $A_2 = 0.075 \times 0.115 \text{ m}$ . **[15]**
- b) Derive expression for specific eddy current loss. **[10]**

**P.T.O.**

## SECTION-II

- Q4)** a) Design a single phase transformer with following data  $V_{pri} = 300V$  rms,  $I_{rms} = 4A$  rms, turns ratio = 4, operating frequency  $f = 100KHz$ ,  $T_s = 100^\circ C$ ,  $T_a = 40^\circ C$ . Assume suitable data if required. [15]
- b) Explain the selection criterion of magnetic materials for different applications. [10]

- Q5)** a) Explain the need of soft switching and its concept with V-1 characteristics. [15]
- b) Explain the design procedure of transformer with flow chart. [10]

OR

- Q6)** a) Explain procedure for designs of converter also explain what are different factors and assumption taken into account for design. [15]
- b) Explain procedure for design of inverter. [10]



Total No. of Questions : 8]

SEAT No. :

**P3827**

**[4760]-253**

[Total No. of Pages : 2

**M.E. (Electrical) (Power Electronics & Drives)**

**AUTOMATION IN INDUSTRIAL DRIVES**

**(2008 Course) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer three questions from section - I and three questions from section - II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

**SECTION - I**

- Q1) a)** State the torque-speed characteristics of different loads used in a drive system. Explain matching of Torque-speed characteristics of motor with that of loads and operating regions. **[10]**
- b) Explain different types of duty cycles and calculation of motor rating. **[8]**
- Q2) a)** What is Adaptive control? Give a schematic block diagram and explain implementation of adaptive control for dc drive. **[8]**
- b) Discuss steady state analysis of dc motor drive. Explain the expression for steady state torque and speed. **[8]**
- Q3) a)** Draw and explain Implementation diagram for slip power control method for 3-phase induction motor. **[8]**
- b) With necessary diagrams, explain cycloconverter fed induction motor drive. What are the limitations of stator voltage control of induction motor? **[8]**
- Q4) a)** State the different Electrical braking methods that are used for induction motor. Explain how energy loss due to braking methods is calculated. **[10]**
- b) Discuss on loss minimization in adjustable speed drives. **[6]**

**P.T.O.**

## SECTION - II

- Q5)** a) Draw the schematic block diagram for closed loop control of synchronous motor with adjustable frequency operation. [10]  
b) Discuss on different control strategies used for Synchronous motor drive. [8]
- Q6)** a) Discuss different components that are used in automation of industrial drives. With necessary block diagrams, explain the purpose of each components used in the automation. [8]  
b) Discuss how PLC is effectively used to control and protect a industrial drive. [8]
- Q7)** a) Use a functional diagram and explain SCADA implementation for multiple control of industrial drives. [8]  
b) Explain implementation of direct vector control of induction motor. [8]
- Q8)** a) Write short notes on Ladder programming for motor protection. [8]  
b) With necessary block diagram, discuss DTC drive system. [8]

*EEE*

Total No. of Questions : 6]

SEAT No. :

**P3955**

**[4760] - 255**

[Total No. of Pages :2

**M.E.(Electrical)(Power Electronics and Drives)  
MICROCONTROLLER & ITS APPLICATIONS  
( 2008 Course) (Elective-III) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Solve any two questions from section I and two questions from Section II.*
- 3) *Figures to the right side indicates full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a) Write note on [15]**

- i) reset circuit of 8051
- ii) Power down mode in 8051
- iii) AD converter

b) Enlist the microcontroller family and explain architecture of 8051 [10]

**Q2) a) Explain the interrupt structure of 8051 and toggle the LED connected at P1.0 through interrupt pin [15]**

b) Explain the generation of sine wave using 8051. Program expected.[10]

**Q3) a) Write down cross assembler directives used in 8051 [15]**

b) Write note on Queues and Macros [10]

***P.T.O.***

## SECTION - II

- Q4)** a) Discuss interfacing of LCD to 8051. (Circuit diagram & program expected) [15]  
b) Explain BLDC drive operation using 8051 [10]
- Q5)** a) Enlist any five sensors/actuators and their interface with 8051 [15]  
b) Explain different modes of timer in 8051 [10]
- Q6)** a) Explain the 8051 based auto synchronizing unit. [15]  
b) Write short note on DC motor speed control using 8051 [10]



Total No. of Questions : 6]

SEAT No. :

P3828

[Total No. of Pages : 2

[4760] - 257

**M.E. (Electrical) (Power Electronics and Drives)**  
**SPECIAL TOPICS IN POWER ELECTRONICS AND DRIVES**  
**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from section-I and any two questions from section-II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain operation of three phase inverter in 120 degree conduction mode with output voltage and pulses waveform. Explain PWM, SPWM inverter in detail. [15]
- b) How voltage variation is achieved within inverter. Explain different methods. [10]
- Q2)** a) What are the advantages and disadvantages of CSI? Explain current regulated PWM CSI. Draw circuit diagram and output voltage, current waveform. [15]
- b) What are basic types of switching mode regulators? Explain any two in detail. [10]
- Q3)** a) Explain buck converter with output voltage and current waveform. What are advantages and disadvantages of buck regulator? [15]
- b) What are different methods of power factor control explain any two methods in detail. [10]

**P.T.O.**

## SECTION - II

- Q4)** a) What are IEEE standards for power quality? [10]  
b) Show in detail implementation of single phase active filter and associated output. [15]
- Q5)** a) Explain vector control operation of three phase induction motor with block diagram and function of each block. [15]  
b) What is sensor less control of Induction Motor and explain any one control method for control of IM. [10]
- Q6)** a) What is sensor less control of Synchronous Motor? [10]  
b) Describe the design of 1-phase APF with PWM inverter as voltage source controller. [15]



Total No. of Questions : 6]

SEAT No. :

**P4528**

[Total No. of Pages : 2

[4760] - 259

**M.E. (E&TC) (Microwave) (Semester - I)**  
**ELECTROMAGNETICS AND ANTENNA THEORY**  
**(2008 Pattern) (Revised)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

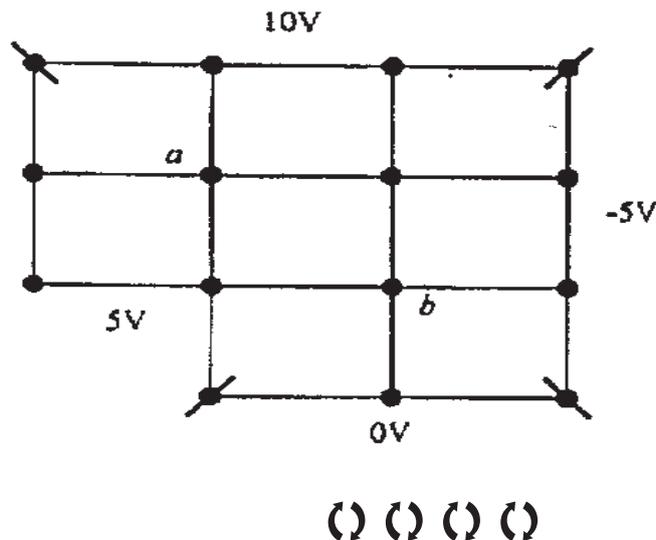
- Q1)** a) Define the following parameters with reference to antenna with relevant diagrams and mathematical expressions **[15]**
- i) Directivity
  - ii) Directive Gain
  - iii) Radiation Resistance
  - iv) Polarization
  - v) Bandwidth and Beam efficiency
- b) Explain the various feeding techniques for microstrip antenna with relevant diagrams and compare all the techniques. **[10]**
- Q2)** a) Derive the field expressions for Hertzian dipole from the current distribution and also state it's all parameters. **[20]**
- b) Write a note on Yagi Uda Antenna, draw its radiation pattern, write its design equations. **[5]**

**P.T.O**

- Q3)** a) Explain the construction and working of Helix Antenna. Derive the expression for axial ratio and circumference. Also explain its various modes. [15]
- b) Write a detailed note on Green's function and its application. [10]

**SECTION - II**

- Q4)** a) Derive the array factor for N-element linear array and sketch the pattern for 10 element linear array for broadside mode. Assume the inter element spacing to be half a wavelength. [15]
- b) Write a detailed note on YEE's FD algorithm. [10]
- Q5)** a) Design a rectangular microstrip antenna using substrate with dielectric constant of 2.5,  $h=0.12\text{cm}$ , so as to resonate at 10GHz. Give the design procedure. [10]
- b) Using MoM, derive the expression for field distribution using integral for potential equations. [10]
- c) What is the advantage of using triangular mask in FEM? [5]
- Q6)** a) What are the various numerical techniques to compute electric and magnetic fields? Explain finite difference method with suitable example. [10]
- b) Find the potentials at points  $a$  and  $b$  for the system shown in following figure using Finite Difference Method. [15]



Total No. of Questions : 8]

SEAT No. :

**P3742**

[Total No. of Pages : 2

[4760] - 26

**M.E. (Civil) (Hydraulics)**

**HYDROINFORMATICS AND SIMULATIONS (Elective - II)**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section. Q. No. 4 of section I and Q. No. 8 of section II are compulsory.*
- 2) *Answer to the two sections should be written in separate answer booklet.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** What are the different techniques used in Hydroinformatics to satisfy the huge water demand in industrial sector without disturbing the available water resource systems? Explain role of internet and web based modeling in the same regards. **[16]**

**Q2)** What is decision support system. Discuss design of decision support system for flood protection including various components. **[16]**

**Q3)** Discuss various methods of simulations. Discuss possible simulation model for predicting inflow-outflow to a reservoir. **[16]**

**Q4) a)** Enlist practical Hydroinformatics tools available in the market and explain one with suitable example. **[8]**

b) Explain the role of government in implementing Decision Support System for the development of water resources systems. **[10]**

**P.T.O.**

**SECTION - II**

- Q5)** What are Artificial Neural Networks. Explain in detail standard back propagation algorithm. Compare back propagation algorithm and cascade correlation algorithm. **[16]**
- Q6)** Discuss the flow chart of Genetic Algorithm. Explain mutation, crossover and reproduction. **[16]**
- Q7)** a) What is the necessity of cross validation in ANN modeling? Explain any method of cross validation in detail. **[8]**  
b) “GA works on the Darwinian Principle of survival of the fittest” Explain. **[8]**
- Q8)** Write short notes on **[18]**
- a) Conjugate Gradient algorithm
  - b) Applications of ANN in rainfall-runoff modeling
  - c) Stopping criteria in GA



Total No. of Questions : 8]

SEAT No. :

**P3956**

[Total No. of Pages :2

**[4760]-260**

**M.E. (E & TC / Electronics)**

**Digital System / VLSI & Embedded Systems / Microwave /  
Communication Network / Signal Processing**

**PRINCIPLES & PRACTICES FOR IT MANAGEMENT  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) What is business ethics? What is required to be done to develop an ethical environment. [8]  
b) State and explain different management principles. [8]
- Q2)** a) Define project goals. Discuss in detail establishing project priorities.[8]  
b) Explain the process of creating Work Breakdown Structure (WBS).[8]
- Q3)** a) Explain situation for revision of project plan and role of project manager. [8]  
b) Explain the process of tracking project progress. [8]
- Q4)** Write short notes on any three: [18]  
a) Planning of an IT project.  
b) Risk Management.  
c) Energy Management and Energy Audit.  
d) Six sigma.

***P.T.O.***

## SECTION - II

- Q5)** a) Elaborate the concept of knowledge management as modern approach to management. [8]  
b) Discuss the applications of IT in Agriculture sector. [8]
- Q6)** a) State the modern approaches to management with reference to supply chain management. [8]  
b) Explain the following terms in details. [8]  
i) CPI  
ii) PND  
iii) TCPI
- Q7)** a) Give the tools and techniques of strategic management. [8]  
b) State and explain various project quality standards. [8]
- Q8)** Write short notes on any three: [18]  
a) IPR & Cyber law.  
b) Employee Welfare.  
c) Customer Relationship and quality control.  
d) Stress management.



Total No. of Questions : 6]

SEAT No. :

**P3829**

**[4760]-261**

[Total No. of Pages : 3

**M.E. (E & TC. Microwave)**  
**RF AND MICROWAVE CIRCUIT DESIGN**  
**(2008 Pattern) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Figures on the right indicate full marks.*
- 3) *Assume suitable data, wherever necessary.*

**SECTION-I**

**Q1) a)** Explain in detail the working of BJT Transistor along with its electronics applications. **[12]**

b) An X band amplifier has a gain of 20dB and a 1 GHz bandwidth. Its noise temperature is to be measured via the Y-factor method. The following data is obtained: **[13]**

$$\text{For } T_1 = 290 \text{ K,} \quad N_1 = -62.0 \text{ dBm}$$

$$\text{For } T_2 = 77 \text{ K,} \quad N_2 = -64.7 \text{ dBm}$$

Determine the equivalent noise temperature of the amplifier. If the amplifier is used with a source having an equivalent noise temperature of  $T_s = 450\text{K}$ , what is the output noise power from the amplifier, in dBm?

**Q2) a)** Describe in detail operating principle of PIN diode along with its equivalent circuit and characteristics. **[13]**

b) Explain with equivalent circuit diagram working of: **[12]**

i) Wilkinson Power divider.

ii) Lange Coupler.

**P.T.O.**

**Q3) a)** Four different load impedances: [12]

i)  $Z_L = 50\Omega$

ii)  $Z_L = 48.5\Omega$

iii)  $Z_L = (75+j25)\Omega$

iv)  $Z_L = (10-j5)\Omega,$

are sequentially connected to a  $50\Omega$  transmission line. Find the reflection coefficients and the SWR circles. Also determine return loss in dB.

b) Describe in detail operating principle of IMPATT diode. [13]

### SECTION-II

**Q4) a)** A two port network is known to have the following scattering matrix: [12]

$$[S] = \begin{bmatrix} 0.15\angle 0^\circ & 0.85\angle -45^\circ \\ 0.85\angle 45^\circ & 0.2\angle 0^\circ \end{bmatrix}$$

Determine if the network is reciprocal and lossless. If port 2 is terminated with a matched load, what is the return loss seen at port 1? If port 2 is terminated with a short circuit, what is the return loss seen at port 1?

b) Explain working of low noise and power GaAs FETs. [13]

**Q5) a)** Design a BJT Colpitts oscillator for 200 MHz in common emitter configuration having bias point of  $V_{ce} = 3V, I_c = 3\text{ mA}$ . Following circuit parameters are given at room temperature of  $25^\circ\text{C}$ .  $C_{BC} = 0.1\text{ fF}$ ,  $r_B = 2\text{ K}\Omega$ ,  $r_{CE} = 10\text{ K}\Omega$ ,  $C_{BE} = 10\text{ fF}$ . If the inductance should not exceed  $L_3 = L = 5\text{ nH}$ , find the values for capacitances in the feedback loop. [13]

b) Explain working of Quartz oscillator along with its equivalent circuit. [12]

**Q6) a)** Explain in details the concept of unilateral design for power amplifiers. **[10]**

b) An RF amplifier has following S-parameters: **[15]**

$S_{11} = 0.3 \angle -70^\circ$ ,  $S_{12} = 0.2 \angle -10^\circ$ ,  $S_{21} = 3.5 \angle 85^\circ$ ,  $S_{22} = 0.4 \angle -45^\circ$ .  
Furthermore, the input side of the amplifier is connected to voltage source with  $V_s = 5V$  and source impedance  $Z_s = 40\Omega$ . The output is utilized to drive an antenna which has an impedance of  $Z_L = 73\Omega$ . Assuming that S-parameters of the amplifier are measured with reference to a  $Z_0 = 50\Omega$  characteristic impedance, find the following quantities:

- i) Transducer gain  $G_T$ , Unilateral transducer gain  $G_{TU}$ , available gain  $G_A$ , operating power gain  $G$  and
- ii) Power delivered to the load  $P_L$ , available power  $P_A$ , and incident power to the amplifier  $P_{inc}$ .



Total No. of Questions : 8]

SEAT No. :

**P3957**

**[4760]-263**

[Total No. of Pages : 2

**M.E. (E & TC) (Microwave)**

**DIGITAL IMAGE PROCESSING AND ANALYSIS**

**(2008 Course) (Semester - I) (Elective - I) (504224)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Explain with block schematic methods of image analysis and image understanding. **[8]**

b) With reference to relation between pixels, explain **[8]**

- i) 4-connectivity
- ii) 8-connectivity
- iii) Mixed connectivity

Explain with suitable example where the concept of connectivity is used in image processing.

**Q2) a)** What is histogram equalization? Explain different types of histogram equalization techniques. **[6]**

b) A three bit image has following gray level distribution. **[10]**

| Gray Level    | $G_0$ | $G_1$ | $G_2$ | $G_3$ | $G_4$ | $G_5$ | $G_6$ | $G_7$ |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|
| No. of Pixels | 400   | 700   | 1350  | 2500  | 3000  | 1500  | 550   | 0     |

Determine gray level distribution for the output image using histogram equalization procedure.

**P.T.O.**

- Q3)** a) Explain the following properties of the 2-D Fourier Transform. [8]
- i) Translation
  - ii) Rotation & scaling
  - iii) Convolution
- b) Discuss in brief about RGB YIQ and HIS models for color images. [8]
- Q4)** a) Explain RGB to HIS conversion? What is its need? [9]
- b) Explain the importance of hysteresis thresholding and nonmaximal suppression in the canny edge detection process. How do these two concepts influence the resulting edge image? [9]

### SECTION - I

- Q5)** a) What is Morphological image processing? Explain Dilation, Erosion, opening and closing operation. [8]
- b) What is Hough transform? Explain how it is used to determine the colinearity of points. [8]
- Q6)** a) Explain with neat block diagram working of 2D transform coding for image compression. Discuss considerations for selecting the sub-image size and 2D transform. [8]
- b) With neat block diagram explain JPEG baseline compression system. [8]
- Q7)** a) What is boundary representation? Explain how chain codes are used for boundary representation. [8]
- b) Explain how B-spline curves can be used for boundary representation. [8]
- Q8)** Write short notes on: [18]
- a) Image restoration techniques.
  - b) Pseudo coloring.
  - c) Wiener filter.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4708**

**[4760] - 264**

[Total No. of Pages :3

**M.E. (E & TC) (Microwave)**  
**COMMUNICATION NETWORKS**  
**(2008 Pattern) (Semester - I) (Elective -I) (504224)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section - I and three questions from Section-II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

**Q1) a)** Explain any four different Network design issues briefly. **[8]**

- b) We are given three system. All have 50% utilizations. All have average message lengths of 1400 bits. The first has exponentially distributed message lengths. The second has constant 1400 bits message length. In the third, half the messages are 400 bits long and the other half are 2400 bits long. **[8]**

Calculate

- i) What is arrival rate A
- ii) the mean service time E(S)
- iii) the waiting time  $T_w$  for first case
- iv) the waiting time  $T_w$  for second case

**Q2) a)** 24 terminals share a 9600 bps line. Each terminal sends an average of 10 msg/min over the line. The message lengths are exponentially distributed with an average length of 2000 bits **[8]**

**P.T.O.**

Calculate

- i) Average time that a message spends in system  $T_s$
  - ii) What is arrival rate  $A$
  - iii) Total time in the system  $T$
  - iv) What is utilization of server  $U$
- b) Explain the following.
- i) Erlang - B function. [4]
  - ii) 802.11 MAC layer. [4]
- Q3)** a) Draw and explain TCP header diagram. [8]
- b) Explain the structure of Network design tool. [4]
  - c) What is concept of CELL in ATM networks? [4]
- Q4)** Write short note on any three. [18]
- a) Frame Relay
  - b) POISSON function
  - c) IPV4 Vs IPV6
  - d) Physical layer of IEEE-802.11.

### SECTION - II

- Q5)** a) Draw and Explain H.323 protocol architecture. [8]
- b) Explain types of real time Interactive Audio/Video communication. [4]
  - c) Write a short note on Videoconferencing. [4]
- Q6)** a) Write a short note on network monitoring tool? [6]
- b) Write a short note on Protocol Analyzer. [6]
  - c) Write a short note on Cryptography model. [4]

**Q7) a)** Compare Public key and private key algorithm with example. **[8]**

b) Write short note on DNS system. **[8]**

**Q8)** Write short note on any three. **[18]**

a) Bluetooth protocol stack

b) PGP and S/MIME

c) SNMP

d) Compare H.323 and SIP in detail.



Total No. of Questions : 10]

SEAT No. :

**P4729**

**[4760] - 265**

[Total No. of Pages : 3

**M.E. (E&TC) (Microwaves)  
SMART ANTENNAS  
(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question Nos. 5 and 6 are compulsory. Out of the remaining attempt 2 questions from section I and 2 questions from section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Describe the key features of Smart antenna and compare it with conventional antenna system in terms of range extension, hole filling and building penetration. [8]
- b) Derive the mathematical framework for array factor of smart antenna as a function of Direction of arrival. [8]
- Q2)** a) Explain the model of the channel between the portable transmitter and base station receiver using Vector Channel Impulse Response (VCIR). [8]
- b) Describe the various implementation aspects of spatial processing receivers. [8]
- Q3)** a) Derive the mathematical model of adaptive antenna system with MMSE approach. [8]
- b) Describe the Fixed beam forming Network and adaptive array processors. [8]

**P.T.O.**

**Q4) a)** Explain the beam selection criterion for different multiple access methods. [8]

b) Describe the structure of wideband adaptive array in terms of spatial and temporal filtering. [8]

**Q5)** Explain the following techniques in terms of software radio: [18]

a) Down conversion.

b) Channelization.

c) In-phase and quadrature signal component extraction.

d) Demodulation.

### **SECTION - II**

**Q6) a)** Describe the structure of coherent combining array receiver and spatial filtering Rake receiver for CDMA. [10]

b) How dynamic re-sectoring is useful for time varying traffic in smart antenna system. [8]

**Q7) a)** Explain the downlink beamforming technique for CDMA. [8]

b) Justify, mathematically, the range extension in CDMA using smart antenna. [8]

**Q8) a)** Illustrate how directional base station antennas can improve the reverse link in a single cell CDMA system. [8]

b) Investigate the CDMA system capacity improvement by using smart antennas on the reverse link in multi-cell CDMA systems. [8]

**Q9) a)** Describe the effect of spatial filtering on reverse channel at the subscriber unit in detail. [8]

b) Explain the importance of smart antennas and directional antennas in increasing the cell to cell isolation at subscriber unit. [8]

**Q10)** Apply vector based approach to analyze the capacity improvement in CDMA system using smart antennas. [16]



Total No. of Questions : 8]

SEAT No. :

**P3830**

[Total No. of Pages : 2

[4760] - 266

**M.E. (Electronics and Telecommunication)**

**MICROWAVE ENGINEERING**

**Speech Processing And Application**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each Section.*
- 2) *Right hand side figures indicated marks.*
- 3) *Assume data necessary.*

**SECTION - I**

- Q1)** a) Explain the importance of preprocessing of speech signal? [8]  
b) Write a short note on spectral analysis of speech signal? [8]
- Q2)** a) What is speech coding? Why speech coding is necessary? [8]  
b) What are the different speech digitization techniques? Explain it? [8]
- Q3)** a) What is Linear Predictive Coefficient (LPC)? Explain Levinson Durbin algorithm? [10]  
b) What are the different methods of pitch estimation? Explain in brief any one Method of pitch estimation? [6]
- Q4)** a) What is filter bank processing of speech signal? Explain it? [10]  
b) What are the issues to be considered in development of speech and speaker recognition systems? [8]

**SECTION - II**

- Q5)** a) What is speech enhancement? What are the quality measures of speech enhancement? [8]  
b) Write a short note on Spectral subtraction method of Speech enhancement? [8]

**P.T.O.**

- Q6)** a) What is Hidden Markov Model (HMM)? What are three problems in HMM implementation? [8]  
b) Explain role of Neural Network is used in speech processing? [8]
- Q7)** a) How dynamic programming based on speech recognition application?[10]  
b) What are spectrum distance measures for speech recognition? [6]
- Q8)** a) Explain Hardware and Software required for speech processing? [8]  
b) What is MFCC? Explain cepstrum analysis of speech signal? How it can be used to calculate source/excitation and Vocal tract characteristic. [10]



Total No. of Questions : 8]

SEAT No. :

**P3831**

[Total No. of Pages : 2

[4760] - 267

**M.E. (E&TC) (Microwave)**

**SEMICONDUCTOR DEVICES MODELLING AND TECHNOLOGY**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Draw and explain basic structure of pn junction. Also mention the effect of zero bias, forward bias and reverse bias with respect to the parameters of space charge region and capacitance effects. [8]
- b) What is meant by Schottky barrier? Compare Schottky barrier diode with p-n junction diode. [8]
- Q2)** a) Explain basic operation of MOSFET. With reference to Voltage transfer Curve, explain various regions of operation of MOSFET. [8]
- b) Explain threshold voltage and its significance. Also mention the impact on corresponding parameters with respect to mathematical formula. Describe substrate bias effects on threshold voltage. [8]
- Q3)** a) Define and explain junction capacitance model with reference to p-n junction. [8]
- b) Draw and explain minority carrier distribution and basic currents in forward biased n-p-n bipolar transistors. [8]
- Q4)** Write short notes on any three: [18]
- a) Ideal MOS capacitor.
  - b) Frequency limitations of transistors.
  - c) Rectifying and ohmic contacts
  - d) High -frequency and high speed issues

**P.T.O.**

## SECTION - II

- Q5)** a) Explain, why the ratio of  $\beta_n/\beta_p$  should be equal to one, for the CMOS Inverter? Draw the Transfer characteristic of CMOS Inverter. [8]  
b) What is Technology Scaling? Explain three ways of scaling the devices. Explore each in brief. [8]
- Q6)** a) What is SPICE? List SPICE model parameters of MOSFET. How are these useful in design? [8]  
b) Explain with neat diagrams, CMOS layout design rules with respect to maximum and minimum size spacing for [8]  
i) n-well  
ii) poly  
iii) metal  
iv) active area
- Q7)** a) Explain in detail the CMOS fabrication process steps used in integrated circuit designs. [8]  
b) Explain SPICE models of p-n diode and BJT. List SPICE model parameters. How are these useful in design? [8]
- Q8)** Write short notes on any three: [18]  
a) CMOS parasitic  
b)  $\lambda$  Parameter and layout design rules.  
c) Bi-CMOS inverter  
d) Diffusion and ion implantation



Total No. of Questions : 6]

SEAT No. :

P4541

[Total No. of Pages : 2

[4760]-268

M.E. (E & TC) (Microwave)

MICROWAVE INTEGRATED CIRCUITS

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Solve any two questions of each section.
- 2) Draw diagram wherever necessary.
- 3) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) What are the methods of MIC synthesis. Discuss any one of them. [15]  
b) Design a microstrip line for  $100\Omega$  characteristic impedance the substrate thickness is 0.138 cm with  $\epsilon_r = 2$ . What is the guide wavelength of this x-line, if operating frequency is 3 GHz. [10]
- Q2)** a) What are microwave discontinuities? Discuss in detail. [12]  
b) Calculate the various parameters for the design of coplanar transmission lines at 100 MHz. [13]
- Q3)** a) Explain, discuss & compare hybrid & monolithic microwave integrated circuits. [13]  
b) Describe the technological steps involved in the fabrication of hybrid ICs. [12]

**SECTION - II**

- Q4)** a) Explain in detail the technique involved in the measurement of noise in MIC circuits. [13]  
b) Explain uncertainty & confidence in measurement. [12]

**P.T.O.**

- Q5)** a) Explain in brief power splitter, coupler & reflector meter. [12]  
b) Explain power measurement technique. [13]
- Q6)** Write notes on applications of MICs to [25]  
a) Radio System.  
b) Satellite Communication.  
c) Broadcast System.  
d) Future trends in MICs.



Total No. of Questions : 8]

SEAT No. :

**P4573**

[4760] - 269

[Total No. of Pages : 3

**M.E. (E & TC ) (Microwave)**

**SIGNAL PROCESSING FOR WIRELESS  
COMMUNICATION  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if required.*
- 5) *Use of scientific calculator is allowed.*

**SECTION - I**

- Q1) a)** Explain the following distribution function with the help of equations and sketches. **[8]**
- i) Gaussian distribution
  - ii) Poisson distribution
  - iii) Uniform distribution
- b) Explain the terms likelihood and sufficiency. **[4]**
- c) Explain Gauss Markov model. **[4]**
- Q2) a)** Explain the term hypothesis testing. Explain the difference between null hypothesis and alternate hypothesis. **[6]**
- b) Explain Bayes detection and derive the expression for Likelihood ratio for the same. **[10]**

***P.T.O.***

- Q3)** a) Derive the expression for threshold for the correlation receiver used for binary decision problem. Draw the structure for the same. [10]  
b) Explain what do you mean by the term intersymbol interference. [6]

- Q4)** a) Explain the term noise and the different type of noise that occurs in communication system. [8]  
b) Draw the receiver structure of colored noise and derive the related mathematical equations. [10]

### **SECTION - II**

- Q5)** a) Explain the basic concept of adaptive filter with the help of block diagram. [6]  
b) Explain any two applications of adaptive filters with the help of neat diagrams. [6]  
c) Explain the basic concept of RLS algorithm. [4]

- Q6)** a) Explain the term power spectrum estimation (PSE). [4]  
b) Explain the periodogram method of Power spectrum estimation. [6]  
c) Explain Welch method of PSE. [6]

- Q7)** a) Explain spread spectrum communication in detail. [8]  
b) Explain the basic concept of matched filter along with the required expression. [8]

**Q8)** Write short notes on any three:

**[18]**

- a) Adaptive equalizers
- b) Kalman filters
- c) LMS algorithm
- d) Performance of digital communication systems.



Total No. of Questions : 6]

**P3743**

SEAT No. :

[Total No. of Pages : 2

[4760] - 27

**M.E. (Civil / Hydraulics)**

**HYDROPOWER**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) 'Majority of untapped hydropower potential lies in Brahmaputra basin', discuss causes and remedies. **[8 + 4 = 12]**
- b) Write a short note on: **[8]**
- i) Black out
  - ii) Brown out
- c) Why hydropower is considered to be clean and cheap source of power generation. **[5]**
- Q2)** a) State and explain various components of storage power plant. **[10]**
- b) Write a detailed note on pumped storage plant. **[10]**
- c) Briefly discuss about Tidal power plant. **[5]**
- Q3)** a) With the help of neat sketch explain water conductor system. **[12]**
- b) Write a short note on
- i) Problems faced during construction of WR project. **[5]**
  - ii) Briefly explain compact powerhouse. **[8]**

**P.T.O.**

## SECTION - II

- Q4)** a) Write a note on hydraulic design of penstock and explain 'Economic Diameter of a Penstock'. [5 + 5 = 10]  
b) Briefly explain different types of surge tanks. [5]  
c) Determine discharge through a cast iron pipe 20 cm diameter having 2 cm wall thickness. Also calculate the rise in pressure if valve at the end is suddenly closed. The stress in the pipe is not to exceed  $2 \times 10^6 \text{ N/m}^2$ . Assume  $E_s = 130 \times 10^8 \text{ N/m}^2$  and  $K = 200 \times 10^6 \text{ N/m}^2$ . [10]
- Q5)** a) A power plant with 3 units of 60,000 kW output run under a head of 100 m at 100 r.p.m. with 90% efficiency. A model of the turbine is tested on a flume of 0.3 cumec under a head of 5 m. Compute scale ratio of the model, its speed and power. [8]  
b) Derive the equation for suction head developed due to provision of draft tube. [10]  
c) Describe governing of reaction turbine with neat sketch. [7]
- Q6)** a) Explain micro hydro development on canals. [15]  
b) Compare between economics of micro hydro and storage power plant. [10]



Total No. of Questions : 8]

SEAT No. :

**P4331**

**[4760] - 270**

[Total No. of Pages :2

**M.E. (E & TC) (Microwave)  
MOBILE COMMUNICATION GSM AND CDMA  
(2008 Course) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) State the features of Code division multiple access (CDMA). Compare CDMA with FDMA and TDMA. [8]
- b) Find the Fraunhofer distance for an antenna with maximum dimension of 1 m and operating frequency of 900 MHz. If antennas have unity gain, calculate the path loss. [4]
- c) Explain the concept of frequency use in cellular communication. Explain the benefits of this approach with example. [6]
- Q2)** a) Explain the following in brief: [8]
- i) Cell splitting
  - ii) Microcell zone concept
- b) Draw and explain frame hierarchy in GSM. [8]
- Q3)** a) Write short note on Channel planning in wireless system. [8]
- b) Derive the Erlang C formula to determine the delayed probability. [8]
- Q4)** Write a short note on: [16]
- a) GSM standard and architecture.
  - b) EDGE.

*P.T.O.*

## SECTION - II

- Q5)** a) State and explain types of small scale fading. [8]  
b) Explain MSK modulation technique and compare Power Spectral Density of MSK signals to QPSK signals. [10]
- Q6)** a) State and explain the four categories of space diversity reception methods in brief. [8]  
b) Write a short note on CDMA - 2000. [8]
- Q7)** a) Explain frequency and channel specifications of IS-95. [8]  
b) Explain the following term: [8]  
i) Power control  
ii) Soft hand off
- Q8)** Write a note on: [16]  
a) Algorithms for Adaptive equalization.  
b) RAKE Receiver.



Total No. of Questions : 8]

SEAT No. :

**P4747**

[Total No. of Pages : 2

[4760] - 271

**M.E. (E & TC) (Microwave)  
FIBER OPTIC COMMUNICATION  
(2008 Pattern) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Q.1 and Q.5 are compulsory solve any two questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is pulse spreading? Discuss any one the reason for the occurrence of pulse spreading. Also suggest the mechanism to reduce the same. [10]  
b) Explain any two fabrication techniques of fiber. [8]
- Q2)** a) Explain polarization mode dispersion in fibers. [8]  
b) Explain temperature effect on gain of avalanche photodiode. [8]
- Q3)** a) Explain various noise sources and disturbances associated with errors in the signal detection system in fiber. [8]  
b) A graded index fiber with a parabolic refractive index profile core has a refractive index at the core axis of 1.5 and refractive index difference of 1% Estimate the maximum possible core diameter which allows single mode operation at wavelength of 1.55  $\mu\text{m}$ . [8]
- Q4)** a) Explain the term critical bend radius with reference to optical fibers. Estimate the critical bend radius of curvature at which large bending losses would occur for a 62.5/125 $\mu\text{m}$  MMSE fiber with core refractive index of 1.5 relative refractive index difference  $\Delta = 3\%$  and operating wavelength of 820 nm. [8]  
b) Draw and explain the schematic of optical receiver. [8]

**P.T.O.**

## SECTION - II

- Q5)** Explain the following terms with respect to attenuation of the signal in fiber :[18]
- a) bending losses
  - b) scattering losses
  - c) core and cladding losses
- Q6)** a) Explain in detail the concept of WDM. [8]  
b) Explain OTDR and how to locate a fault in fiber using OTDR. [8]
- Q7)** a) What is mean by link power budget? How to calculate the required length of Fiber if rest parameters are given? [8]  
b) Explain Raman Optical Amplifier [8]
- Q8)** Write short notes on : [16]
- a) Semiconductor optical Amplifiers
  - b) Noise in optical amplifiers



Total No. of Questions : 8]

SEAT No. :

**P4725**

[Total No. of Pages : 2

[4760] - 272

**M.E. (E&TC) (Microwave)  
SYSTEM DESIGN  
(2008 Pattern) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Q. 1 & Q. 5 are compulsory.*
- 2) *Solve any two questions from Q. 2, Q. 3 & Q. 4 for Section I.*
- 3) *Solve any two questions from Q. 6, Q. 7 & Q. 8 for Section II.*
- 4) *Answers to the two sections must be written in separate sheets,*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Figures to the right indicate full marks.*
- 7) *Assume suitable data; if necessary.*

**SECTION - I**

- Q1)** a) Explain the basic building blocks of an system hardware design. [8]  
b) With neat diagram explain hierarchical design using top-down and bottom-up methodology. [10]
- Q2)** a) Enlist various system partitioning techniques. Explain any one in detail. [8]  
b) Explain the interfacing between system components. [8]
- Q3)** a) Comment on synchronous and asynchronous design styles. [8]  
b) Explain the concept of metastability and what are the techniques for handling it. [8]
- Q4)** Write short notes on: [16]  
a) Interfacing of Linear & Digital systems  
b) Data conversion circuits  
c) Finite State Machines  
d) Data flow graphs

**P.T.O.**

**SECTION - II**

- Q5)** a) Comment on various techniques for power efficiency. [8]  
b) Explain various analog and digital modulation schemes for RF circuits. [10]
- Q6)** a) Explain with neat diagram coherent and non-coherent detection. [8]  
b) Comment on the behavior of BJT and MOSFET at RF frequencies. [8]
- Q7)** a) Explain various steps for mixer design at high frequencies. [8]  
b) Comment on various design issues in integrated RF filters. [8]
- Q8)** Write short notes on: [16]  
a) Power Supply Decoupling  
b) Border Scan  
c) Basic blocks of RF system  
d) Critical Path analysis



Total No. of Questions : 8]

SEAT No. :

**P4332**

**[4760] - 273**

[Total No. of Pages :2

**M.E. (E& TC) (Microwave)  
EMI & EMC TECHNIQUES  
(2008 Course) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section I and three questions from section II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of Electronic pocket calculator is allowed.*

**SECTION - I**

- Q1)** a) Explain different sources of uncertainty in RF and microwave measurement. [8]  
b) Derive scattering parameters for two port network device. [8]
- Q2)** a) Explain the basic principles and method for attenuation measurements. [8]  
b) Discuss various types of noise and noise sources. [8]
- Q3)** a) Explain Detector linearity tests for attenuation. [8]  
b) Explain the significance of Noise Figure and Noise Temperature for Microwave System with necessary mathematical expressions. [8]
- Q4)** Write notes on: [18]  
a) Calibration procedure for RF milli volt meter  
b) Vector Volt meter  
c) Vector Network Analyzer.

**P.T.O.**

## SECTION - II

- Q5)** a) Explain how Spectrum Analyzer can be used to analyze AM & FM waveforms? [8]  
b) Explain the operation of Noise figure Analyzer. [8]
- Q6)** a) Discuss, how total power Radiometer can be used to measure the noise? [8]  
b) Explain how to calibrate a waveguide power sensor using two couplers? [8]
- Q7)** a) Discuss in brief various methods of sensing and measuring the average power at RF and Microwave frequencies. [8]  
b) Discuss calibration techniques and standards for RF power measurements. [8]
- Q8)** Write notes on: [18]  
a) Calorimeter,  
b) Power splitters  
c) RF Reflectometer



Total No. of Questions : 6]

SEAT No. :

**P3958**

[Total No. of Pages : 2

**[4760] - 277**

**M.E. (E&TC) Microwave  
SOFTWARE PROJECT MANAGEMENT  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Attempt any two questions from section I and any two from section II.*
- 2) *Figures to right indicate full marks.*
- 3) *Use separate answer sheet for both section.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data wherever necessary.*

**SECTION - I**

- Q1)** a) Explain brain storming technique for problem solving, team building and creative process. **[8]**
- b) Draw an Activity Network using either Activity on Node or Activity-on -Arrow network conventions for each of the following projects:**[9]**
- i) Choosing and purchasing desktop computer.
  - ii) Travel from Pune to Delhi.
  - iii) Planning get-together of old school friends.
- c) What is risk? What are different categories of risks with risk management model? What are different tools and techniques for identifying and assessing risks and response planning? **[8]**
- Q2)** a) What is Project Management? Write five goals of project. What is role of Project Manager in Project Management? **[13]**
- b) Explain following : **[12]**
- i) Cost Estimation.
  - ii) Quality planning.
  - iii) PERT Chart.

**P.T.O.**

- Q3)** Write short notes on any Four : **[25]**
- a) Project Management Activities.
  - b) Tracking Project Progress.
  - c) Software Project Teams.
  - d) Work Breakdown Structure.
  - e) Types of cost estimates.

**SECTION - II**

- Q4)** a) Explain categories of data function types. Also explain rules for identification. **[12]**
- b) Explain how project performance can be improved using qualitative analysis. **[13]**
- Q5)** a) Enlist and explain fourteen general system characteristics used as basis in the calculation of value adjustment factor. **[16]**
- b) Explain aspects helping in designing critical platform for success story of projects. **[9]**
- Q6)** Explain any four from following : **[25]**
- a) General System Characteristics.
  - b) Project Procurement management.
  - c) Project Control in Project Management.
  - d) Return on investment.
  - e) Assessing Project Viability.



Total No. of Questions : 8]

SEAT No. :

P4741

[Total No. of Pages : 2

[4760]-278

**M.E. (E&TC) (Semester - II)**  
**DIGITAL SIGNAL COMPRESSION**  
**(2008 Pattern) (Open Elective - IV)**

*[Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answers any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is Linear Predictive Coding (LPC)? How LPC is used in speech coding? [8]
- b) Draw the block diagram of Lossy Predictive Coding System & explain. [8]
- Q2)** a) Explain CLEP model of Speech Processing. [8]
- b) What is adaptive quantization? How step size will adaptively changed by tracking the statistics of signal? How to select optimal delta? [8]
- Q3)** a) Explain Huffman coding procedure for constructing optima? Explain with code. [8]
- b) What is MIDI? How this is used in digital music synthesis? [8]

**P.T.O.**

- Q4)** a) Explain discrete cosine transform and its properties. How the image compression is achieved by coding of DCT coefficients. [9]
- b) What is Vector Quantization (VQ)? How image or signal is compressed using VQ? What are the advantages and disadvantages of VQ? [9]

## **SECTION - II**

- Q5)** a) Explain H.264 code with block diagram. [8]
- b) What is fractal? Explain encoding process of image compression based on the fractals [8]
- Q6)** a) Explain block diagram of Video Coding Layer (VCL) for motion estimation & compression. [8]
- b) Explain an algorithm to generate bit stream EZW coder. [8]
- Q7)** a) Explain with the help of diagram motion compensated video compression. [8]
- b) Explain sub-band coding of speech. How sub-band coding will be advantageous? [8]
- Q8)** a) List various key functions of MPEG-4 standard. Explain perceptual coding in MPEG audio. [9]
- b) Explain image encoding & decoding system based on WAVELET transform. [9]



Total No. of Questions : 8]

SEAT No. :

**P3832**

[Total No. of Pages : 2

[4760] - 279

**M.E. (E & T/C) (VLSI & Embedded Systems)**

**ANALOG AND DIGITAL CMOS IC DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Use of electronics calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Where and how MOSFET is used as diode/active resistor? [8]  
b) Use self biased high swing cascade current sink configuration to design a current sink of  $250\mu\text{A}$  and a  $V_{\min}$  of 0.5V. Assume suitable data. [8]
- Q2)** a) Explain in detail the concept of BGR with its necessity. [8]  
b) On which principle Current mirrors are based? Explain in short non-ideal effect of current mirrors. What is use of Current mirror? [8]
- Q3)** a) What is design technique for low noise Op-amp? Explain with the help of necessary expression. [8]  
b) Sketch an equivalent model of MOSFET. Explain how to use it as switch. Give the expression for drain current and ON resistance. [8]
- Q4)** Write Short Notes on any Three : [18]  
a) Current and Voltage references  
b) Current amplifiers  
c) Micropower Op-amp  
d) Current Sink and Source

***P.T.O.***

## SECTION - II

- Q5)** a) Explain CMOS NORA logic dynamic digital topology in detail. [8]  
b) Explain metastability problem in digital design. How designers can avoid it? [8]
- Q6)** a) What is  $\lambda$  parameter? Explain CMOS layout rules. [8]  
b) Design a Lift controller for 4 floor building. Assume standard specifications. Draw the minimized state diagram. [8]
- Q7)** a) What is transmission gate? State its advantages and disadvantages for realizations of logical functions. Realize 4:1 Multiplexer using Transmission Gate. [8]  
b) Define PDP and EDP. Derive the expressions for static and dynamic dissipations. [8]
- Q8)** Write short notes on any Three : [18]  
a) Domino Logic.  
b) Technology Scaling and its effects.  
c) Stick Diagram and CMOS Layout  
d) Sources and elimination techniques of hazards.  
e) MOSFET Models.



Total No. of Questions : 8]

SEAT No. :

P3744

[Total No. of Pages : 3

[4760]-28

M.E. (Civil) (Hydraulics & Engg.)  
**OPEN CHANNEL HYDRAULICS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answer any three questions from section one and three questions from section two.*
- 3) *Answer to the two sections should be written in separate answer booklet.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Your answer will be valued as a whole.*
- 7) *Use of electronic pocket calculator is allowed.*
- 8) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** a) A trapezoidal channel 5 m wide and having a side slope of 1.5 horizontal to 1 vertical is laid on a slope of 0.00035. The roughness coefficient  $n=0.015$ . Find the normal depth for a discharge of  $20 \text{ m}^3/\text{s}$  through this channel. **[8]**

b) The velocity of an open channel is given by  $\frac{V}{V_{\max}} = \left(\frac{y}{D}\right)^{1/4}$

Where 'V' is the velocity at distance 'y' from the bed of channel &  $V_{\max}$  is the velocity at the free liquid surface, distance 'D' above the bed.

Determine  $\alpha$  and  $\beta$ .

**[8]**

**P.T.O.**

- Q2)** a) Derive equation to estimate sequent depth ratio for hydraulic jump occurring on sloping floor. [8]
- b) An overflow spillway has its crest at elevation 125.4m and a horizontal apron at an elevation of 95m on the downstream side. Find the tail water elevation required to form hydraulics jump when the elevation of energy line is 127.9m. The  $C_d$  for the flow can be assumed as 0.735. The energy loss for the flow over the spillway face can be neglected. [8]
- Q3)** a) A rectangular channel 20 m wide flow with normal depth of 2.1 m with a slope of bed 1 in 6400. At a certain section, the flow depth is 2.9 m. How far upstream or downstream of this section will the depth be 2.5 m. Use step method and take only two steps. Take Manning's coefficient = 0 .015. sketch & mention the profile. [8]
- b) Explain  $M_3$ ,  $S_2$  and  $H_3$  profile with a neat sketch. [8]
- Q4)** Write short notes on (any three) : [18]
- a) V. T. Chow's method of direct integration.
- b) Types of hydraulic jump.
- c) Parameters on which Manning's 'n' depends.
- d) Types of channel slopes.

### SECTION - II

- Q5)** a) Derive dynamic equation for spatially varied flow with increasing discharge. [8]
- b) What is a side weir? Explain with the help of definition sketch. Explain any one type of side weir. [8]
- Q6)** a) Distinguish between [4]
- i) Hydraulic and Hydrologic method of flood routing.
- ii) Prism storage and wedge storage.
- b) Route the following flood through a reach for which  $K= 22$  h and  $x = 0.25$ . Plot the inflow and outflow hydrographs and determine the peak lag and attenuation. At  $t = 0$  the outflow discharge is  $40 \text{ m}^3/\text{s}$ . [12]

**Q7)** a) Derive dynamic equation for gradually varied unsteady flow (Saint Venant's equation). [8]

b) A rectangular channel carries water at a depth of 2 m and a velocity of 1.5 m/s. Sudden opening of gate at its upstream causes surge of depth 3.5.

Determine absolute velocity of surge and increased discharge. [8]

**Q8)** Write short notes on (any four) : [18]

a) Classification of SVF profiles.

b) Method of characteristics.

c) Types of rapidly varied unsteady flow.

d) Solitary wave.



Total No. of Questions : 8]

SEAT No. :

**P3833**

**[4760]-280**

[Total No. of Pages : 2

**M.E. (E & TC) (VLSI Embedded System)**

**EMBEDDED SYSTEM DESIGN**

**(2008 Course) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a)** Explain in brief design matrix of embedded system. **[8]**

b) State different cache mapping techniques and explain any one in detail. **[8]**

**Q2) a)** Explain the following integrated circuit technologies which are used in embedded system and compare them. **[8]**

i) ASICS.

ii) CPLDs.

iii) FPGA.

b) Compare ARM7 & ARM9 processors. Explain in details pipeline used in both processors. **[8]**

**Q3) a)** Explain CAN bus protocol used for Communication. List out its features. **[8]**

b) Differentiate memory mapped I/O & standard I/O. **[4]**

c) State the different buses used in ARM processes & their functions. **[4]**

***P.T.O.***

**Q4)** Write short note on Any Three: **[18]**

- a) 12C protocol.
- b) IEEE 80.2.11 protocol.
- c) Power optimization in embedded system.
- d) Design productivity gap.

**SECTION-II**

**Q5)** a) Explain different modes of ARM7 processors. **[8]**

b) Explain following instruction of ARM7. **[8]**

- i) RSBLES r4 r5,#5.
- ii) BICEQ r2,r3,#7.
- iii) LDR r2,[r1].
- iv) LDMFD SP!,{r0-r12,pc}.

**Q6)** a) Draw & explain design flow of embedded system. **[8]**

b) Draw & explain 'V' model used in embedded system development. **[8]**

**Q7)** a) Explain the software architecture of embedded system. **[8]**

b) Differentiate general purpose, application specific & single purpose processors. **[8]**

**Q8)** a) Explain the necessity of code optimization in embedded system design. Explain any two methods to achieve it. **[10]**

b) Explain the function of timers, counters and watchdog timers. **[8]**



Total No. of Questions : 6]

SEAT No. :

**P3959**

**[4760]-281**

[Total No. of Pages : 2

**M.E. (E & TC) (VLSI & Embedded System)**

**ASIC DESIGN AND MODELING**

**(2008 Course) (Semester - I) (Elective - I) (504184)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Assume suitable data if necessary.*
- 3) *All questions are compulsory.*

**SECTION - I**

- Q1)** a) With neat diagram, explain the working of ASIC design flow. [8]
- b) Write a short note on modeling combinational and sequential circuits.[10]
- Q2)** a) List verification issues. Explain in detail the working of hardware and software design verification. [8]
- b) Explain with neat diagram, hardware modeling with VHDL. Give one example in detail. [8]
- Q3)** a) Write a brief note on verification strategy of complex logic design model. [8]
- b) Classify and explain in brief different ASIC construction. [8]

**SECTION - II**

- Q4)** Write a short note on [18]
- a) Static timing analysis.
- b) Clock Tree synthesis.

***P.T.O.***

- Q5)** a) List different objectives of physical verification. [8]
- b) What are different goal of system partitioning explain one algorithm in detail. [8]
- Q6)** a) With neat example, explain stick diagram by using CMOS for various combination. [8]
- b) List out features of tools used for front to back end chip design. [8]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3834**

**[4760] -282**

[Total No. of Pages :2

**M.E. (E & TC) (VLSI & Embedded System)  
NANOTECHNOLOGY  
(2008 Course) (Elective - I) (Semester- I) (504184)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Figures on right indicate marks.*

**SECTION - I**

- Q1)** a) “Biosystems is nothing but complex nanosystems”, Justify the statement. [8]  
b) What is the role of Molecular Recognition in nanotechnology? [8]
- Q2)** a) Are the tools required for nanotechnology is different? If yes justify. [8]  
b) Enlist the tools for measurement of nanostructures. [8]
- Q3)** a) Write useful properties of CNT. [8]  
b) How CNT is useful for medical applications? [8]
- Q4)** Write short note on. [18]  
a) Self healing structure  
b) Electronic nose  
c) Role of smart nanosensors in modern era?

**P.T.O.**

## SECTION - II

- Q5)** a) Compare NEMS & MEMS. [8]  
b) Explain advantages & disadvantages of optical beam lithography over e-beam lithography. [8]
- Q6)** a) Explain Dip pen lithography with suitable diagram. [8]  
b) Classify carbon nanotubes. [8]
- Q7)** a) How nanotechnology will help doctors for diagnosis? [8]  
b) Is it possible to make nano devices? Explain it with suitable example. [8]
- Q8)** Write short note on [18]  
a) Soft lithography  
b) Lithography using photon  
c) Atomic force microscopy



Total No. of Questions : 8]

SEAT No. :

**P4333**

**[4760]-283**

[Total No. of Pages : 2

**M.E. (E & TC) (VLSI and Embedded Systems)**  
**MACHINE INTELLIGENCE**  
**(2008 Course) (Elective-I) (Semester-I) (504184)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain Soft computing and artificial intelligence. What is derivative free optimization? [8]
- b) What are fuzzy relations? Explain the operation on the fuzzy relations? [8]
- Q2)** a) Explain the following. Use mathematical equation and diagram wherever required. [8]
- i) Triangular and Gaussian MF.
  - ii) Cylindrical extension of one dimensional fuzzy set.
  - iii) Max-min composition.
  - iv) Extension principal.
- b) What is genetic algorithm? Describe major components of genetic algorithms? [8]
- Q3)** a) What is the fuzzy set and how does it difference from crisp set? Explain minimum and maximum operation on fuzzy sets? [8]
- b) Compare and contrast the fuzzy inference techniques of Mamdani, sugeno and Tsukamoto. [8]

***P.T.O.***

**Q4)** Write a short note on (Any Three): **[18]**

- a) Fuzzy filtered neural networks.
- b) Derivative based optimization.
- c) Learning from reinforcement.
- d) Fuzzy if then rules and fuzzy reasoning.

### **SECTION-II**

**Q5)** a) Identify supervised and unsupervised basic learning laws. Compare LMS, Perceptron and delta learning laws? **[8]**

b) What is meant by each of the following? **[8]**

- i) Transient State.
- ii) Steady state.
- iii) Equilibrium state.
- iv) Stable state.

**Q6)** a) Why back propagation learning is also called generalized delta rule? What is significance of momentum term in back propagation learning? **[8]**

b) What is the Hopfield model of neural network? Explain the differences between discrete and continuous Hopfield models in terms of energy landscape and stable states. **[8]**

**Q7)** a) Describe Boltzmann machine? What is the basis for Boltzmann learning law? **[8]**

b) Explain the learning process in Radial Basic function network. **[8]**

**Q8)** Write a short note on (Any Three): **[18]**

- a) LVQ.
- b) Competitive learning.
- c) Principal component networks.
- d) Advanced Neuro fuzzy modeling.



Total No. of Questions : 8]

SEAT No. :

P3835

[Total No. of Pages : 2

[4760] - 284

**M.E. (E&TC)( VLSI & Embedded Systems)**

**RECONFIGURABLE COMPUTING**

**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer three questions from section-I and three questions from section-II*
- 2) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain fixed function, programmable and configurable devices with suitable examples. **[8]**  
b) Explain issues in general purpose computing. **[8]**
- Q2)** a) Define **[8]**  
i) Functional Density  
ii) Regular computing tasks  
iii) Granularity  
iv) Data Density  
b) “The basic idea of configurable array computation has been around as long as the ideas for programmable processors. But programmable processors become the mainstream of general- purpose processing while “reconfigurable computing” is only now emerging as a competitive,general-purpose computing technology” Explain Why? **[10]**
- Q3)** What is “Peak Performance Density” in RP space model? Explain why the capacity over the time is consistent in processors and has increased for memories. **[16]**
- Q4)** a) Give the first order comparison of area occupied by different blocks on FPGA. What is conclusion? **[8]**  
b) Write a note on “Multicontext FPGA” **[8]**

**P.T.O.**

## SECTION - II

- Q5)** a) List the shortcomings of following simple networks when required to scale for FPGAs. [8]
- i) Crossbar,
  - ii) Multistage,
  - iii) Mesh
- b) Explain wire growth in Rent's hierarchy model. [8]
- 
- Q6)** a) Explain need of instruction compression and suitable methods to achieve the same. [8]
- b) Explain RP area space model. [8]
- 
- Q7)** What is task switching? What is innovative in TSFPGA? Explain the architectural blocks of TSFPGA in detail. What are its merits and limitations? [16]
- 
- Q8)** Write Short Notes on any three: [18]
- a) Conventional interconnect in FPGA
  - b) Dynamic vs. Static Reconfiguration
  - c) Rent's rule
  - d) DPGA



Total No. of Questions : 8]

SEAT No. :

P3836

[Total No. of Pages : 2

[4760] - 285

**M.E. (E&TC)( VLSI & Embedded System)**

**MEMORY TECHNOLOGIES**

**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer three questions from each section.*
- 2) Answer to the two sections should be written on separate answer books.*
- 3) Neat diagram must be drawn wherever necessary.*
- 4) Figures to right indicates full marks.*
- 5) Assume suitable data if required.*

**SECTION - I**

- Q1)** a) What are the advantages and disadvantages of SRAM? [8]  
b) What do mean by Dual-port SRAMs? What are its application and features? Draw typical dual-port RAM cell. [9]
- Q2)** a) What is the role of sense amplifier in semiconductor memory? Draw typical circuit for sense amplifier. What are the improvements which are required in sense amplifier for improving performance of DRAM? [9]  
b) What are the advantages of STC? What are the different types of structure of STC? [8]
- Q3)** a) Explain the principle of operation of floating gate transistor. How to use this for storing the information? [8]  
b) Explain is the concept of shadowed RAM? Write utility of such RAM. [8]
- Q4)** a) Is fault diagnosis in semiconductor memory is essential? Enlist the faults of occurs in RAM. [8]  
b) How Embedded DRAM faults Modelling and Testing is carried out? [8]

***P.T.O.***

## SECTION - II

- Q5)** a) Draw typical bathtub curve for semiconductor memory and explain its significance. [8]  
b) Explain assembly and packaging related failures in short. [8]
- Q6)** a) Discuss reliability issues of Flash memory. [8]  
b) What is radiation hardening? How it help in improving the performance of semiconductor memories? [8]
- Q7)** a) What is FRAM? Write advantage and disadvantages of FRAM? Where this FRAM's are used? [8]  
b) Explain principle of analog memory. Enlist applications of same. [8]
- Q8)** Write short note on (any three) [18]  
a) High Density Memory Packaging Technologies  
b) SD card  
c) Lifespan and care tips for memory cards  
d) Tablet PC



Total No. of Questions : 8]

SEAT No. :

**P3960**

**[4760] - 286**

[Total No. of Pages : 2

**M.E. (E & TC) VLSI & Embedded Systems**

**VLSI EDA TOOLS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** What is meant by stick diagram? Explain with the help of suitable example. **[8]**

b) What is meant by antenna problems? What are the rules and precautions taken? **[8]**

**Q2) a)** What is need of verification? At what stage of design cycle is it done? Explore in detail. **[8]**

b) Explain ASIC design flow in detail. What different simulations are carried out at various stages? **[8]**

**Q3) a)** What is meant by synthesis? What inputs & constraints are involved in synthesis process? **[8]**

b) List different design rule checks involved in chip design. **[8]**

**Q4) Write notes on any three.** **[18]**

- a) Cross compilers
- b) Cell design
- c) Floor planning
- d) LVS

**P.T.O.**

## **SECTION - II**

- Q5)** a) What is timing verification? Explore in detail. [8]  
b) Explain static & dynamic timing analysis in brief. [8]
- Q6)** a) What is SPICE? Explain various parameters in detail. [8]  
b) Explore any two layout editor tools in brief. What are their capabilities?[8]
- Q7)** a) List various simulation tools. Explore the capabilities of any two of them. [8]  
b) What is need of IP core? Give examples of any two IP cores. [8]
- Q8)** Write short notes on any three. [18]  
a) Power budget & estimation.  
b) Layout techniques.  
c) Layout file formats  
d) Manufacturing tests.



Total No. of Questions : 8]

SEAT No. :

P3837

[Total No. of Pages : 2

[4760]-287

M.E. (E & TC) (VLSI & Embedded System)

REAL TIME OPERATING SYSTEM

(2008 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What are the different techniques used to solve the shared data problem? **[10]**
- b) What are the requirements of operating system for embedded system?**[6]**
- Q2)** a) Describe Priority inversion & Dead lock situation related with RTOS.**[8]**
- b) Explain Task scheduling, Task synchronization context switching and mutual exclusion. **[8]**
- Q3)** a) What are the techniques used for time delay generation in RTOS? Explain why accurate delay generation is difficult in RTOS? **[8]**
- b) Explain Semaphore related to RTOS. Can Semaphore used for task synchronization? Justify the answer using typical example. **[8]**
- Q4)** Write short note on the following (any three) : **[18]**
- a) Memory management in RTOS.
  - b) Traditional O.S. Vs. RTOS
  - c) Inter Task Communication.
  - d) Preemptive type scheduler.

**P.T.O.**

## SECTION - II

- Q5)** a) Describe the features of V<sub>x</sub> Work. [8]  
b) Explain Integrated Development Environment (IDE) tool used for development of an Embedded system. [10]
- Q6)** a) List and explain the various functions supported by the Linux/RT Linux. [10]  
b) Explain different operations involved in porting  $\mu$ COS-II O.S. [6]
- Q7)** a) Explain the different functions used  $\mu$ COS-II to handle mailbox. [8]  
b) Describe critical section of code. How it is handled in  $\mu$ COS-II? [8]
- Q8)** a) Describe the structure of Monolithic Operating System. [8]  
b) Draw and explain architecture of Linux Kernel. [8]



Total No. of Questions : 8]

SEAT No. :

**P3838**

[4760] - 288

[Total No. of Pages : 2

**M.E. (E & TC) (VLSI & Embedded System)**

**EMBEDDED SIGNAL PROCESSING**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, electronic and pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** State the different types of correlation. Explain each type with suitable example and comment on its use. **[9]**

b) State the basic elements used for realization of filters and different types of realizations. Realize the following transfer function using parallel form of realization. **[9]**

$$H(z) = 3 (2 z^2 + 5z + 4) / ((2z + 1) (z + 2))$$

**Q2) a)** Explain concept of Retiming. Explain the different techniques of retiming. **[8]**

b) What is DCT & IDCT? Explain in detail different properties of DCT. **[8]**

**Q3) a)** Define STFT. Write the mathematical expression & explain its significance with suitable example. **[8]**

b) Show that multiplication of DFT's is equal to circular convolution. **[8]**

**P.T.O.**

- Q4)** a) Compare the FIR and IIR filters. State their applications. Which type of filter is used more in practice? Why? [8]
- b) Define Unfolding. State and explain properties of Unfolding. [8]

### **SECTION - II**

- Q5)** a) Compare general purpose Microprocessor and DSP processor. Explain the use of MAC and barrel shifter unit. [8]
- b) Explain fixed point and floating point data formats in DSP processor. [8]
- Q6)** a) Explain the use of Adaptive filters for system identification and for noise cancellation in the system. [8]
- b) Explain the different selection criteria for DSP processor in a real time embedded system. [8]
- Q7)** a) With the help of suitable block diagram explain the architecture of TMS320C67XX processor. [8]
- b) Explain how Adaptive filter can be implemented using LMS algorithm. [8]

- Q8)** Write short note on (any three) : [18]
- a) Finite word length effect.
- b) Issues related with hardware interfacing.
- c) Wavelet and filter bank.
- d) DTMF generation and detection.



Total No. of Questions : 8]

SEAT No. :

**P4334**

**[4760] - 289**

[Total No. of Pages :2

**M.E. (E & TC) (VLSI & Embedded Systems)**

**RF IC DESIGN**

**(2008 Course) (Semester - II) (504190)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any THREE questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

**SECTION - I**

- Q1)** a) Using the method of open circuit time constant and incremental model, Derive the expression for input resistance, output resistance & voltage gain of CS amplifier. **[8]**
- b) Explain with necessary expressions various methods to compute bandwidth of HF CMOS amplifier. **[8]**
- Q2)** a) What is EMC? What are the techniques to achieve EMC for ASIC? Explain in brief. **[8]**
- b) What are the effects of channel length on RF design? Give the necessary mathematical expression. **[8]**
- Q3)** a) With suitable example explain back gate bias effect. **[8]**
- b) What is noise model? Explain any one noise optimization technique in detail. **[8]**
- Q4)** Write short notes on (any **Three**): **[18]**
- a) Causes and sources of crosstalk.
  - b) HF Compensation techniques.
  - c) Short channel effects of MOSFET.
  - d) Properties of cascaded amplifier.

**P.T.O.**

## SECTION - II

- Q5)** a) Starting with the concept of mixer, explore different types of mixers with necessary mathematical analysis in detail. [8]  
b) Describe effects of technology scaling on RF amplifiers. [8]
- Q6)** a) Compare Single ended LNA and Differential LNA with appropriate diagram and expression. [8]  
b) Explain Johnson noise and applied to RF amplifiers. Give the expression for noise figure. Compare with white noise. [8]
- Q7)** a) Design LNA to operate at 400 MHz Design suitable bias. Compute device width degenerating inductance, noise figure & Lg. Assume suitable data. [8]  
b) Which are the dominant parasitic to limit the bandwidth of amplifier? What are the techniques to improve? Explore one method in detail. [8]
- Q8)** Write short notes on (any **Three**): [18]  
a) Thermal Noise in MOSFETs.  
b) EDA tools in Analog IC design.  
c) ASIC design flow.  
d) Crosstalk Mitigation techniques.



Total No. of Questions : 8]

SEAT No. :

**P3745**

[Total No. of Pages : 2

[4760] - 29

**M.E. (Civil)(Hydraulics)**

**HYDROLOGY**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Write a note on Intensity Duration Frequency relationship. **[8]**

- b) Given below are the stream flows from a catchment area of 20 km<sup>2</sup> due to a storm of 1- hour duration. Find the surface runoff hydrograph ordinates from an effective rainfall of 6 cm and a duration of 1- hour. Assume a constant base flow of 15 cumec. **[8]**

| Time (hr)           | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
|---------------------|----|----|----|----|----|----|----|----|----|----|----|
| Stream flow (cumec) | 15 | 25 | 50 | 55 | 48 | 35 | 30 | 27 | 24 | 20 | 15 |

**Q2) a)** Write a note on time series. **[8]**

- b) Enlist various factors affecting evaporation rate and explain any two of them in detail. **[8]**

**Q3) a)** Explain the terms SPF and PMF with the situations wherein either of these two are considered. **[8]**

- b) Explain Gumbel's method of estimation of peak flood. **[8]**

**P.T.O.**

**Q4)** Write short notes on : **[18]**

- a) Flood lift
- b) Extreme value theory
- c) DAD analysis.

**SECTION - II**

**Q5)** a) In a recuperation test on an open well, the water level was depressed by 4 m and it was observed to rise by 2.5 m in 90 minutes. What is the specific capacity of the well? What would be the yield from the well under a depression head of 3 m, if the diameter of the well is 7.5 m? **[8]**

b) Write a note on storativity and Transmissivity. **[8]**

**Q6)** a) Write a note on ground water salinity. **[8]**

b) Briefly explain the precautionary measures to minimize ground water pollution. **[8]**

**Q7)** a) Explain 'Basin Method' of artificial recharge of ground water. **[8]**

b) Write a note on ground water development. **[8]**

**Q8)** Write short note on : **[18]**

- a) Method of images
- b) Perched aquifer
- c) Types of strainers



Total No. of Questions : 6]

SEAT No. :

**P3961**

**[4760]-290**

[Total No. of Pages : 2

**M.E. (E & TC/Electronics) (VLSI and Embedded Systems)**

**FAULT TOLERANT SYSTEM DESIGN**

**(2008 Course) (Semester-II) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *All questions are compulsory.*

**SECTION-I**

**Q1) a)** Classify and explain different types of simulation techniques. **[10]**

b) Define unknown logic value. Explain the working of static Hazard detection method. **[8]**

**Q2) a)** With neat example, explain the working of multiple stuck fault model. **[8]**

b) Explain in brief single stuck and bridging fault model. **[8]**

**Q3) a)** Compare different fault simulation methods. **[8]**

b) Define fault sampling. Describe the working principle of statistical fault analysis. **[8]**

**SECTION-II**

**Q4) a)** Describe with neat diagram, working of Transition Count compression technique. **[8]**

b) Explain with neat diagram, how Berger code checkers are used as self checking system. **[8]**

***P.T.O.***

- Q5)** a) With neat diagram, explain the working of self testing circuits for systems. [8]  
b) Explain with neat diagram, the working of signature analyser. [8]
- Q6)** a) Write a short note on PLA testing. [9]  
b) Write a short note on Automatic Test pattern generator. [9]



Total No. of Questions : 10]

SEAT No. :

**P4574**

**[4760] - 291**

[Total No. of Pages :3

**M.E. (E & TC) (VLSI & Embedded Systems)**

**BIOMEDICAL SIGNALS & SYSTEMS**

**(2008 Pattern) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain the action potential & Na<sup>+</sup> - K<sup>+</sup> pump action. [8]  
b) Explain the bio-instrumentation setup for acquiring EMG signals. Highlight the important design constraints for the same. [8]
- Q2)** a) Draw a typical ECG waveform over one cardiac cycle indicating the important component of the wave. How is the waveform affected by passage through [12]  
i) A low pass filter with cut off frequency of 40Hz?  
ii) A high pass filter with cut off of 5Hz?  
b) Describe difficulties encountered in biomedical signal acquisition & analysis. [6]
- Q3)** a) Explain 10-20 electrode system for acquiring EEG signal. [8]  
b) Explain following with reference to cardio-vascular system [8]  
i) Heart rate variability  
ii) Arrhythmia  
iii) Myocardial Infraction  
iv) Slow heart & fast heart

**P.T.O.**

- Q4)** a) Explain the terms. [8]
- i) ECG
  - ii) EMG
  - iii) PCG
  - iv) VAG
- b) Explain any one technique for 'QRS' detection in ECG signal. [8]
- Q5)** a) Explain the genesis of PCG signals & their correlation with ECG. [8]
- b) Explain the butterworth LPF for high frequency noise removal, also explain design steps for the same. [8]

### **SECTION - II**

- Q6)** a) Show how ECG signal & carotid pulse signals may be used to break a PCG signal into it's systolic & diastolic parts. [9]
- b) Explain the operations involved in homophoric filter & state it's applications for any bio-medical signal. [9]
- Q7)** Write short notes on (Any two). [16]
- a) The Pan-Tompkin's Algorithm
  - b) Application of Neural Network in biomedical signal analysis
  - c) Use of adaptive filters for segmentation.
- Q8)** a) Why is the 'ST' segment of ECG signal is relevant in diagnosis? Recommend signal analysis techniques for analysis of 'ST' segment variation in clinical applications. [10]
- b) Enlist & explain various short-time statistical measures used to characterize a non - stationary signal. [6]

**Q9)** Propose a method to detect the presence of ' $\alpha$ ' rhythm in EEG channel. How would you extend the method to detect the presence of the same rhythm simultaneously in two EEG channels? **[16]**

**Q10) a)** Discuss any one technique for envelope extraction & analysis of any appropriate bio-signal activity. **[8]**

b) State & explain the signal - flow diagram of AR model with appropriate example. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P3839**

**[4760] - 292**

[Total No. of Pages :2

**M.E. (E & TC) (VLSI & Embedded System)  
ADVANCED DIGITAL SYSTEM DESIGN  
(2008 Pattern) (Semester - II) (Elective - III) (504191)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each sections.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Assume Suitable data, if necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Use of scientific Calculator is allowed.*

**SECTION - I**

- Q1)** a) Design a sequential circuit that computes the product of two four bit numbers. **[10]**
- b) Describe the design of RISC and CISC processor. **[8]**
- Q2)** a) Draw and explain ASM chart for shift and add multiplier. **[8]**
- b) For digital system, explain the following: **[8]**
- i) Reliability and reliability function
  - ii) Failure rate & MTBF
- Q3)** a) What is control unit? Explain any one method of control unit implementation with necessary code, specifications & block schematic? **[8]**
- b) Implement the switching function.  $f = x_1x_2 + x_1x_3$  **[8]**
- i) Which hazard exists in the circuit.
  - ii) Derive the hazard free circuit for the above switching function.

**P.T.O.**

**Q4)** Write short notes on:(Any four). **[16]**

- a) Static and Dynamic Hazards
- b) Fault tree analysis
- c) Switch Debouncing
- d) Address and data path architecture of CPU
- e) ATM packet Generator

**SECTION - II**

**Q5)** a) What is SRAM cell? Design 2×2 array of SRAM cell and explain its operation. **[10]**

b) Explain an interfacing diagram of 486 bus with microprocessor? **[8]**

**Q6)** a) What is system reliability? How it is calculated for digital system? **[8]**

b) How BIST scheme is implemented for sequential circuit? **[8]**

**Q7)** a) Write a short note on Boundary scan. **[8]**

b) Model 1k×8 dual port RAM using VHDL. **[8]**

**Q8)** Write a short note on: (Any four) **[16]**

- a) ATM switch
- b) System Integrity
- c) Scan path Technique
- d) ASM & FSM
- e) IEEE 486 Bus.



Total No. of Questions : 8]

SEAT No. :

P4335

[Total No. of Pages : 2

[4760] - 293

**M.E. (E & TC) (VLSI and Embedded System)**

**EMBEDDED AUTOMOTIVE SYSTEMS**

**(2008 Pattern) (Semester - II) (Elective - IV (a))**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is importance of Electromagnetic interference suppression? Explain in detail. [8]
- b) Which are the components for Electronic engine management systems? Explain briefly. [8]
- Q2)** a) Describe different methods of vehicle motion control. Describe role of sensors in motion control. [8]
- b) Explain the role of dashboard electronic instruments? Discuss on board diagnostic system. [8]
- Q3)** a) What are the types ignition system and explain their principle of operation of solid state ignition systems. [8]
- b) Write Short note on : [10]
- i) Digital engine control system.
  - ii) Electronic management of chassis system.

**P.T.O.**

- Q4)** a) Which are different types of fuel injection systems? Explain. [8]  
b) What is Hybrid vehicle? What are recent trends in Hybrid vehicle systems? [8]

**SECTION - II**

- Q5)** a) How fuel metering is done? Which are the different techniques? [8]  
b) What are the different safety measures taken using embedded systems in modern vehicles? [8]

- Q6)** a) Classify electronics control systems in open loop and closed loop control system and explain advantages of closed loop systems. [8]  
b) How fuel measurement is done? Which are the different techniques? [8]

- Q7)** a) Briefly explain the technique of Integrated engine control and exhaust emission control technique. [8]  
b) Draw a schematic arrangement for a typical CAN network containing a master and number of slaves. How multiprocessor communication is possible? [8]

- Q8)** Write short note on : [18]  
a) Recent trends in cruise control of car  
b) Role of Artificial Intelligence in modern automobiles.  
c) GPS based vehicle tracking system.



Total No. of Questions : 8]

SEAT No. :

P4336

[Total No. of Pages : 3

[4760] - 294

M.E. (E & TC) (VLSI and Embedded Systems)

SYSTEM ON CHIP (Elective - IV)

(2008 Pattern)

Time :3 Hours]

[Max. Marks :100

Instructions to the candidates:-

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data if necessary.

### SECTION - I

Q1) a) What do you mean by clock skew? How it can be rectified? Explain it with neat waveform(s) for cases when [8]

- i)  $clk1 > clk2$
- ii)  $clk1 < clk2$  for following Fig1a.

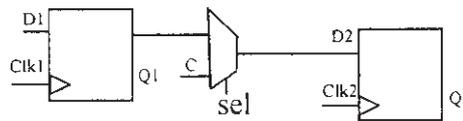


Fig1a

b) Explain rat's net plot algorithm? What are limitations of this algorithm? [8]

Q2) a) Explain significance of CAD tools in SoC design. What kind of improvements you can suggest? [8]

b) Define layout routing? How automatic layout routing is playing important role in CMOS fabrication? [8]

P.T.O.

**Q3)** a) Explain hierarchy of design abstraction? Draw logic diagram of full adder. Draw four bit adder from full adder. Name each component in full adder and define four bit adder as a type. Draw the component hierarchy, showing the four bit adder, the full adder and logic gates. [8]

b) How hot electrons are formed? What is its effect on CMOS operation? [8]

**Q4)** Explain :

a) Stacked capacitor. [6]

b) How state encoding affects delay? [6]

c) Why is metal2 - metal2 spacing is larger than metal1 - metall spacing? [6]

### SECTION – II

**Q5)** a) Compute and plot the Elmore delay for metal-1 wire of size  $4000 \lambda \times 4\lambda$  using : [8]

i) 2-sections

ii) 4-sections

iii) 8-sections

b) Differentiate : RC Vs RLC model for interconnect. Explain Ismile and Fredman's contribution in regard to inductive delay. [8]

**Q6)** a) Differentiate MTCOMS over VTCMOS. How VTCMOS overcome problem of MTCMOS? [8]

b) Explain : [4 × 2 = 8]

i) Dynamic latch

ii) Static latch

iii) Multiplexed latch

iv) Re-circulating latch

- Q7)** a) What is maximum allowable skew as predicated by Hatiman and Cash constraint for the parameter values :  $T = 10$  ns,  $t_{pr} = 1$  ns,  $t_{sr} = 1$  ns,  $t_{sl} = 1$  ns,  $t_{pl} = 5$  ns,  $t_{pi} = 5$  ns. What is minimum allowable clock period under that value of skew? [8]
- b) What are requirements of clocking in pipeline? Explain it with waveforms. [8]
- Q8)** a) Why an output pad does not require electrostatic discharge protection circuitry? [3]
- b) Design and analyze  $8 \times 8$  Wallace tree multiplier : [15]
- i) Draw the block diagram for an 8-bit carry save adder.
  - ii) Draw the complete block diagram for the multiplier.
  - iii) Draw the basic floorplan for multiplier including the partial product generators and Wallace tree.
  - iv) Identify the critical path through the multiplier.



Total No. of Questions : 10]

SEAT No. :

P4337

[Total No. of Pages : 2

[4760] - 295

**M.E. (E & TC) (VLSI and Embedded System)**

**SOFTWARE DEFINED RADIO (ELECTIVE)**

**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is software defined radio? How software defined radio is different than conventional radio? [8]  
b) Explain the relation between cognitive radio and software radio. [8]
- Q2)** a) Explain the relation of software communications architecture (SCA) in relation with Software defined radio. [8]  
b) Explain how smart selection of ADC/DAC enables better design of software radio? [8]
- Q3)** a) Explain the networking overview of JTRS Software Communications Architecture. [8]  
b) What are different RF receivers used in software radio? [8]
- Q4)** a) Explain different types of transmitters used for SDR? [8]  
b) State and explain various RF front ends used in SDR. [8]

**P.T.O.**

- Q5)** a) What factors must be considered while selecting RTOs in SDR development? [9]  
b) What are different hardware development issues in SDRs? [9]

**SECTION - II**

- Q6)** a) What are the factors to be considered for selecting antenna? Explain any one smart antenna architecture in brief. [8]  
b) What is different adaptation algorithms used in smart antenna? Explain any one in brief. [8]

- Q7)** a) Why is it important for the RF components in an antenna array to have uniform Characteristics across the channels? [8]  
b) Explain system propagation loss with neat block diagram. [8]

- Q8)** a) Describe a typical low cost set up of SDR. [8]  
b) What is selection criterion for processors in SDR. [8]

- Q9)** a) What factors should be considered while selecting RTOS? [8]  
b) Explain any one RTOS : [8]  
i) VxWorks  
ii) RTLinux.

- Q10)** Write Short Notes [Any Three] : [18]  
a) CORBA.  
b) SPEAKEASY.  
c) Future of SDR.  
d) Military Applications of SDR.



Total No. of Questions : 8]

SEAT No. :

P3962

[Total No. of Pages : 2

[4760] - 296

M.E. (IT)

HIGH PERFORMANCE COMPUTER NETWORKS

(2008 Pattern)

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain SRP Protocol and Authentication in detail. [8]  
b) What is need of Signaling Systems? Explain SS7 with its Architecture. [8]
- Q2)** a) With the help of the Architecture explain Gigabit Ethernet. [8]  
b) What is Broad Band Networks? Explain Architecture of Broad Band Networks. [8]
- Q3)** a) Compare X.25, Frame Relay and ATM w.r.t need, architecture, specification and applications. [8]  
b) What is ISDN? Explain B-ISDN in detail. [8]
- Q4)** Solve Any Three : [18]  
a) ATM Service Categories.  
b) QoS in HPCN.  
c) IP over ATM.  
d) Queuing System.

**P.T.O.**

## SECTION - II

- Q5)** a) Explain DMT with neat block diagram. [8]  
b) Compare different technologies DSL, ADSL, HDSL, SDSL, VDSL w.r.t technical specifications and specific usage / applications. [8]
- Q6)** a) With the help of layered Architecture, Explain SONET in detail. [8]  
b) What is the use of storage in Networks? Explain SAN Architecture in detail. [8]
- Q7)** a) What is WLAN. Give design issues for WLAN along with technical specifications. [8]  
b) What is the significance of Mobile IP? Explain in detail. [8]
- Q8)** Solve Any Three : [18]  
a) DWDM  
b) UMTS  
c) GSM  
d) Fiber Channel protocol Architecture



Total No. of Questions : 8]

SEAT No. :

P4338

[4760] - 297

[Total No. of Pages : 4

**M.E. (E&TC) (Signal Processing)**  
**LINEAR ALGEBRA AND RANDOM PROCESSES**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Determine the characteristic roots and the corresponding characteristic

vectors of the matrix  $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

**[8]**

**b)** Apply test rank to examine if the following equations are consistent. **[6]**

$$2x - y + 3z = 8$$

$$-x + 2y + z = 4$$

$$3x + y - 4z = 0$$

If consistent, find the complete solution.

**c)** Show that A is involutor, if and only if  $(I + A)(I - A) = 0$ . **[4]**

**Q2) a)** Prove that  $\Delta = \begin{vmatrix} 1+a & 1 & 1 & 1 \\ 1 & 1+b & 1 & 1 \\ 1 & 1 & 1+c & 1 \\ 1 & 1 & 1 & 1+d \end{vmatrix} = abcd \times \left[ 1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d} \right]$

**[6]**

**P.T.O.**

- b) Determine non singular matrices P&Q such that PAQ is in normal form

$$\text{where } A = \begin{bmatrix} 3 & 2 & -1 & 5 \\ 5 & 1 & 4 & -2 \\ 1 & -4 & 11 & -19 \end{bmatrix} \quad [6]$$

- c) Prove or Disprove each of the following statements : [4]

- i) The product of 2 upper triangular matrices is upper triangular.  
ii) The product of 2 Toeplitz matrices is Toeplitz.

- Q3)** a) Prove that every invertible matrix possesses a unique inverse. [4]

- b) Solve completely the system of equations

$$\begin{aligned} 4x + 2y + z + 3u &= 0 \\ 6x + 3y + 4z + 7u &= 0 \\ 2x + y + u &= 0 \end{aligned} \quad [6]$$

- c) Find the characteristic roots of matrix A and verify Caley-Hamilton

theorem for the matrix  $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ . Find inverse of matrix A. [6]

- Q4)** a) For what values of  $\lambda$  will the following equations fail to have unique solution.

$$\begin{aligned} 3x - y + \lambda z &= 1 \\ 2x + y + z &= 2 \\ x + 2y - \lambda z &= -1 \end{aligned}$$

Will the equations have any solutions for these values of  $\lambda$ ? [6]

- b) Write matrix A of quadratic form  $6x^2 + 65y^2 + 11z^2 + 4zx$ .

Find Eigen values of A and hence determine the value and class of the given quadratic form. [4]



- Q7)** a) Explain a 2D random variable along with an example. List its types and properties. [8]
- b) A 2-D random variable is given by  $P(1,1) = 0.28$ ,  $P(2,2) = 0.52$ ,  $P(3,3) = 0.2$ . Write the equations of CDF and find the marginal distribution functions of X & Y. [8]
- Q8)** a) Explain 2<sup>nd</sup> order statistics of a random process with respect to Autocorrelation function, and autocovariance. Derive the relation between them. [6]
- b) Write a short note on Poission's process. [5]
- c) What is Narrow band noise? Represent it in terms of its In-Phase and Quadrature components. [5]



Total No. of Questions : 8]

SEAT No. :

**P4339**

**[4760] - 298**

[Total No. of Pages :3

**M.E. (E & TC) (Signal Processing)**  
**SIGNAL PROCESSING TECHNIQUES**  
**(2008 Pattern) (504502) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data, if necessary.*

**SECTION - I**

**Q1) a)** A 8-point DT sequence is given by **[8]**

$$x(n) = \left\{ \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0 \right\}. \text{ Obtain DFT using DIF-FFT.}$$

b) Consider a causal LTI system with  $x(n)$  as Input &  $y(n)$  as output. Output is given by  $y(n) = \frac{1}{2}y(n-1) + x(n)$

Determine  $y(n)$  if input  $x(n) = \delta(n-1)$ . **[8]**

**Q2) a)** State and explain the convolution (circular) property of the DFT. Determine the circular convolution of the sequences using the same property  $x_1(n) = \{1, 2, 3, 1\}$ ,  $x_2(n) = \{4, 3, 2, 2\}$ . **[10]**

b) If  $x(n) = a^n u(n) + b^n u(n-1)$ . Find  $X(z)$  and ROC if **[8]**

i)  $a < b$

ii)  $a > b$

iii) In which case  $X(z)$  exist and why.

**P.T.O.**

- Q3)** a) Convert the analog filter with the system function. [6]

$$H(s) = \frac{s+0.1}{(s+0.1)^2 + 9}$$

into digital filter by means of impulse invariance method. (Sampling Time 1sec)

- b) Compare impulse invariance and bilinear Transformation method of IIR filter design. [6]
- c) Determine the signal  $x(n)$ , whose z-transform is given by  $X(z) = \log(1 + az^{-1})$   $|z| > |a|$ . [4]

- Q4)** a) Design linear phase FIR filter (low pass) using hamming window by taking 5 samples of window sequence and cut-off frequency 0.35 rad/samples. Also mention remaining specifications of the filter. [8]

- b) State whether each of the following statement is true or false with justification. [8]

- i) Linear phase filters are always IIR.
- ii) A stable filter is always FIR type.
- iii) IIR filters have recursive realization always.

### SECTION - II

- Q5)** a) Explain IIR filter design by approximation of derivatives. [8]

- b) Using bilinear Transformation, design a Butterworth filter which satisfies the following specifications. (Sampling Time = 1 sec)

$$0.8 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.2\pi$$
$$|H(e^{j\omega})| \leq 0.2 \quad 0.6\pi \leq \omega \leq \pi \quad [8]$$

**Q6) a)** Realize the system with difference equation [8]

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

i) Direct I form

ii) Cascade form

**b)** Determine the inverse z-Transform of [8]

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

if

i) ROC  $|z| > 1$

ii) ROC  $|z| < 0.5$

iii) ROC  $0.5 < |z| < 1$

**Q7) a)** Compare the features of digital Butterworth, Chebyshev type I and Chebyshev type II and elliptic filters. [6]

**b)** Prove that for FIR filter if  $z_1$  is a zero or root of FIR filter system  $H(z)$  then  $1/z_1$  is also zero or root. [6]

**c)** Determine Inverse DFT of the sequence [6]

$$X(k) = \{6, -2 + 2j, -2, -2 - 2j\}$$

using DIT - Inverse FFT

**Q8) a)** Find the linear convolution using overlap-add method of the following sequences: [8]

$$x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 2, -1\}$$

$$h(n) = \{1, 2, 3\}.$$

**b)** Explain frequency sampling technique of FIR filter design (type II). [8]



Total No. of Questions : 8]

SEAT No. :

**P3840**

**[4760] - 299**

[Total No. of Pages :2

**M.E.(E&TC) Signal Processing  
DIGITAL IMAGE PROCESSING  
( 2008 Course)(Semester-I) (Elective- I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section*
- 2) *Answer to the two sections should be written in separate books*
- 3) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain elements of visual perception and image formation model. [8]
- b) Explain spatial and gray level resolution. What is the effect of spatial and gray scale resolution on the details of image? [8]
- Q2)** a) What are the different fundamental steps in image processing? Explain with neat block diagram. [8]
- b) Write the equation of 2D FT.Explain following properties of 2D FT: [8]
- i) Translation
  - ii) Rotation
  - iii) Scaling
  - iv) Convolution
- Q3)** a) Explain image restoration using inverse filtering. [8]
- b) What is Pseudocoloring? Give its applications. [8]

***P.T.O.***

**Q4)** Write shorts notes on:

**[18]**

- a) High boost filter
- b) Match band effect
- c) KL Transform

**SECTION-II**

**Q5) a)** Explain image degradation model. What is difference between image enhancement and image restoration? **[8]**

b) Compute the discrete cosine transform (DCT) for a given image **[8]**

|   |   |
|---|---|
| 2 | 2 |
| 1 | 2 |

Also comment on the energy compaction property of DCT.

**Q6) a)** Discuss different types of redundancies found in images. **[8]**

b) Explain bit plane coding and transform coding **[8]**

**Q7) a)** What is the significance of Hough transform? Explain how Hough transform is used for edge linking **[8]**

b) Explain two types of region based image segmentation algorithms. **[8]**

**Q8)** Write short notes on :

**[18]**

- a) Lossy predictive coding
- b) Chain codes
- c) Fingerprint recognition



Total No. of Questions : 8]

SEAT No. :

**P4288**

[4760] - 3

[Total No. of Pages :2

**M.E. (Civil) (Construction and Management  
CONSTRUCTION TECHNOLOGY  
(2008 Course) (Semester - I) (501103)**

*Time : 4Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from Section - I and any three from Section - II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) How 'Tunnel driving' in hard and soft strata differs. [8]  
b) Explain briefly any two methods of underwater concreting? [8]
- Q2)** a) What is grouting? Explain grouting techniques. [8]  
b) Define-Shafts. Write advantages of shafts? Explain the classification of shafts with sketches. [8]
- Q3)** a) Why dewatering of 'shallow and deep excavations' is essential. Explain different systems of dewatering. [10]  
b) Explained vacuum dewatering by electro-osmosis. [8]
- Q4)** Write a short note on any four of the following: [16]  
a) Cut and cover method of tunnelling.  
b) Problems in underwater concreting.  
c) Jet grouting technique.  
d) Single and multiple well system.  
e) Clay grouting.

**P.T.O.**

## SECTION - II

- Q5)** a) Differentiate and explain in details precast piles and cast in situ piles. [10]  
b) What is negative and positive skin friction? Explain. [8]
- Q6)** a) Explain pile driving methods, its merits and demerits. [10]  
b) What are friction piles? Explain. [6]
- Q7)** a) Describe cofferdams and its types. [8]  
b) Write detailed note on under reamed piles. [8]
- Q8)** Write a notes on any four of the following: [16]
- a) Pneumatic Caissons.
  - b) Single acting hammers in driven piles.
  - c) Sheet pile cofferdam.
  - d) Cyclic loading on piles.
  - e) Soldier construction method of cofferdam.



Total No. of Questions : 08]

SEAT No. :

**P3746**

**[4760] - 30**

[Total No. of Pages :2

**M.E.(Civil) (Hydraulics)**

**SEDIMENT TRANSPORT AND RIVER MECHANICS**

**(Semester-II) ( 2008 Course)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any Three Questions from Each Section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are the various kinds of loads considered in sediment transportation mechanism? Explain them in detail. Also comment on the statement “ During winter suspended loads are converted into bed loads” [10]
- b) How the form resistance and grain resistance vary in different flow regimes? [8]
- Q2)** a) What do you mean by regime of flow? Define and explain ripples,dunes,transitions and antidunes with sketches. [10]
- b) What do you mean by bed load,contact load and wash load? Distinguish between bed load and contact load. [6]
- Q3)** a) Use Meyer-Peter and Muller equation for bed load transport of sediment in an alluvium channel with following data [10]
- i) width=100m
  - ii) discharge=350m<sup>3/s</sup>
  - iii) depth of water=3.5m
  - iv) bed slope of channel=1 in 4000
  - v) mean size of sediment particle=3mm
- b) How to determine sediment load by remote sensing method ? Discuss it in brief. [6]

P.T.O

- Q4)** a) Discuss in detail “Critical Tractive Stress” along with neat sketches. [10]  
b) Water flows at a depth of 0.500m in a wide rectangular channel with bed slope 1 in 1000. The average diameter of sand grain in the channel bed is 1mm. Comment on whether the grains are stationary or in motion? [6]

### SECTION - II

- Q5)** a) Compare Kennedy method and Lacey method for the design of an irrigation channel Also Design an irrigation channel in alluvial soil according to Lacey’s method for following data [12]  
i) Full supply discharge:  $40 \text{ m}^3/\text{sec}$   
ii) Lacey’s silt factor-0.9.  
iii) Channel side slope 0.5H :1V  
b) What are the causes of stream bed variations in the form of aggradations and degradation? [6]
- Q6)** a) Explain microscopic and macroscopic methods for bed load measurements and suspended load measurements [8]  
b) Explain in detail reservoirs sedimentation and trap efficiency [8]
- Q7)** a) What is river gauging? Explain the methods of river gauging in detail. [8]  
b) Explain river training for sediment control [8]
- Q8)** a) Explain the types of classification of river training works. [8]  
b) write short notes on [8]  
i) Gryones  
ii) Launching aprons



Total No. of Questions : 12]

SEAT No. :

P4745

[Total No. of Pages : 2

[4760] - 300

M.E. (SP)

Automotive Electronics

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Attempt section - I Q.1 or Q.2, Q.3 or Q. 4, Q.5 or Q.6, section - II Q.7 or Q.8, Q. 9 or Q.10, Q. 11 or Q.12.
- 2) Figures to the right indicate full marks.

**SECTION - I**

- Q1)** a) Explain in Brief basic automotive system & it's components. [10]  
b) Explain Electronic ignition system configuration of IC engine. [8]

OR

- Q2)** a) Explain following sensors with working principle with characteristics and use. [10]  
i) Position sensing  
ii) Temperature sensing  
iii) Flow sensing  
b) Explain various aspects of engine management. [8]

- Q3)** a) Draw & Explain Electronically controlled engine. [8]  
b) Explain coding system in automobile & hence explain typical coolant sensor with diagram. [8]

OR

- Q4)** a) Explain various advantages of vision sensors in automobile hence explain safety features incorporated through them for the user. [8]  
b) Explain working principle characteristics of any two types of actuators in context with automobile systems. [8]

**P.T.O.**

- Q5)** a) Explain with block diagram Automotive digital Instrumentation system. [8]  
b) Draw and explain Electronic pressure measurement system for a vehicle. [8]

OR

- Q6)** a) Explain Hall effect position sensor. [8]  
b) Draw block diagram of ideal speed control system in automobile. [8]

**SECTION - II**

- Q7)** a) What is emission control system? Explain. [8]  
b) Justify selection of sensors for following applications. [8]  
i) Anticollision system.  
ii) Vehicle tyres protection.

OR

- Q8)** a) Write a short note on wiper control. [8]  
b) Write a short note on antitheft system. [8]

- Q9)** a) What is basic wiring system and multiplex wiring system? Explain. [8]  
b) What is integrated engine control system. [8]

OR

- Q10)**a) Explain with block diagram digital cruise control configuration. [8]  
b) With appropriate example differentiate between analog and digital control methods in context with automotive systems. [8]

- Q11)**a) Explain significance and advantage of lane detection system with relevant schematic. [10]  
b) Enlist various features incorporated in modern automotive systems related to safety of human. [8]

OR

- Q12)**a) Explain active night vision system and passive night vision system in automobiles for drivers assistance. [10]  
b) Explain significance of intelligent braking system and it's challenges/future scope in automobile safety. [8]



Total No. of Questions : 8]

SEAT No. :

P4746

[Total No. of Pages : 2

[4760]-301

M.E. (E & TC) (Signal Processing)

ARTIFICIAL INTELLIGENCE

(2008 Pattern) (Elective - I)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** A problem solving search can proceed either forward (from a known start state to a desired state) or backward (from a goal state to a start state). What factors determine the choice of a direction for a particular problem? Give examples. [18]
- Q2)** Explain structure of intelligent agent. Explain Reflex agent, Model based agent. [16]
- Q3)** Explain Minimax algorithm and its use in detail with examples. [16]
- Q4)** Explain role of events in knowledge representation and reasoning system. [16]

**SECTION - II**

- Q5)** Compare biological neuron and artificial neuron. Explain various applications of artificial neural networks with any one algorithm in detail. [18]
- Q6)** Define Fuzzy logic. Compare it with classical set theory. Explain any Rule based system in detail. [16]

**P.T.O.**

**Q7)** Explain breadth first search and depth first search algorithm. **[16]**

**Q8)** Write notes on (any two) : **[16]**

- a) Applications of Artificial Intelligence.
- b) Utility theory.
- c) Planning.



Total No. of Questions : 10]

SEAT No. :

P3841

[Total No. of Pages : 3

[4760] - 302

M.E. (E&TC) (Signal Processing)

BIOMEDICAL SIGNAL PROCESSING

(2008 Pattern)

Time :3 Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) Answer any 3 questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Your answers will be valued as a whole.
- 6) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 7) Assume suitable data , if necessary.

**SECTION - I**

- Q1)** a) Explain the design criteria and process for a biomedical system design. [9]
- b) What are the measurement constraints in a biomedical instrumentation system? [9]
- Q2)** a) Explain the action potential in a cell and the terms absolute refractory period & relative refractory period. [8]
- b) Calculate the resting potential of a cell when the ratio of intracellular ion concentration to the extracellular ion concentration is 30 at room temperature of 27°C. Given: R=Gas constant=8.31436 Joule<sup>-1</sup>deg<sup>-1</sup>  
F = Faraday constant = 96488 coulomb/gm-equivalent. [8]
- Q3)** a) State the requirements of biomedical sensors and state the classification of sensors. [8]
- b) Describe the semiconductor temperature transducer (PTAT) and derive the expression for its output voltage as a function of absolute temperature. [8]

**P.T.O.**

- Q4)** a) Draw and explain the “pump and hydraulic system” model for cardiovascular circulation. [8]  
b) Explain the spectral analysis techniques used for processing the phonocardiogram signals. [8]

- Q5)** a) Explain alpha ( $\alpha$ ), beta ( $\beta$ ), delta ( $\delta$ ), and theta ( $\theta$ ) waves in an EEG signal and state their significance and characteristics. [8]  
b) Explain the “Back-projection” method of image reconstruction used in computed tomography. [8]

### **SECTION - II**

- Q6)** a) Highlight the significance of safety in biomedical equipment stating the susceptibility factors therein. [8]  
b) Explain the applications of active filters for biomedical signals clearly stating the requirements of components to be used with these filters.[8]

- Q7)** a) An ECG signal of 1 volt peak-to-peak has a bandwidth of 0.1 to 250 Hz. Assume that broadband noise may be present in the signal at about 0.1 volts .This signal is filtered using a four-pole low-pass filter. What sampling frequency is required to ensure that the error due to aliasing is less than -50 dB? [8]  
b) Why do we need anti-aliasing filters? Explain with a suitable example.[8]

- Q8)** State the design equations for coefficients of digital Lowpass, Highpass,Bandpass, and Bandstop filters (window method) [16]

- Q9)** a) What are the sources of variability in biomedical signals? [8]  
b) What are the effects of signal windowing? Explain the various types of windowing techniques with necessary equations, time domain and spectral responses. [8]

**Q10)** Write notes on: (any two)

**[18]**

- a) Use of Artificial Neural Networks for pattern classification of ECG signals.
- b) Spectrogram and its application for biomedical signal analysis.
- c) Welch method for spectral density estimation of a signal.



Total No. of Questions : 8]

SEAT No. :

P4340

[Total No. of Pages : 3

[4760] - 303

**M.E. (E & TC) (Signal Processing)**  
**WIRELESS AND MOBILE COMMUNICATION**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two Sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Moltier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Explain the concept of “FREQUENCY REUSE” as applied to Cellular Communications. What are the advantages of this approach? [8]
- b) Draw the block diagram of a Cellular Mobile Communication system. Explain the various steps involved in placing a call from: [8]
- i) Mobile to a Landline phone,
  - ii) Landline Phone to a Mobile Phone.
- Q2) a)** A cellular system uses a 12 cell repeating pattern. There are 120 cells in the system and 20,000 subscribers. Each subscriber uses the phone on an average of 30 minutes per day but on an average 10 of these minutes are during the peak hour. Calculate : [8]
- i) Average and Peak Traffic in Earlangs for the whole system,
  - ii) Average and Peak Traffic in Earlangs for one cell,
  - iii) Assume the callers are evenly distributed.

**P.T.O.**

- b) Explain the following terms : [8]
- i) 1G Telephone Systems,
  - ii) 2G Phone Systems,
  - iii) 3G Systems.
  - iv) 4G Systems

**Q3)** a) If a Signal to Interference ratio of 15 dB is required for satisfactory forward channel performance of a Cellular system, what is the frequency reuse factor and Cluster Size that should be used for maximum capacity if the path loss exponent is (i) 3 and (ii) 4. [8]

Assume that there are six co-channel cells in the first tier and all of them are there at the same distance from the mobile.

- b) What is meant by Diversity Reception? What are its different types and what are its advantages in Cellular communication? Explain in brief. [8]

**Q4)** a) Explain the following types of reflection. [8]

- i) Specular Reflection,
- ii) Diffuse Reflection
- iii) Diffraction.

- b) What is the need for equalization in a receiver? Also explain the linear equalizer in detail. [4]

- c) Explain the Trellis Coded Modulation concept and Turbo Codes along with its application. [6]

## SECTION - II

**Q5)** a) With the help of suitable examples, explain the procedure for obtaining the effective height of an antenna. Explain how path loss can be obtained from a Point to Point Prediction Model. [8]

- b) A cellular system with omni-directional antennas employs a cluster of size 7. The cell at the center of the cluster has a lot more traffic than others and needs to borrow some channels from adjacent cells. Explain the strategy to be used to determine the donor cell within the cluster and outside the cluster. [8]

- Q6) a)** Explain the following GSM Radio Interfaces: **[12]**
- i) Mobile Station (MS) to Base transceiver Interface (BTS),
  - ii) BTS to BSC,
  - iii) BSC to MSC,
  - iv) Interfaces between other GSM Entities.
- b) What are the functions of authentication and encryption used in GSM? How is system security maintained? **[6]**
- Q7) a)** How does the near far effect influence CDMA systems? What are the counter measures in CDMA systems? **[10]**
- b) The IS-95 system uses a rate  $\frac{1}{2}$  convolutional encoding in the forward channel and a rate  $\frac{1}{3}$  convolutional coding in the reverse channel. What were the reasons for doing so? **[6]**
- Q8) a)** Explain Interference in space, time, frequency and code domain. What are the countermeasures in SDMA, TDMA, FDMA & CDMA systems respectively? **[10]**
- b) What is the main physical reason for the failure of many MAC schemes used successfully in wired networks in wireless networks? **[6]**



Total No. of Questions : 8]

SEAT No. :

P3842

[Total No. of Pages : 2

[4760]-305

M.E. (E & TC) (Signal Processing)  
STATISTICAL SIGNAL PROCESSING  
(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Compare the auto correlation and covariance method of signal modeling when only a finite data record is available. [8]
- b) How to design a filter using Pade' approximation and Prony's method. [8]

- Q2)** a) Solve the following set of Toeplitz equations using Levinson recursion method. [8]

$$\begin{bmatrix} 4 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 4 \end{bmatrix} \begin{bmatrix} x(0) \\ x(1) \\ x(2) \end{bmatrix} = \begin{bmatrix} 9 \\ 6 \\ 12 \end{bmatrix}$$

- b) State and explain Levinson - Durbin recursion algorithm. [8]
- Q3)** a) Explain the following: [10]
- i) Parametric methods of spectrum estimation.
  - ii) All pole modeling using Prony's method.
- b) Compare the performance of Bartlett's and Welch's method of spectrum estimation. [8]

P.T.O.

- Q4)** Write short notes on : **[16]**
- a) FIR least squares inverse filter.
  - b) Schur Recursion.

**SECTION - II**

- Q5)** a) Consider a signal  $x(n)=d(n)+v(n)$  where  $d(n)$  is an AR(1) process that satisfies the difference equation,  $d(n)=0.8d(n-1)+w(n)$

Where  $w(n)$  is white noise with variance,  $\sigma_w^2=0.36$  and  $v(n)$  is unit variance white noise. **[8]**

- i) Design a Wiener filter with length  $M=2$ .
  - ii) Determine the MMSE for  $M=2$ .
- b) Compare causal Wiener filter with Kalman Filter. **[8]**

- Q6)** a) Implement a third order FIR Filter  $H(z)=1+0.5z^{-1}-0.1z^{-2}-0.5z^{-3}$  using a lattice filter structure. **[8]**

- b) Given that  $\gamma_x(0) = 2$  and the sequence of reflection coefficients,

$$\Gamma_1 = \Gamma_2 = \Gamma_3 = \frac{1}{2}. \quad \text{[8]}$$

Find the corresponding auto correlation sequence,

$$\gamma_x = [\gamma_x(0), \gamma_x(1), \gamma_x(2), \gamma_x(3)]^T$$

- Q7)** a) Explain the use of Wiener filter for noise cancellation. **[8]**
- b) Derive Wiener-Hopf equation for causal FIR Wiener Filter. **[8]**

- Q8)** Write short notes on : **[18]**

- a) AR, MA and ARMA models.
- b) Shank's method.
- c) Minimum variance spectrum estimation.



Total No. of Questions : 8]

SEAT No. :

**P3843**

[4760] - 306

[Total No. of Pages : 2

**M.E. (E & TC) (Signal Processing)**  
**ADVANCED DIGITAL SIGNAL PROCESSING**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answers any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Explain and differentiate between Decimation and Interpolation. **[8]**

b) What is interpolator, why is a filter required for an interpolator? Draw the spectrum of the output of an interpolator and after the filter. **[10]**

**Q2) a)** A signal with a sampling frequency of 2.048 kHz is to be decimated by a factor of 32 to get a new sampling frequency of 64 Hz. The signal band of interest extends from 0 to 30 kHz. The pass band deviation is 0.01 dB and the stop band attenuation is 80dB. Pass band 0-30 Hz & stop band 32-64 Hz. Signal components in the range from 30-32Hz should be protected from aliasing. Design suitable one-stage filter. **[8]**

b) Why should we use the interpolator first before the decimator in case of sampling rate conversion by a factor I/D. Derive the equation for the output of a sampling rate convertor? **[8]**

**Q3) a)** Explain applications of Multi rate DSP. **[8]**

b) Draw and explain efficient implementation of decimator and interpolator. **[8]**

**P.T.O.**

- Q4)** a) Write short notes on properties of direct form RLS algorithm. [8]  
b) Explain the concept of decimation for image resizing. [8]

**SECTION - II**

**Q5)** a) Explain adaptive beam former. What are requirements of good adaptive beam former? [10]

b) Draw and explain delay and sum beam former. [8]

**Q6)** a) Draw second order Lattice filter for FIR filter realization. Write the equation for output of filter. Find the relation between predictor coefficients and reflection coefficients. [8]

b) Explain Levinson and Durbin algorithm to determine the autoregressive parameters of linear predictive filter. [8]

**Q7)** a) Discuss the features of TMS 320C54xx in detail. [8]

b) Explain widrow LMS algorithm. [8]

**Q8)** a) Write short note on - [8]

i) MAC

ii) Barrel shifter

iii) ALU

iv) Circular addressing

b) Describe applications of adaptive filters. [8]



Total No. of Questions : 8]

SEAT No. :

**P3963**

**[4760]-307**

[Total No. of Pages : 2

**M.E. (E & TC) (Signal Processing)  
VLSI IN SIGNAL PROCESSING  
(2008 Course) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections must be written in separate sheets.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of logarithmic tables and electronic pocket calculator is allowed.*

**SECTION-I**

- Q1)** a) Write a short note on vector quantization. [8]  
b) What are applications of Unfolding, explain each in detail. [8]
- Q2)** a) Write a short note on DSP application demands & scaled CMOS technologies. [8]  
b) Explain with the help of an example the algorithm to retime a DFG for clock period minimization. [8]
- Q3)** a) Explain systolic array design with an example. [8]  
b) Explain how pipelining and parallel processing can achieve low power. [8]
- Q4)** Write short note on of the following: [18]  
a) Properties of retiming.  
b) Properties and applications of folding.  
c) Systolic design for matrix multiplication.

***P.T.O.***

## SECTION-II

- Q5)** a) Explain with neat schematic 4\*4 Baugh Wooley Multiplier. [8]  
b) Explain parallel multipliers, also state types of it. [8]
- Q6)** a) Explain design of bit serial multiplier using systolic mapping. [8]  
b) Explain the applications of DCM available on FPGAs. How 4X clock can be achieved using DCM. [8]
- Q7)** a) Explain various integrated design resources and routing resources available in FPGAs. Also elaborate how these resources helps in implementing DSP application. [8]  
b) With the help of neat diagrams explain the IO block, CLB slices and block memory of any FPGA. [10]
- Q8)** Write short note on of the following: [16]  
a) Booth Wallace Tree Multiplier.  
b) VLSI design flow for implementation on FPGA.  
c) Floor planning in FPGA.



Total No. of Questions : 8]

SEAT No. :

**P3844**

**[4760] - 308**

[Total No. of Pages :2

**M.E. (E & TC)**

**SIGNAL PROCESSING**

**Acoustics & Speech Processing**

**(2008 Pattern) (Semester - II) (Elective - III) (504510)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the SISO and MIMO models. **[8]**
- b) Explain following characteristics of acoustic channels: **[8]**
- i) Frequency selectivity
  - ii) Reverberation time
  - iii) Linearity
  - iv) Shift-invariance
- Q2)** a) Explain different categories of microphones in detail. **[8]**
- b) Explain the electroacoustical reciprocity method for microphone calibration. **[8]**
- Q3)** a) Explain the problem of acoustic reverberation with respect to absorption coefficients of common building material like-plaster, brick wall, draperies, floor, glass, wood paneling, glazed tiles, rock wool etc. **[8]**
- b) Explain the principle of pressure reciprocity calibration. **[8]**

**P.T.O.**

**Q4)** Write short notes on: **[18]**

- a) Graphic equalizers
- b) Studio design
- c) Acoustic reverberation

**SECTION - II**

**Q5)** a) How human speech production system can be digitally modeled? Explain. **[8]**

- b) How vocal tract can be modeled by an acoustic tube closed at one end. Explain the relation of acoustic tube resonances with the formants. **[8]**

**Q6)** a) Explain the following: **[8]**

- i) Weighted Euclidean distance
- ii) Log-spectral distance
- iii) Cepstral distortion measure
- iv) Geometric distance between two vectors

b) Explain the process of extracting the MFCC features. **[8]**

**Q7)** a) How human speech perception system works? How it can be modeled by a filter bank? **[8]**

- b) How cepstrum can be used to extract the pitch and the formants from a voiced part of the speech signal? **[8]**

**Q8)** Write short notes on: **[18]**

- a) Motor theories of speech perception
- b) Use of cepstrum in speech analysis
- c) Implementation issues in HMM.



Total No. of Questions : 8]

SEAT No. :

**P3845**

**[4760] - 309**

[Total No. of Pages :2

**M.E. (E & TC) (Signal Processing)  
DIGITAL SIGNAL COMPRESSION  
(2008 Pattern) (Semester - II) (Elective -III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain Huffman coding procedure for constructing optima? Explain with code. **[8]**
- b) Explain an algorithm to generate bit stream using EZW Coder with the help of example. **[10]**
- Q2)** a) Give a comparison between lossless and lossy data compression techniques. **[8]**
- b) Consider a source with symbol probabilities  $P(a_1) = 0.6$ ,  $P(a_2) = 0.05$  and  $P(a_3) = 0.35$ . Find the tag using arithmetic coding for a sequence  $a_1, a_2, a_3$ . **[8]**
- Q3)** a) Explain forward and backward quantization with the help of neat block diagram. **[8]**
- b) Explain rate distortion theory? How it minimizes distortion? **[8]**

**P.T.O.**

- Q4)** a) What is Linear Predictive Coding (LPC)? How LPC is used in speech Coding? [8]
- b) Explain in context with video compression the different sampling formats of YCbCr color space. [8]

## SECTION - II

- Q5)** a) What is adaptive quantization? How step size will adaptively change by tracking the statistics of signal? How to select optimal delta? [8]
- b) Explain MPEG-4 in details and list the various key functions of MPEG-4 standard. [8]
- Q6)** a) Explain CLEP Model of Speech Processing in detail. [8]
- b) Explain how to decide the transmission rate if the tolerable distortion is given. [8]
- Q7)** a) Explain Discrete Cosine transform and its properties. How the image compression is achieved by coding of DCT coefficients. [8]
- b) What is MIDI? How this is used in digital music synthesis? [8]
- Q8)** a) Explain image encoding & decoding system based on Wavelet transform. [9]
- b) Explain with help of diagram of motion compensated video compression. [9]



Total No. of Questions : 12]

SEAT No. :

**P3747**

**[4760]-31**

[Total No. of Pages : 4

**M.E. (Civil) (Hydraulics)**  
**IRRIGATION AND DRAINAGE**  
**(2008 Course) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data if necessary.*
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

**SECTION - I**

- Q1) a)** The root zone of a certain soil has a field capacity of 25% permanent wilting point is 8% **[8]**
- i) What is the depth of moisture in the root zone at field capacity and permanent wilting point?
  - ii) How much water is available if the root zone depth is 1.10m?
- The dry weight of soil is 13.75 kN/m<sup>3</sup>.
- b)** Explain the terms: **[6]**
- i) Soil moisture tension.
  - ii) Soil moisture stress.
- c)** Explain the classification of soil water. **[4]**

OR

- Q2) a)** What is the meaning of consumptive use? On what factors does it depend? How would one calculate the consumptive use for a given crop? **[8]**

**P.T.O.**

- b) Explain the terms: [6]
- i) Field capacity
  - ii) Wilting point
  - iii) Available moisture
  - iv) Readily available moisture
- c) Describe important physical and chemical properties of soil which are important from considerations of irrigation. [4]

- Q3)** a) Which are the different methods of Evaporation measurement? Explain any one in detail. [8]
- b) Explain the importance of Evapotranspiration. [8]

OR

- Q4)** a) Explain the terms: [8]
- i) Consumptive Irrigation Requirement (CIR)
  - ii) Net Irrigation Requirement (NIR)
  - iii) Field Irrigation requirement (FIR)
  - iv) Gross Irrigation Requirement (GIR)
- b) Find the Net and Field irrigation Requirement if loss in field application is 10%. Also what is the frequency of irrigation? If [5]
- i) Field capacity = 20%
  - ii) Wilting point = 8%
  - iii) Permissible depletion of available moisture content = 50%

- iv) Root zone depth = 2m
  - v) Dry unit weight of soil = 1400 kg/m<sup>3</sup>
  - vi) Effective rainfall = 20 mm.
  - vii) Daily consumptive use = 5.6 mm
- c) Explain the terms Duty and Delta. Derive a relationship between the two for a given base period. [3]

- Q5)** a) Explain the effects of irrigation management on soil salinity and alkalinity. [8]
- b) Explain the importance of Soil conservation. What are the methods to avoid erosion of soil? [8]

OR

- Q6)** a) Explain the drip irrigation scheme with its Advantage & disadvantages. [8]
- b) Explain the design concept of Drip irrigation scheme. [8]

### SECTION - II

- Q7)** a) Explain the importance of lift irrigation scheme. What are the functions of intake well in scheme? [10]
- b) Write a short note on cost economics in any Irrigation scheme. [8]

OR

- Q8)** a) Explain the design concept of Sprinkler Irrigation scheme. [10]
- b) Explain the Sprinkler Irrigation Method. What are the types of Sprinklers? [8]
- Q9)** a) What are the objectives of command area development? How are these achieved through Command Area Development Programs? [8]
- b) Describe the different on Farm structures practiced in India. [8]

OR

- Q10)a)** Discuss the methods of subsurface irrigation to field. [8]
- b) What are the factors considered while selecting the time of irrigation?[8]
- Q11)a)** Explain the criteria for selection of Canal Outlet capacity. [6]
- b) Explain Kennedy's gauge outlet. [6]
- c) Discuss the criteria for selection of type of canal outlet. [4]

OR

- Q12)a)** In a drainage system, closed drains are placed with their centers 2.20 m below the ground level. The highest position of the drained water table is 1.90 m below the ground level. If the impervious layer is at a depth of 6.00 m below the ground level, determine the spacing of drains. The average annual rainfall is 75 cm. Take  $k = 1 \times 10^{-5}$  m/s. [6]
- b) What are the WMD recommendations for Drainage of Irrigated land?[6]
- c) Discuss the measures for prevention of water logging in irrigated areas.[4]

EEE

Total No. of Questions : 8]

SEAT No. :

**P3846**

**[4760] - 310**

[Total No. of Pages :2

**M.E. (E & TC) (Signal Processing)  
MULTIMEDIA TECHNIQUES  
(2008 Pattern) (Semester - II) (Elective -III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) What are the hardware & software components of a multimedia platform? Using block diagram explain the functions of multimedia development system. [8]
- b) Explain the terms hypertext, hypermedia & multimedia & comment on their interrelation. [8]
- Q2)** a) Draw a neat block diagram of PAL encoder & explain function of each block. [8]
- b) Differentiate between magnetic & optical storage media for multimedia data. State the selection criteria for storage media with typical application. [8]
- Q3)** a) With the help of generic block diagram of video compression explain how the compression is carried out? Discuss briefly the different compression techniques. [8]
- b) Compare NTSC, PAL & SECAM colour TV systems. [8]

***P.T.O.***

**Q4)** Write short notes on any three: **[18]**

- a) Static and Dynamic HTML
- b) Motion Estimation and Compensation
- c) JPEG compression standard for video.
- d) Line-drawing algorithm and circle-drawing algorithm.

### **SECTION - II**

**Q5)** a) What are the different types of data blocks of VOC file format? Compare VOC with WAV? **[8]**

b) Explain with an example the Animation principles of presentation. **[8]**

**Q6)** a) State objective of MPEG-2 standard? How does layered coding improve quality of picture? **[8]**

b) Explain the graphics editing techniques with example. **[8]**

**Q7)** a) Explain the steps in creating 3D animation. **[8]**

b) With help of neat block diagram explain JPEG encoder and decoder. **[8]**

**Q8)** Write short notes on any three: **[18]**

- a) Virtual reality
- b) Salient features of a typical audio editing software
- c) MIDI Audio file making
- d) Multimedia authoring tools.



Total No. of Questions : 8]

SEAT No. :

P4731

[Total No. of Pages : 2

[4760] - 311

M.E. (E & TC) (Signal Processing)

**RADAR & SATELLITE SIGNAL PROCESSING**

(2008 Pattern) (Elective - IV)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Q. 1 & Q. 5 are compulsory.*
- 2) *Solve any two questions from Q. 2, Q. 3 & Q. 4 for Section I.*
- 3) *Solve any two questions from Q. 6, Q. 7 & Q. 8 for Section II.*
- 4) *Answers to the two sections must be written in separate sheets.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Figures to the right indicate full marks.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the basic principles of a radar system with neat block diagram. Give the limitations and applications of radars. [6]
- b) Derive the radar range equation? Explain the factors that affect the maximum range of radar. [8]
- c) Explain basic principle at Pulsed radar system. [4]
- Q2)** a) Explain with neat block diagram the working principle of Moving Target Indicator (MTI) radar. [8]
- b) Comment on various design considerations for antennas used in RADAR communication. [4]
- c) Explain the concept of Doppler effect associated with moving targets with mathematical relevance. [4]
- Q3)** a) With respect to Doppler radar explain the following : [8]
- i) Correlation ii) Convolution
- b) Compare analog filters with digital filters. Explain any one digital filtering technique in detail. [8]

**P.T.O.**

- Q4)** Write short notes on : **[16]**
- a) Blind speeds.
  - b) Continuous Radar.
  - c) Military radars.
  - d) Radar tracking.

**SECTION - II**

- Q5)** a) With respect to satellite communication explain the following multiple access techniques: **[8]**
- i) SDMA.
  - ii) Random Access.
- b) Explain with neat block diagram concept of TTC in satellite communication. **[10]**
- Q6)** a) Comment on various interferences and noise sources in satellite communication system. **[8]**
- b) Explain in brief the concept of link design for Geostationary satellites. **[8]**
- Q7)** a) Explain with neat block diagram & relevant waveforms Quadrature Amplitude Shift Keying (QASK). **[8]**
- b) Obtain the error probabilities for QASK & QPSK. Comment on the results. **[8]**

- Q8)** Write short notes on : **[16]**
- a) Link Budget.
  - b) Minimum Shift Keying (MSK).
  - c) Forms of ALOHA.
  - d) Carrier to Noise (C/N) ratio.



Total No. of Questions : 8]

SEAT No. :

P3847

[Total No. of Pages : 2

[4760] - 312

**M.E. (E & TC) (Signal Processing)**  
**OPERATING SYSTEM AND OPEN SOURCE SYSTEM**  
**(2008 Pattern)(Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the functions of OS. List different types of OS with examples. [8]
- b) Explain virtual memory management with paging and how to reduce fragmentation. [8]
- Q2)** a) Draw and explain process state diagram. List the events pertaining to state transition. [8]
- b) Explain User and Kernel threads. Explain multi threading models. [8]
- Q3)** a) List and explain the CPU scheduling criteria. [8]
- b) Explain with example the Banker's Algorithm for Deadlock Avoidance. [8]

**P.T.O.**

- Q4)** a) Explain in brief following scheduling algorithms with examples : [12]
- i) First Come First Served
  - ii) Round robin
  - iii) Shortest Job first
- b) Write short notes on : [6]
- i) Process Control Block
  - ii) Dining Philosopher's Problem

### SECTION - II

- Q5)** a) List and explain various file operations, file attributes, file types and file access methods. [8]
- b) Explain the concept of I-node with the information stored with it. [8]
- Q6)** a) Compare the system calls and library functions in Linux. [8]
- b) Explain user stack and kernel stack. [8]
- Q7)** a) Explain Linux file system and directory structure. [8]
- b) Explain in brief open source OS Linux and OS X. [8]
- Q8)** a) Explain in brief the basic components of LINUX and its features. [6]
- b) Write short notes on : [12]
- i) Distributed OS.
  - ii) Different ways to have interprocess communication.
  - iii) Super block in Linux.



Total No. of Questions : 8]

SEAT No. :

P4341

[Total No. of Pages : 2

[4760] - 313

M.E. (E & TC) (Signal Processing)

COMPUTER VISION

(2008 Pattern)

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data if required.*

**SECTION - I**

- Q1)** a) Explain following camera specifications : [8]
- i) Depth of field
  - ii) Field of view
- b) An ideal pinhole camera has focal length of 5 mm. Each pixel is (0.02 mm × 0.02 mm) and image principal point is at pixel (200, 200). Pixel coordinates start at (0, 0) in upper left corner of the image. Find internal camera calibration matrix. [8]
- Q2)** a) Explain how we get color image using Bayer filter array. [8]
- b) Explain frame transfer CCD image sensor. [8]
- Q3)** Write short notes on :
- a) Orthographic and Weak orthographic projections: [6]
  - b) Homogeneous coordinates. [6]
  - c) Demosaicing. [6]

**P.T.O.**

- Q4)** a) What is camera matrix? What is its significance? How we can find camera matrix. [10]  
b) Explain internal camera calibration parameters. [6]

**SECTION - II**

- Q5)** a) What is Image rectification? How it is important in stereo matching. [8]  
b) What is disparity? What information we get from disparity? [8]
- Q6)** a) Explain epipolar constraint and ordering constraint in stereo matching. [8]  
b) Compare dense disparity map and sparse disparity map. [8]
- Q7)** a) What is Optical flow? Explain its significance. [8]  
b) Explain Lucas Kanade optical flow algorithm. [8]
- Q8)** Write short notes :
- a) Radon transform. [9]  
b) Feature tracking. [9]



Total No. of Questions : 8]

SEAT No. :

**P4342**

**[4760] - 314**

[Total No. of Pages : 2

**M.E. (E & TC) (Communication Network) (Semester - I)**  
**CODING AND MODULATION TECHNIQUES**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of non-programmable electronic calculator is allowed.*

**SECTION - I**

- Q1)** a) Explain Rayleigh multipath fading phenomenon. **[8]**  
b) Describe Switch/Selection (SS) technique in receive spatial antenna diversity combining techniques. **[8]**
- Q2)** a) Explain MMSE based frequency domain equalization. **[8]**  
b) Describe the principle of multicarrier modulation OFDM in detail. **[8]**
- Q3)** a) Explain motion estimation block in MPEG coding. **[8]**  
b) How DCT is useful compared to other transform techniques for image and video compression. **[8]**
- Q4)** Write short note on : **[18]**  
a) Dolby audio system.  
b) Lossless image compression.  
c) Modulation Impairments.

***P.T.O.***

## SECTION - II

- Q5)** a) Explain man-made system interference in wireless communication. [8]  
b) Write note on link budget of wireless communication system. [8]
- Q6)** a) Explain Rake Finger architecture in wideband CDMA. [8]  
b) Draw and explain hybrid DPCM/DCT video codec model. [8]
- Q7)** a) Explain in brief lossless predictive coding with the help of encoder and decoder. [8]  
b) Determine the compression ratio required to transmit 30fps video at 4CIF (SDTV format) resolution with 4:2:0 YUV sampling over 100kbps channel. [8]
- Q8)** Write short note on : [18]  
a) Handoff technique  
b) Symbol timing recovery  
c) Modulation scheme migration



Total No. of Questions : 8]

SEAT No. :

P4735

[Total No. of Pages : 2

[4760] - 315

M.E. (E & TC) (Communication Networks)

**MODELLING AND SIMULATION OF COMMUNICATION  
NETWORKS  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain how simulation helps in performance studies of the following types of communication systems. **[10]**
- i) Analytically tractable system
  - ii) Analytically tedious system
  - iii) Analytically intractable system
- b) With suitable example compare deterministic and stochastic simulation. **[8]**
- Q2)** a) What are the aspects for selection of sampling frequency for a simulation? What is up sampling and down sampling? Illustrate these concepts with reference to simulation of a communication system. **[8]**
- b) What are PN sequence generators? Why do we need them? What are the components of a PN sequence generator? What are properties of a PN sequence? **[8]**

**P.T.O.**

- Q3)** a) What are various techniques to generate uniformly distributed random numbers. Compare and contrast the following algorithms. [6]  
 i) Mixed congruence algorithm  
 ii) Multiplicative algorithm with prime modulus.
- b) What are the different methods to map uniform random variables to an arbitrary pdf? Explain in detail Inverse Transform Method. [10]
- Q4)** a) What are correlated Gaussian numbers? Why do we need them? Explain any two techniques to generate correlated Gaussian numbers in detail.[8]  
 b) What is effect of fixed point and floating point arithmetic on quantization error? [8]

### SECTION - II

- Q5)** a) Write an algorithm for simple Monte Carlo simulation for QPSK. Assuming AWGN channel, Data symbols at source output are independent and equally probable and No pulse shaping performed at transmitter.[12]  
 b) What is semi analytic simulation technique? Hence suggest modifications in an algorithm for BER estimation for QPSK. [6]
- Q6)** a) Write an algorithm to estimate value of  $\pi$  using Monte Carlo estimation.[8]  
 b) What is an empirical model based on swept tone measurement? Explain Saleh's model in detail. [8]
- Q7)** a) Enlist factors to be considered while simulating nonlinearities. [8]  
 b) What are the categories of a communication channel? What are the various specifications to be considered while simulating a radio channel? Explain multipath fading channel. [8]
- Q8)** a) What is tapped delay line model for LTV system? How various tap gains are generated? [8]  
 b) What are the different techniques used to reduce run-time of the Monte Carlo method? Hence explain importance sampling. [8]



Total No. of Questions : 10]

SEAT No. :

**P3848**

[Total No. of Pages :2

[4760] - 316

**M.E.(E&TC)(Communication Networks)(Elective-I)**

**MICROWAVE AND ANTENNA THEORY**

**( 2008 Course)(Semester-I)(504603)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question Nos. 5 and 10 are compulsory.out of the remaining attempt 2 questions from section I and 2 questions from Section II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain the principle of operation of Travelling wave tube and state its applications. [8]  
b) Discuss the various modes of operation of Gunn diode [8]
- Q2)** a) Enlist the applications of microwaves [8]  
b) Discuss in detail on [8]  
i) Role of MMIC's in microwave circuits  
ii) Microwave circulator
- Q3)** a) Discuss the difficulties faced in using FET, transistor and diode at microwave frequencies [8]  
b) Explain in brief about the construction and applications of PIN diode [8]
- Q4)** a) Explain the working of 4 port directional coupler with its applications. Define coupling factor [8]  
b) Explain the RF structure and working of magnetron with suitable diagram and discuss in brief about  $\pi$  mode of operation [8]
- Q5)** a) Explain the principle of operation of IMPATT diode used at microwave frequencies [8]  
b) Explain the working of reflex klystron oscillator and its different modes [10]

***P.T.O.***

## SECTION - II

- Q6)** a) Discuss the following terms and their significance with respect to any antenna with relevant mathematical expressions [10]
- i) Input impedance
  - ii) Antenna radiation efficiency
  - iii) Antenna gain
  - iv) Half power Beamwidth
  - v) Directivity
- b) Discuss in brief about pyramidal horn antenna [6]
- Q7)** a) Derive suitable expressions for radiation efficiency, gain and directivity of loop antenna. [10]
- b) Explain in brief about the concept of adaptive antenna array [6]
- Q8)** a) A rectangular microstrip antenna with overall dimension  $L=0.906\text{cm}$  and  $W=1.186\text{cm}$  substrate with  $h=0.1588\text{cm}$  and the dielectric constant  $\epsilon_r=2.2$  is operating at 10 GHz, Find [10]
- i) input impedance
  - ii) Position of the input feed points, where the input impedance is  $50\Omega$ .
- b) Discuss in detail about the construction and working of lens antennas. [6]
- Q9)** a) Discuss in detail about the applications of MICs in satellite communication systems [8]
- b) A parabolic dish provides a gain of 75db at 20GHz. Calculate the capture area of the antenna, its 3dB and null beamwidth [8]
- Q10)** Write short notes on the following antennas with respect to radiation pattern, geometrical configuration, principle of operation operating frequency, advantages and applications [18]
- i) Microstrip antenna
  - ii) Parabolic Dish antenna
  - iii) Cassegrain feed antenna



Total No. of Questions : 8]

**P3849**

SEAT No. :

[Total No. of Pages :2

**[4760] - 318**

**M.E.(E&TC)(Communication Networks)**

**Adhoc NETWORKS**

**( 2008 Course)(Elective-I) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each Section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*
- 5) *Figure to right indicates full marks.*

**SECTION-I**

- Q1)** a) List the major advantages of adhoc wireless internet [9]  
b) Enlist various application of adhoc wireless network and explain it's suitability for various applications. [9]
- Q2)** a) Discuss the pro's and con's of a routing protocol that uses GPS information for the adhoc wireless network for search and rescue operation? [8]  
b) Explain the role of routing protocol for providing QoS guarantees for Adhoc wireless network? [8]
- Q3)** a) What are the advantages of reservation based MAC protocols over contention based MAC protocols. [8]  
b) Explain applications where contention based, reservation based and packet scheduling based MAC protocol can be used. [8]
- Q4)** a) What are the design issue of transport layer protocol for adhoc wireless network? classification of transport layer solutions. [8]  
b) Explain the split TCP. [8]

***P.T.O.***

## SECTION - II

- Q5)** a) What are the trade-offs to be considered in the design of power management schemes? [9]  
b) What are the different energy conservation techniques? Explain the device dependent battery management schemes? [9]
- Q6)** a) What are the design issues of multicast routing protocol for Ad hoc wireless network? [8]  
b) Explain preferred link based multicast routing protocol. [8]
- Q7)** a) Explain the application layer attacks and security attacks in ad hoc wireless network? [8]  
b) Explain how security provisioning in ad hoc wireless network differs from that in infrastructure based networks. [8]
- Q8)** a) Explain the classification QoS solutions. [8]  
b) What are the design challenges in providing QoS support in adhoc wireless networks. [8]



Total No. of Questions : 8]

SEAT No. :

**P3748**

[4760]-32

[Total No. of Pages : 2

**M.E. (Civil) (Hydraulic Engg.)**

**COASTAL ENGINEERING**

**(2008 Course) (Semester - II) (Elective - III) (501311)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Derive equation for particle velocity and acceleration. [8]  
b) Define celerity, group velocity, dynamic free surface boundary condition kinematic free surface boundary condition. [8]
- Q2)** a) What is wave diffraction? Write in detail about the phenomenon, causes and effects. [8]  
b) Derive equation for general refraction by bathymetry. [10]
- Q3)** a) Discuss the corrections required to be done in wind velocity measured 10 m above mean sea level ( $U_{10}$ ). [8]  
b) Define: Fully developed sea, Swell, Significant wave height, Zero cross wave period. [8]
- Q4)** Write short notes on (any four): [16]  
a) Wave refraction,  
b) Stokes wave theory,  
c) Wave reflection,  
d) Process of wave generation,  
e) Assumptions made in wave theories.

**P.T.O.**

## SECTION - II

- Q5)** a) List theoretical wave spectra. Write in brief on Pierson - Muskowitz spectrum. [8]  
b) Explain terms in the long term and short term analysis of recorded wave data and significance of the results in the estimation of wave climate.[8]
- Q6)** a) What are the causes of coastal erosion? Differentiate between them.[6]  
b) Discuss cross shore sediment transport. [6]  
c) What are the effects of longshore sediment transport. [6]
- Q7)** a) What are various coastal protection methods? Explain any one of them in detail. [8]  
b) Discuss the environmental parameters which influence the coastal region. [8]
- Q8)** Write short notes on (any four): [16]  
a) Sea wall,  
b) Case study related to coastal erosion in India,  
c) Coastal sediment budget,  
d) Mechanism of sediment transport,  
e) Beach profiles.

*EEE*

Total No. of Questions : 8]

SEAT No. :

P3850

[Total No. of Pages : 2

[4760] - 320

**M.E. (E & TC) (Communication Networks)**  
**NETWORK ARCHITECTURE & DESIGN**  
**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with examples information flows between network analysis, architecture and design. [8]
- b) What do you mean by supportability? Which two main task it focuses? [8]
- Q2)** a) Consider a network project where you can talk to the users. What resources you can use to gather user, application, device and network requirements? Briefly outline a method for gathering and deriving requirements in the absence of user involvement. [8]
- b) Compare and contrast hierarchy and interconnectivity. [8]
- Q3)** a) Describe different types of delays (real time, interactive-burst, interactive-bulk and asynchronous). Give examples of applications or traffic types that have each type of delay. [8]
- b) Give examples of external relationships between each of the following component architectures; addressing/routing, Network management, performance and security. [8]

**P.T.O.**

- Q4)** a) explain the examples of best effort services. [6]  
b) Explain two guidelines for evaluating technologies based on capacity and service plan. [6]  
c) Give an MTBCF requirement of 10000 hours and an MTTR requirement of 6 hours, calculate an availability requirement. [6]

**SECTION - II**

- Q5)** a) What is role of network management mechanism? [8]  
b) Explain any two flow models in detail. [8]
- Q6)** a) Explain in detail Flowspec algorithm and which rules it applies? [8]  
b) Explain role of security component architecture in context to network architecture design. [8]
- Q7)** a) Explain the concept of degrees of hierarchy and interconnectivity in context to routing. [8]  
b) Explain threat analysis with example. [8]
- Q8)** a) For each of the following Queuing mechanisms, give an example of how each would be used within a network. What problem(s) is, each solving mechanism? [10]  
i) RED  
ii) WFQ  
b) Which common design goals one should be included for Network Design? [8]



Total No. of Questions : 10]

SEAT No. :

P3851

[Total No. of Pages : 2

[4760] - 321

**M.E. (E & TC) (Communication Networks)**  
**COMPUTATIONAL ELECTROMAGNETICS**  
**(2008 Pattern) (Semester - I) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three question from Section I and any three questions from SectionII.*
- 2) *Question No 5 and 10 are compulsory.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Answers to the two sections should be written in separate books.*
- 6) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

- Q1)** a) Derive the Maxwell's equations for time varying electric and magnetic fields. [12]
- b) Explain the role of Poynting theorem in electromagnetic fields and explain its significance. [4]
- Q2)** Using Method of Moments ,derive the expression for field distribution using Integral form of potential equations. [16]
- Q3)** a) Given  $H = H_m e^{j(\omega t + \beta z)} a_x$  A/m in free space. Find Electric field intensity and Power radiated. [8]
- b) Compare and contrast FEM and MoM techniques . [8]
- Q4)** a) What are the various numerical techniques to compute electric and magnetic fields? Explain finite difference method with suitable example [12]
- b) Explain in brief the significance of using tetrahedral mask in FDTD? [4]

**P.T.O.**

**Q5)** Write short note on any two.

- a) Applications of computational electromagnetics.
- b) Strengths and weaknesses of Method of Moments.
- c) Yee's algorithm. [18]

**SECTION - II**

**Q6)** a) Derive the expression for Green's function G corresponding to PDE for free space. [10]

b) Explain in detail the time domain modeling of electromechanical devices. [6]

**Q7)** a) Obtain wave equations for an electromagnetic wave in perfect dielectric medium in terms of electric and magnetic fields. [10]

b) Write the expression of Laplace Equation and its significance. [6]

**Q8)** a) Explain FEM analysis and its application with suitable example. [10]

b) What is the advantage of using triangular mask in FEM? [6]

**Q9)** a) Explain the following characteristics with respect to Finite Difference Time Domain

- i) Consistency
- ii) Stability
- iii) Accuracy [12]

b) Discuss various hybrid computational methods . [4]

**Q10)** Write note on any two.

- a) Time domain modeling of electromechanical devices
- b) Green's function
- c) Poisson's equations [18]



Total No. of Questions : 8]

SEAT No. :

P3852

[Total No. of Pages : 2

[4760]-322

M.E. (E & TC) (Communication Networks) (Semester - II)

**WIRED & WIRELESS NETWORKS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the TCP/IP model with protocols at each layer. [8]  
b) Compare and contrast a circuit - switched and packet – switched network. [8]
- Q2)** a) What is ARQ? Explain different techniques of ARQ. [8]  
b) What is VLAN? Explain VLAN with suitable diagram. [8]
- Q3)** a) Explain the following: [9]  
i) I - persistent CSMA.  
ii) Non- persistent CSMA.  
iii) P-persistent CSMA.  
b) What is NAT? How can NAT help in address depletion? [8]
- Q4)** a) How can we distinguish a multicast address in IPv4 addressing? How can we do so in IPv6 addressing? [9]  
b) Explain how and when a bridge, switch, hub and routers are used to expand a network. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain the link state routing in detail. [8]  
b) What is DHCP? How does it work? [8]
- Q6)** a) Compare TCP and UDP. Under what circumstances you will use them. [8]  
b) What is ATM? Give the format of ATM cell and explain. [8]
- Q7)** a) Show the format of typical IP datagram header and explain. [9]  
b) Why is adaptive routing superior to non-adaptive routing? [8]
- Q8)** a) Explain in brief ALOHA, slotted ALOHA mentioning efficiency and advantages. [9]  
b) How does token ring LAN operate? [8]



Total No. of Questions : 8]

SEAT No. :

**P3853**

**[4760] - 323**

[Total No. of Pages : 2

**M.E. (E & TC - Communication Network) (Semester - II)**

**NETWORK TRAFFIC ANALYSIS AND QOS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Define QoS? Explain different types of QoS models? [8]  
b) Explain QoS-oriented communication architectures and protocols? [8]

- Q2)** a) i) What is Bandwidth Allocation? [2]  
ii) Enlist the Bandwidth Reallocation Parameter. [3]  
iii) Explain suitable value for the bandwidth reallocation parameter. [3]  
b) Explain following terms which are related to Traffic Engineering. [8]  
i) Busy Hour  
ii) Busy Hour Calling Rate  
iii) Call Completion Rate  
iv) Grade of Service

- Q3)** a) What are the various congestion control schemes? Explain any one congestion control scheme in detail? [8]  
b) i) What is Congestion? [2]  
ii) Explain concept of congestion with suitable diagram? [6]

***P.T.O.***

- Q4)** Write short notes on : **[18]**
- a) LAN traffic management
  - b) Differentiated Services (DiffServ)
  - c) Multi Protocol Labeling Switching

**SECTION - II**

- Q5)** a) How network traffic is measure in the network like WAN? **[5]**
- b) Why it is necessary to measure network traffic? **[5]**
- c) What are the basic performance metrics of network traffic? **[6]**
- Q6)** Explain traffic management planning and its methodologies also expalin Quality of perception (QoP). **[16]**
- Q7)** a) Explain adaptive communication protocol to provide an enhanced QoP?**[8]**
- b) Expalin Management of Multimedia on the Internet? **[8]**
- Q8)** Expalin following statistical parameters based on Statistical Analysis for real time traffic.
- a) Mean **[4]**
  - b) Median **[4]**
  - c) Standard Deviation **[5]**
  - d) Variance. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P4343**

**[4760] - 324**

[Total No. of Pages :2

**M.E. (E & TC) (Communication Network)**

**WIRELESS SYSTEM DESIGN**

**(2008 Course) (504609) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Derive characteristic impedance equation of a transmission line. What do you mean by G & R? [8]
- b) What is effect on transmission line if not terminated properly? Write equation of input reflection coefficient. [8]
- Q2)** a) What is meaning of a stability circle? How to define stable and unstable region? Describe with output stability circle? [8]
- b) Write difference between conditional and unconditional stability of RF amplifier. [8]
- Q3)** a) Draw block diagram of RF amplifier and describe each block. [8]
- b) Draw and describe basic oscillator model, derive expression of loop gain. [8]
- Q4)** Write short note on any Three of the following: [18]
- a) Multistage amplifier.
  - b) VSWR circle.
  - c) Power gain components in RF amplifier.
  - d) Clap oscillator.

**P.T.O.**

## SECTION - II

- Q5)** a) What is operating principle of YIG resonator? Describe YIG oscillator. [8]  
b) What is dynamic quality factor and dynamic cut off frequency of a varactor diode in VCO? Describe with equations. [8]
- Q6)** a) What do you mean by conversion gain of a mixer? Write its expression and show that it is a function of local oscillator signal. [8]  
b) Derive relation between DSB noise figure and SSB noise figure. [8]
- Q7)** a) What is linearity and 1 dB compression point in mixer. [8]  
b) In a Colpitt oscillator,  $I_{\text{Bias}} = 4 \text{ m A}$ ,  $R = 500 \Omega$ ,  $L = 200 \text{ nH}$ ,  $C_1 = 33 \text{ pF}$ ,  $C_2 = 180 \text{ pF}$ . Calculate  $V_{\text{tank}}$  and oscillating frequency (f). [8]
- Q8)** Write short note on any three of the following: [18]  
a) Demerits of non linear type mixer.  
b) IIP3 in mixer.  
c) Propagation loss.  
d) Link budget.



Total No. of Questions : 8]

SEAT No. :

**P3854**

**[4760] - 325**

[Total No. of Pages :2

**M.E. (E & TC) (Communication Networks)  
WIRELESS SENSOR NETWORK  
(2008 Pattern) (Semester - II) (Elective -III) (504610)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer three questions from Section -I and three questions from Section-II.*
- 3) *Answer to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain in detail different applications of Wireless Sensor Network. [8]  
b) What are the different network performance objectives? Explain any three in detail. [8]
- Q2)** a) Enlist the various wireless data networks. Explain any three in detail. [8]  
b) Write short note on physical layer in Wireless Sensor Networks. [8]
- Q3)** a) Explain in detail different Medium access control techniques. [8]  
b) Elaborate a wireless sensor network employing cluster tree architecture. [8]
- Q4)** Write a short note on (any 3). [18]  
a) Mediation Device  
b) System Analysis & Simulation  
c) Partitioning Decision  
d) Transducer Interfaces

**P.T.O.**

## SECTION - II

- Q5)** a) Explain the various power sources used in wireless sensor network. [8]  
b) What are the different types of voltage converters? Explain the voltage conversion strategy. [8]
- Q6)** a) Elaborate the antenna in terms of: [8]  
i) Characteristics  
ii) Efficiency & antenna placement  
iii) Bandwidth  
iv) Antenna Design choice  
b) Explain in detail the Victim circuits in receivers. [8]
- Q7)** a) Explain coupling mechanism in detail. What are the different methods used to avoid coupling problems? [8]  
b) What are the different methods used to minimize the ESD problems?[8]
- Q8)** Write short notes on (any 3) [18]  
a) Self-Interference  
b) Detective/Corrective Techniques.  
c) Physical Properties of Electrostatic disclosure  
d) IEEE 802.15.4 low rate WPAN standard.



Total No. of Questions : 8]

SEAT No. :

**P4344**

**[4760] - 326**

[Total No. of Pages :2

**M.E. (E& TC) (Communication Network)**

**MOBILE COMPUTING**

**(2008 Course) (Semester - II) (Elective - III) (504610)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Discuss case studies of secure mobile application development? [8]  
b) What are the fundamental of wireless mark-up language WML script application? [8]
- Q2)** a) Explain the authentication process in 802.11 framework? [8]  
b) What are the various issues to be considered in designing of the WLAN environment? [8]
- Q3)** a) Explain 4G mobile telephone technology? [8]  
b) Explain GPRS transmission plane protocol stack? [8]
- Q4)** Write a short note on [18]  
a) 1-G technology  
b) GSM architectures

***P.T.O.***

## SECTION - II

- Q5)** a) How do you enhance GSM architecture to use it for GPRS? [8]  
b) Explain the three tier architecture of mobile computing? [8]
- Q6)** a) Discuss MIMO in details? [8]  
b) Explain dynamic channel allocation? [8]
- Q7)** a) Discuss the design issues in personal wireless system? [8]  
b) Differentiate 2 G & 3G. [8]
- Q8)** Write a short note on- [18]  
a) Bluetooth and it's protocol stack.  
b) CDMA



Total No. of Questions : 8]

SEAT No. :

**P3855**

**[4760] - 327**

[Total No. of Pages :2

**M.E. (E & TC) (Communication Networks)**

**NETWORK SECURITY**

**(2008 Pattern) (Semester -II) (Elective - IV)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from section -I.*
- 2) *Solve any three questions from section -II.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain MAC protocol used in Digital cellular systems such as GSM in detail. **[8]**
- b) List the entities of mobile IP and describe data transfer from a mobile node to a fixed node and vice versa. Why and where is encapsulation needed? **[8]**
- Q2)** a) How is mobility restricted using WLANs? What additional elements are needed for roaming between networks, how and where can WLANs support roaming? **[8]**
- b) Discuss Power Aware routing metrics in relation to Mobile Ad-hoc networks. **[8]**
- Q3)** a) What are the disadvantages of the binary exponential back-off mechanism used in MACA and how they are overcome in MACAW? Explain with suitable example topology why exposed node should not be allowed to transmit in MACAW. **[8]**

**P.T.O.**

- b) Classify Routing protocols for Mobile Ad hoc networks (MANETs). Explain DSDV (Destination Sequenced Distance Vector) routing protocol in detail. Why DSDV protocol is not scalable in limited bandwidth, highly dynamic ad hoc networks? [8]

**Q4)** Write Short Notes (Any three). [18]

- a) IEEE 802.11 Infrastructure networks vs Ad hoc network
- b) Bluetooth
- c) Snooping TCP
- d) Issues in designing a sensor network.

### SECTION - II

**Q5)** a) Give detailed classification of Security Services, Security Mechanisms and Security Attacks. [8]

- b) What is the purpose of the S-Boxes in DES? Explain the S-Box design criteria. Explain the strengths of DES in brief. [8]

**Q6)** a) What requirements should a Digital Signature scheme satisfy? What are the properties a digital signature should have? What are some threats associated with a direct digital signature scheme? [8]

- b) What properties a hash function H must have for message authentication? Explain simple hash function. [8]

**Q7)** a) Explain the security attacks briefly. [4]

- b) What is CIA in network Security? Explain Briefly. [4]

c) Draw and explain the model for Internet security. [4]

- d) Explain the concept of key distribution in cryptography. [4]

**Q8)** a) Explain the protocol “SET” in web security. [4]

- b) Explain the RSA algorithm in detail. [6]

c) Explain the IPsec in detail. [4]

- d) Explain the SSL in detail. [4]



Total No. of Questions : 10]

SEAT No. :

P4345

[Total No. of Pages : 2

[4760]-328

**M.E. (E & TC) (Communication Network)**

**SOFTWARE RADIO**

**(2008 Pattern) (Semester - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the concept and need of Software radio? List the advantages of software defined radio over existing wireless technologies. [8]  
b) How is software radio different than other radios? Explain the relation between cognitive radio and software radio. [8]
- Q2)** a) Explain how smart selection of ADC/DAC enables better design of software radio? [8]  
b) Explain the relation of software communications architecture (SCA) in relation with Software defined radio. [8]
- Q3)** a) What are different RF receivers used in software radio? [8]  
b) Draw and explain the hardware architecture of Software radio. [8]
- Q4)** a) What is Joint tactical radio system? Explain architecture. [6]  
b) With reference to JTRS explain describe its Functional View, and Networking Overview. [12]

**P.T.O.**

- Q5)** a) What factors should be considered while selecting the RTOS in development of Software radio. [8]  
b) What are different development tools used in Software radio. [8]

**SECTION - II**

- Q6)** a) What is smart antenna? Explain any one architecture of antenna. [8]  
b) State adaptive algorithms used in smart antenna. Explain any one in brief. [8]

- Q7)** a) What is SDR Forum? Explain the tasks carried out by this forum. [8]  
b) What is Speakeasy system? Describe. [8]

- Q8)** a) Why is it important for the RF components in an antenna array to have uniform characteristics across the channel? [8]  
b) What are the factors to be considered while selecting the antenna for SDR? [8]

- Q9)** a) Explain the implementation of low cost SDR platform? [8]  
b) Explain the parameters to be considered for selecting a processor for SDR application [8]

- Q10)** Write short notes on (Any Three) : [18]  
a) CORBA  
b) SDR hardware development issues  
c) Military applications of SDR  
d) Future of Software radio  
e) RTOS in SDR



Total No. of Questions : 8]

SEAT No. :

P3856

[Total No. of Pages : 2

[4760] - 329

**M.E. (Electronics & Telecommunication) (Communication Networks)**

**NEURAL NETWORKS IN COMMUNICATION**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*
- 5) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Draw and explain the McCulloch-Pitts neuron architecture. Generate the output of Exclusive-OR logic function using McCulloch-Pitts neuron. [10]
- b) Discuss the Delta Learning rule. State the error function for Delta rule. [8]
- Q2)** a) Explain architecture, algorithm and the application procedure of the perceptron net. [8]
- b) Develop a perceptron for the AND function with bipolar inputs and targets. [8]
- Q3)** a) Write short notes on automatic language identification. [8]
- b) Explain the discrete Hopfield net with its architecture. [8]

**P.T.O.**

- Q4)** a) With architecture describe the training procedure adopted for neocognitron net. [8]  
b) Explain in detail ATM traffic control using Neural Network. [8]

**SECTION - II**

- Q5)** a) Describe in detail the architecture and training algorithm used in the back propagation network. [8]  
b) Describe in detail the Neural network for switching. [8]
- Q6)** a) Explain the algorithm of the probabilistic neural net with architecture. [8]  
b) Describe in detail the applications of neural network in Telecommunications. [8]
- Q7)** a) Why self organizing neural net is called the topology preserving maps? With architecture, explain the training algorithm used in Kohonen self organizing feature map. [8]  
b) Write short notes on adaptive resonance theory network. [8]
- Q8)** Write short notes on (ANY THREE) [18]  
a) Support Vector machine.  
b) Neural Network channel equalization.  
c) BAM network.  
d) Optical neural network.  
e) Simulated annealing.



Total No. of Questions : 8]

SEAT No. :

**P4748**

[Total No. of Pages : 2

[4760] - 33

**M.E. (Civil) (Hydraulics) (Elective - III)**

**WATER MANAGEMENT & CONVEYANCE SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain point source and non-point source of waste inputs to water systems. [8]
- b) A weir is to be constructed on course sand and to retain water to a depth of 5 m. If the sheet pile on the downstream side of the apron as a depth of 3 m, what should be the length of apron so that safe exit gradient becomes 0.165? [8]
- Q2)** a) Describe in detail about the pollutant transport mechanism. What are the major obstructions faced in this mechanism? [8]
- b) What do you mean by the diffusion and dispersion regime? Describe them in details. [8]
- Q3)** a) What are the various National water problems ? [8]
- b) Discuss in brief [8]
- i) Dissolve oxygen model
  - ii) Toxic substances and heat management in water management.

**P.T.O.**

- Q4)** a) Discuss in detail about reservoir analysis [9]  
b) What are the impacts of water conservation practices on Municipal Service Infrastructure. [9]

**SECTION - II**

- Q5)** a) What meteorological data is required for drainage and runoff control?[8]  
b) Determine the quantity of bed load transported through trapezoidal channel by using M-P-M equation with the following data. [10]
- i) Depth of flow = 2.2 m
  - ii) Width of channel = 2.8 m
  - iii) Bed slope 1:4000
  - iv) Uniform size of bed material = 0.33 mm
  - v) Side slope = 0.5 (H):1.0 (V)
  - vi) Manning's constant. = 0.0211
- Q6)** a) What do you mean by design elements. Discuss in detail about that. [8]  
b) Discuss in detail about urban drainage and runoff control. What are the challenges involved with urban drainage system. [8]
- Q7)** a) Do you think the Global water problems and National water problems are same. If not then justify your answer with valid logic. [8]  
b) Draw the sketch of diversion head works and show all the important parts of it. [8]
- Q8)** a) Draw a neat sketch of hydro electric power plant and label all the parts.[8]  
b) What are the major economic aspects and decision making related to the growth of hydro electric power plant. Discuss them in brief. [8]



Total No. of Questions : 8]

SEAT No. :

**P4575**

**[4760]-330**

[Total No. of Pages : 2

**M.E. (E & TC) (Communication Networks)**

**HARDWARE PLATFORMS FOR NETWORKING APPLICATION**

**(2008 Course) (Semester - II) (Elective -IV) (504611)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** With neat suitable diagram, explain network processor architecture. **[10]**

b) What are the limitations of conventional packet processing techniques and explain in detail. **[8]**

**Q2) a)** Explain with neat diagram IBM processor architecture. **[10]**

b) Describe the following challenges in AMCC family of network processors: **[8]**

i) Physical

ii) Performance

iii) Flexibility

iv) Scalability & Reuse.

**Q3) a)** With neat diagram explain the working of Intel network processor architecture. **[8]**

b) Compare Harvard architecture and Von Neuman architecture. **[8]**

***P.T.O.***

- Q4)** a) List applications of network processors. Explain any one with case study. [8]
- b) Explain general network processor architecture in detail with neat diagram. [8]

**SECTION - II**

- Q5)** a) Explain the features and benefits of LPC 2378 processor. [10]
- b) Explain network processor problem in task scheduling. [8]
- Q6)** a) Describe with suitable block diagram the architecture of LPC 2378 processor. [10]
- b) Explain memory Map of LPC 2378 processor incorporating Ethernet application. [8]
- Q7)** a) Describe packet processing. Explain following performance consideration in packet processing: [8]
- i) Memory Bandwidth.
- ii) Concurrency.
- b) Explain multi-threading in network processors. [8]
- Q8)** Write a short notes on (any two): [16]
- a) Search engines.
- b) Switch fabrics.
- c) Storage N/W processors.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3964**

**[4760] - 331**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital System)**

**MICROELECTRONICS**

**(2008 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any Three Questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable electronic calculators is allowed.*

**SECTION - I**

- Q1)** a) Explain CMOS Inverter and its voltage transfer characteristics indicating various regions of operation. [8]
- b) Define : Feature size and process technology. Draw the complementary CMOS logic of the following circuits. [8]
- i) Two input AND gate.
  - ii) Two input OR gate.
  - iii) Two input XOR gate.
- Q2)** a) Derive the expressions for static and dynamic power dissipations in CMOS inverter. [8]
- b) Draw the stick diagram and layout for 3 Input NAND gate. Estimate cell width and height. [8]
- Q3)** a) Design 4:1 Multiplexer using transmission gate. Compare this schematic with conventional gates. [8]
- b) Which are the various CMOS parasitics? [8]
- Q4)** Write short notes on (any three) : [18]
- a) Clock distribution.
  - b) Ultra fast VLSI circuits.
  - c) Domino Logic.
  - d) I/O architectures.

***P.T.O.***

## SECTION - II

- Q5)** a) What are the different types of attributes used in VHDL. List them with appropriate example. [8]  
b) What is the difference between signals and variables? [8]
- Q6)** a) Write VHDL code for FSM which detects sequence "111" consider overlap. [8]  
b) Explain MOS implementation of a current sink along with its I-V characteristics. [8]
- Q7)** a) What is clock skew? Explain types of physical clocking networks. [8]  
b) What do you mean by data types? Explain various data types used in VHDL. [8]
- Q8)** Write short note on (any three) : [18]  
a) Synthesizable and non-synthesizable VHDL constructs.  
b) Cascode amplifier.  
c) Packages.  
d) MOS switch.



Total No. of Questions : 8]

SEAT No. :

**P4346**

**[4760] - 332**

[Total No. of Pages :2

**M.E. (Electronics - Digital Systems)  
SIGNAL PROCESSING ARCHITECTURES  
(2008 Course) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections must be written in separate answer papers.*
- 2) *Answer any three questions from each sections.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Determine the convolution using overlap add and overlap save method the given two sequences  $x(n) = \{2, 3, 1, 1, -2, 3, 4\}$   $h(n) = \{1, 3, 5, 3\}$  [8]
- b) Compute DFT of a sequence  $x(n) = (1/2)^{2n} u(n)$  for  $N = 8$  using DIT FFT algorithm. [8]
- Q2)** a) With reference to DSP processor explain the following: [8]
- i) Hardware multiplier and accumulator
  - ii) Special instructions
- b) Explain in detail Chebyshev type - 1 and type - 2 filter in detail. Compare Butterworth and Chebyshev approximations. [8]
- Q3)** a) What is linear phase filter? What are the necessary conditions for the linear phase filters? How FIR filter  $y(n) = x(n) - x(n-2)$  gives linear phase? [8]
- b) With respect to DSP processor explain. [8]
- i) Barrel shifter
  - ii) Cache memory
  - iii) DAG
  - iv) MAC/Program sequence

**P.T.O.**

**Q4)** Write short note on: **[18]**

- a) Signal flow graph.
- b) Data flow graph.
- c) Retiming techniques

**SECTION - II**

**Q5) a)** What is fixed point and floating point processing with reference to digital signal processing? How to convert floating point algorithm into fixed point algorithm? Why? **[8]**

b) What are important features of TMS320C54XX DSP processor? Explain addressing modes of TMS320C54XX. **[8]**

**Q6) a)** What are functional blocks present in TMS 320C54XX. Explain the function performed by each block. **[8]**

b) Justify that the pipelining increases the performance of DSP processor with suitable example. **[8]**

**Q7) a)** What are quadrature mirror filters? How do they provide perfect reconstruction? Support your answer mathematically. **[10]**

b) List the number of pipeline stages used in TMS 320C54XX and TMS 320C67XX. **[6]**

**Q8)** Write short notes on: **[18]**

- a) Errors introduced due to quantization process.
- b) QMF filter banks.
- c) IIR filter design using DSP processor.



Total No. of Questions : 8]

SEAT No. :

**P4576**

**[4760] - 333**

[Total No. of Pages :2

**M.E. (Electronics) (Digital Systems)  
FAULT TOLERANT SYSTEM DESIGN**

**(504197) (2008 Pattern) (Elective - I) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Classify simulation Techniques. Explain compiled simulation Technique with reference to unknown logic value. [8]
- b) Compare functional modeling at logic and register level. [8]
- Q2)** a) Explain the following terms: [10]
- i) Fault detection and redundancy.
  - ii) Fault equivalence and fault location.
- b) Compare single stuck and Bridging fault model. [8]
- Q3)** a) With neat diagram, explain the working of serial fault simulation technique. [8]
- b) Compare Deductive and concurrent fault simulation techniques. [8]
- Q4)** Write a short notes on: [16]
- a) Hazord detection.
  - b) Statistical fault Analysis.

**P.T.O.**

## SECTION - II

- Q5)** a) With neat block diagram, explain the working principle of conventional compression techniques. [8]
- b) Explain in detail, the concept of signature analyser in compression techniques. Give one example. [10]
- Q6)** a) Differentiate with neat diagram the working principle of checking and self checking circuits. [8]
- b) Write a brief note explaining the working principle of self checking Berger code. [8]
- Q7)** a) What is the working principle of self testing circuits for memory Testing. [8]
- b) Write a brief note on the working principle of Automatic Test pattern generation. [8]
- Q8)** Write a short note on: [16]
- a) Built in self Test.
- b) PLA Testing.



Total No. of Questions : 8]

SEAT No. :

**P3965**

**[4760]-334**

[Total No. of Pages : 2

**M.E. (E & TC) (Digital System)**  
**ADVANCED DIGITAL SYSTEM DESIGN**  
**(2008 Course) (Semester - I) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are the methods of control unit implementation? Explain any one method with necessary code, specifications and block diagram. [10]
- b) Discuss in detail the design issues of RISC & CISC. [6]
- Q2)** a) What do you mean by self starting and self correcting sequence generator? Design a self correcting sequence generator in which output y is '1', if the input sequence of 11001 occurs at consecutive clock pulses, otherwise y = '0'. [8]
- b) Explain with the neat diagram the CPU architecture of RISC. Also compare it with CISC in all respects. [8]
- Q3)** a) What is the clock skew? What are the possible problems caused by clock skew? What are the solutions for these problems? [8]
- b) Explain in depth what is digital signature. What is the use of signature analysis? Explain with the suitable example. [8]

**P.T.O.**

**Q4)** Write short notes (any 3):

[18]

- a) CAD tools
- b) Built in Logic Block Observer (BILBO)
- c) Signature analysis
- d) Switch bouncing

**SECTION - II**

**Q5)** a) Explain how the BIST scheme is implemented for sequential circuits with necessary block diagram. [8]

b) What is the boundary scan technique? Explain its application with neat diagram. [8]

**Q6)** a) Explain with the suitable example why a finite length of transmission line is not to be terminated other than  $Z_0$ ? If it is terminated in other than  $Z_0$  what will happen? [8]

b) Implement the Boolean function  $F = X_1 X_2 + X_1 X_3$  [8]

i) Which type of Hazards exists in this circuit.

ii) Derive the Hazard free circuit of above Boolean function.

**Q7)** a) What is the system reliability and how it is measured? Explain how it is calculated for digital system with 'n' components, each with different failure rate. [8]

b) Explain in detail the need of network design tool? Explain its structure. [8]

**Q8)** Write short notes (any 3):

[18]

- a) IEEE 486 bus
- b) System integrity
- c) Scan path technique
- d) PR BSG

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4347**

**[4760]-335**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital Systems)**  
**WIRELESS & MOBILE TECHNOLOGIES**  
**(2008 Course) (Elective-I) (Semester-I) (504197)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule and electronic calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) How is synchronization achieved in GSM? Who is responsible for Synchronization? Why is it important? [9]  
b) Explain the VLR/HLR database approach used in GSM. How does this approach limit the scalability among users, especially moving users? [8]
- Q2)** a) If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 kHz RF bandwidth, find: [8]  
i) the number of duplex channels.  
ii) the total number of channels per cell site, if  $n=4$  cell reuse is used.  
b) What are the causes of Co-channel Interference in the Cellular Mobile communication? Why is this effect the most pre-dominant in Cellular communication? What are the limitations caused by this interference in cellular communications? [9]
- Q3)** a) If a mobile is located 7 km away from a base station and uses a vertical  $\lambda/4$  monopole antenna with a gain of 2.55 dB to receive cellular radio signals. The E-field at 1 km from the transmitter is measured to be  $10^{-3}$  V/m. The carrier frequency used for this system is 900 MHz.  
i) Find the length and effective aperture of the receiving antenna.  
ii) Find the received power at the mobile using the two-ray ground reflection model assuming the height of the transmitting antenna is 60m and the receiving antenna is 2m above ground. [8]

**P.T.O.**

- b) Explain how propagation Loss is affected by [8]  
i) Smooth Terrain,  
ii) Rough Terrain.

- Q4)** a) What are the limitations of GSM cell in terms of diameter and capacity for traditional GSM? How can the capacity be increased? [8]  
b) How is subscriber authentication and data Encryption done in GSM? [8]

## SECTION-II

- Q5)** a) Explain the problem of hidden and exposed terminals. Also explain near-far effect. [8]  
b) Explain how a change of foreign agent is handled with the optimized mobile IP. [8]

- Q6)** a) Explain the free space propagation Model and derive an expression for the received power. Make suitable assumptions as necessary. [8]  
b) Explain the following types of reflection: [9]  
i) Specular Reflection,  
ii) Diffuse Reflection,  
iii) Diffraction.

- Q7)** a) Define components and interfaces of the WAP architecture. [9]  
b) What are the differences between IEEE 802.11 and HIPERLAN standards? Discuss. [8]

- Q8)** a) Explain Traffic Channels (TCH) & Control Channels (CCH) in GSM. What are the different types of CCH in GSM? [10]  
b) Explain how the mobile IP packet delivery occurs to and from the mobile node. Explain what is encapsulation. [7]



Total No. of Questions : 8]

SEAT No. :

**P3966**

**[4760] - 336**

[Total No. of Pages : 2

**M.E. (E&TC) (Digital Systems)**  
**MACHINE INTELLIGENCE**  
**(2008 Pattern) (Revised Course)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any three questions from each section*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat digrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the concept of adaptive network based fuzzy inference. [8]  
b) Develop graphically membership function to describe the linguistic variables “cold”, “warm” and ‘ Hot”. The temp. range is 0 to 100 degrees. Use trapezoidal triangular shaped membership functions. [8]
- Q2)** a) What are the different clustering algorithm? Explain K-mean clustering algorithm in detail. [8]  
b) Draw the block diagram for the inverse learning method. Explain in detail the training and application phase of the ANFIS controller. [8]
- Q3)** a) Discuss in detail the composition of Fuzzy relation. Explain max. min. composition and max. product composition. [8]  
b) With suitable example discuss Mamdani fuzzy inference system. [8]
- Q4)** Write short note on (Any three) [18]  
a) Fuzzy filtered neural network.  
b) Tsukamoto model  
c) Derivative based optimization.  
d) Least squares method for system identification.

***P.T.O.***

## SECTION - II

- Q5)** a) What type of problems can a single layer perceptron solve? Give an example using 2-d pattern space. [8]
- b) What is radial basis function network? What are the different architecture and learning methods of radial basis function network? [8]
- Q6)** a) What is feed forward network? With suitable diagram explain backpropagation learning rule. [8]
- b) What are applications of kohonen's self organizing networks? Mention the different steps involved in training of Kohonen's self organizing network. [8]
- Q7)** a) What is Unsupervised learning? Write a short note on competitive learning. [8]
- b) What do you mean by principal component Analysis compare principal component Analysis and regression analysis. [8]
- Q8)** Write short note on (Any three) [18]
- a) Continuous and Binary Hopfield
- b) Reinforcement learning.
- c) Competitive learning.
- d) Self organizing network.



Total No. of Questions : 8]

SEAT No. :

**P3967**

**[4760] - 337**

[Total No. of Pages : 2

**M.E. (Electronics)**

**ADVANCED COMPUTING ARCHITECTURES**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the hardware, software & programming elements of a modern computer system in the context of parallel processing. [8]
- b) Explain the operational model of SIMD computer. [8]
- Q2)** a) Explain with neat diagram the shared memory multiprocessor models UMA, NUMA & COMA. [8]
- b) Explain the architecture of a vector super computer. [8]
- Q3)** a) What do you mean by Data Dependence? Define different types of data dependence. Explain resource dependence. [8]
- b) Explain the different levels of parallelism in program execution. [8]
- Q4)** a) Compare control flow computer with data flow computer. Explain the architecture of data flow computer. [10]
- b) What is dynamic connection network? Explain in detail crossbar network. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Write short note on multiport memory organization. [8]  
b) Compare the complex instruction set computer and reduced instruction set computer architecture. [8]
- Q6)** a) What is symbolic processor? State & explain the characteristics of a symbolic processor. [8]  
b) What is paging and segmentation? How these concepts are used to implement virtual memory? [8]
- Q7)** a) What is cache? Explain the physical address cache and virtual address cache. [8]  
b) Explain the terms reservation tables and latency analysis associated with nonlinear pipeline processor. [8]
- Q8)** a) What is pipelining? Explain the following terms related to instruction pipeline design: [8]  
i) Instruction prefetching &  
ii) Branch handling techniques  
b) Write short note on any two: [10]  
i) Superscalar processor,  
ii) VLIW architecture,  
iii) Set Associative cache.



Total No. of Questions : 10]

SEAT No. :

**P3968**

**[4760] - 338**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital Systems) (Theory)**

**MEMORY TECHNOLOGIES**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers any three questions from each section.*
- 2) *Answers to the two section should be written in separate book.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to right indicate full marks.*

**SECTION - I**

- Q1)** a) Draw and explain various SRAM circuit elements. [4]  
b) Draw and explain in detail the BiCMOS Technology. [6]  
c) Draw the functional block diagram of typical application specific DRAM. [6]
- Q2)** a) Explain with a diagram a simple trench cell and stacked capacitor cell structure DRAM. [8]  
b) Explain high speed DRAM in detail with the help of functional block diagram. [8]
- Q3)** a) Explain with functional block diagram CMOS PROM. [10]  
b) Explain with a diagram floating gate EPROM cell. [6]
- Q4)** a) Explain in detail OTP EPROMs. [8]  
b) Explain in detail nonvolatile SRAM. [8]
- Q5)** Write short notes (Any Three) [18]  
a) Single stack at fault Model  
b) Pattern Sensitive fault  
c) Non volatile memory modeling and Testing  
d) IDDQ Fault modeling and Testing

**P.T.O.**

## SECTION - II

- Q6)** a) Explain in detail RAM fault modeling. [8]  
b) What are the various types of radiation and corresponding transistor/circuit level parameter degradation and failures. [8]
- Q7)** a) Explain in detail radiation hardening techniques and design issues in a semiconductor memory. [8]  
b) Explain in detail assembly and packaging related failures. [8]
- Q8)** a) Explain in detail issues related to DRAM reliability. [8]  
b) Explain in detail the design consideration for reliability. [8]
- Q9)** a) Compare MRAM, SRAM, DRAM, EEPROM and FRAM. [8]  
b) List most commonly used memory packages for both insertion and surface mounting technologies. [8]
- Q10)** Write short notes (Any Three) : [18]  
a) Ananlog memories.  
b) FRAM's reliability issues and radiation effects.  
c) Digital tablet PC.  
d) Different types of high density memory packaging techniques.



Total No. of Questions : 8]

SEAT No. :

P3857

[Total No. of Pages : 2

[4760]-339

M.E. Electronics (Digital Systems) (Semester - II)

**EMBEDDED SYSTEMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What are the design metric? Giving example state about how these metrics are achieved. [8]
- b) Compare: [10]
- i) ASIC
  - ii) CPLD
  - iii) FPGA
- Q2)** a) What are advantages of ARM processor in Embedded System design? Comment on FIVE stage ARM-9 Processor. [10]
- b) What do you mean by exception in ARM? Briefly state the activities during exception. [6]
- Q3)** a) What are the selection criterion of Embedded operating System'? Justify [8]
- b) Draw CAN controller and data packet format. [8]
- Q4)** a) What do you mean by thumb instruction mode of ARM processor. [6]
- b) What are the software development tools used for Embedded System Design and Justify tools suitability. [10]

**P.T.O.**

## SECTION - II

- Q5)** a) Giving the example state the software development life cycle for Embedded System. [8]  
b) Explain the software architecture of embedded system. [8]
- Q6)** a) How semaphore is used for priority inversion discuss briefly. [8]  
b) Compare the Embedded System and real time operating system. [8]
- Q7)** a) What is scheduler in RTOS. Explain any one method for scheduling. [8]  
b) Justify the utility of debugger and emulator. [8]
- Q8)** a) What are the feature of  $\mu$ COS-II for Embedded System. Give its utility. [10]  
b) Give memory management organization in  $\mu$ COS-II. [8]



Total No. of Questions : 8]

SEAT No. :

P4348

[Total No. of Pages : 2

[4760]-340

**M.E. (Electronics) (Digital System)**  
**COMMUNICATION NETWORK AND SECURITY**  
**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) List the entities of mobile IP and describe data transfer from a mobile node to a fixed node and vice versa. Why and where is encapsulation needed? **[8]**
- b) Compare and Contrast Infrastructure based 802.11 LANs and ad-hoc based 802.11 LANs. Give example situations where one type of network is preferred to the other. **[8]**
- Q2)** a) Discuss the issues in designing Routing Protocols for MANETs? Discuss the classification of them in brief. **[8]**
- b) What is the basic purpose of DHCP? Name the entities of DHCP. How can DHCP be used for mobility and support of Mobile IP? **[8]**
- Q3)** a) Explain the concept of data dissemination and data gathering in Wireless Sensor Network (WSN). **[8]**
- b) Is a table-driven routing protocol suitable for high-mobility environments? Discuss the differences in topology reorganization in DSDV and CGSR routing protocols. **[8]**

**P.T.O.**

- Q4)** Write short notes (Any Three) : **[18]**
- a) IPv6 and mobility.
  - b) Bluetooth
  - c) Snooping TCP.
  - d) IEEE 802.11 infrastructure networks v/s Ad hoc networks.

**SECTION - II**

- Q5)** a) Explain IDEA encryption algorithm in detail. **[8]**  
b) What requirements should a Digital Signature scheme satisfy? What are the properties a digital signature should have? What are some threats associated with a direct digital signature scheme? **[8]**
- Q6)** a) What is the purpose of the S-Boxes in DES? Explain the S-Box design criteria. Explain the strengths of DES in brief. **[8]**  
b) What properties a hash function H must have for message authentication? Explain simple hash function. **[8]**
- Q7)** a) What are three broad categories of applications of Public Key Cryptosystems? What requirements must a Public-Key Cryptosystem fulfill to be a secure algorithm? **[8]**  
b) Explain the principle of RSA Algorithm and compare it with Diffie-Hellman Algorithm. **[8]**
- Q8)** Write short notes (Any Three) : **[18]**
- a) IPsec.
  - b) Secure Electronic Transaction(SET)
  - c) Encapsulating Security Payload (ESP).
  - d) S/MIME.



Total No. of Questions : 8]

SEAT No. :

**P3969**

**[4760]-341**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital Systems)**  
**IMAGE PROCESSING AND PATTERN RECOGNITION**  
**(2008 Revised Course) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections must be written in separate answer books.*
- 3) *Use of scientific calculator is allowed.*
- 4) *Assume suitable data wherever required.*
- 5) *Figures to the right indicate full marks.*

**SECTION-I**

- Q1)** a) Write the algorithm to implement the gray scale transformation that will enhance the intensity levels of the pixels if it is in the range of 20 to 50. The intensity levels of the other pixels may be decreased. Explain the action of this transformation. **[10]**
- b) What is log transformation? How will you enhance the x-ray image? How will you select a threshold for image binarization? **[8]**
- Q2)** a) Write Sobel edge operators to detect the edges in the horizontal and diagonal direction. What is the meaning of the gradient? How will you select a threshold to detect the edges? **[8]**
- b) Why is a Gaussian filter used before applying a Laplacian? What is a double derivative? Derive the mask for Laplacian operator. Why is a zero crossing used for edge detection? **[8]**
- Q3)** a) How will you implement a smoothing filter? What is the advantage of using a higher size mask? **[8]**
- b) Explain Histogram equalization method. How will you obtain the histogram for any image? If histogram is crowded in the higher values of intensity, what is your conclusion? **[8]**

**P.T.O.**

- Q4)** a) What is the nature of pdf for Exponentially distributed random variable? Write the formula for Normal distribution pdf. [8]
- b) Explain the low pass filtering and high pass filtering using a 3\*3 mask. [8]

## SECTION-II

- Q5)** a) Two unfair dice are thrown simultaneously. One has the probability of getting face of 5 as  $2/7$  and other has a probability of getting face value of 3 as  $2/7$ . What is the probability of getting a sum of 8 on the two dice faces. [8]
- b) Explain the maximum likelihood estimator for estimation of parameters from the data samples. [8]
- Q6)** a) Explain the leaving one out technique for estimation of error rates. [8]
- b) Describe any one method for estimation of error rates. Compare it with other methods. [8]
- Q7)** a) How will you decide the decision boundary for two class classification? What are outliers? [8]
- b) What is Nearest Neighbor classifier? Compare it with N-Nearest Neighbor classifier. [10]
- Q8)** a) What is hierarchical clustering? Explain partition clustering. [8]
- b) Explain use of Neural network as a classifier. Explain any modification in neural network for better classification. [8]



Total No. of Questions : 8]

SEAT No. :

P4749

[Total No. of Pages : 2

[4760] - 342

**M.E. (Electronics) (Digital Systems)**

**DIGITAL SYSTEMS USING PLDs**

**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Figure to the right indicates full marks.*
- 3) *Assume suitable data, wherever necessary.*

**SECTION - I**

- Q1)** a) Compare the architectures of FPGA, General purpose Processor and ASIC pertaining to functional capacity, functional diversity and data.[8]  
b) What are the research challenges in the design and development of Up to date Digital Systems. [8]
- Q2)** a) Why CPLD architecture is less suitable for a digital system design with high complexity and high component count? [8]  
b) Give the mathematical model to compute area needed for cross-bar and memory. Assume wire pitch of  $8\lambda$ . [8]
- Q3)** a) Draw the architecture of XC 9500 CPLD and explain the function of each logic block. [8]  
b) What is meant by configurable, programmable and fixed function devices? Give suitable examples. [8]
- Q4)** Write short notes on : (any three) [18]  
a) Technology Scaling.  
b) Interconnects.  
c) Spartan III FPGA.  
d) Selection criteria of FPGA.

**P.T.O.**

## SECTION - II

- Q5)** a) What are the concepts behind time switched FPGA and dynamically programmable gate array? Explore the architecture of any one of them in detail. [8]
- b) What is role of the boundary scan logic and BIST in the system design?[8]
- 
- Q6)** a) What are the various FPGA programming techniques ? Explain any one in detail. [8]
- b) Draw and explain the interfacing diagram of  $4 \times 4$  matrix keypad with the XC 9572 CPLD. Draw the flowchart to detect the pressed key of the keypad. [8]
- 
- Q7)** Write the VHDL code for Mod-12 counter and configure the design in the FPGA. Draw the interfacing diagram of common cathode 7-segment LED display with this FPGA. [16]
- 
- Q8)** Write short notes on: (any three) [18]
- a) SRAM design parameters.
  - b) Power optimization in CPLD and FPGA
  - c) Architecture of Digital Signal Processor.
  - d) Families of FPGA architectures used in VLSI designs.

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P3970**

**[4760]-343**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital Systems)**  
**BIO-MEDICAL SIGNALS AND SYSTEMS**  
**(2008 Course) (Elective-III) (Semester-II) (504204)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Which different aspects should be considered in design of Biomedical Instruments? **[8]**
- b) What are difficulties occurred in Biomedical Signal Analysis. Explain with one example. **[10]**
- Q2)** a) Compare Wiener filter and Adaptive filter. How these are used to remove interference. **[8]**
- b) Explain the nature of Biomedical Signals - VMG, VAG, PCG & ECG? **[8]**
- Q3)** a) Explain which filter will you prefer for following applications. **[8]**
- i) Removal of Artifacts in the ECG.
  - ii) Event Detection.
- b) Distinguish between ECG rhythms and EEG rhythms. Explain Morphological Analysis of ECG Waves. **[8]**

**P.T.O.**

- Q4)** a) What is scope of Genetic Algorithm in Biomedical Signal processing? [8]  
b) Explain Identification of Heart Sounds using Matched filter. [8]

### **SECTION-II**

- Q5)** a) Write a principle of image slice selection in MRI scanning. [8]  
b) Explain how Estimation of the Power Spectral Density Function can be used for signal analysis. [10]
- Q6)** a) Explain the Magnetic Resonance Imaging Techniques. [8]  
b) Explain Electromechanical Models of Signal Generation. [8]
- Q7)** a) Explain the use of Adaptive filters for segmentation of PCG signals. [8]  
b) Write a short note on biomedical information management system. [8]
- Q8)** a) Differentiate Supervised Pattern Classification and Unsupervised Pattern Classification. [8]  
b) Explain measures of diagnostic accuracy and Cost, Reliability of Neural network Classifier. [8]



Total No. of Questions : 8]

SEAT No. :

**P4349**

**[4760] - 344**

[Total No. of Pages :2

**M.E. (Electronics -Digital System)  
EMBEDDED VIDEO PROCESSING  
(2008 Course) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Define spatial, temporal & psycho-visual redundancy. Explain their impact on image & video compression. [8]
- b) Discuss the various methods to measure the quality of video stating their advantages & drawbacks. [8]
- Q2)** a) State the objectives of MPEG-2 standard. Discuss the new coding tools used in MPEG - 4. [8]
- b) With the help of neat block diagram explain the H.263 Encoder/Decoder. [8]
- Q3)** a) With proper expressions, compare the three criteria functions like 'MAD'- 'PDC' & BPM deployed in motion vector computation. [8]
- b) Discuss the need of motion estimation & compensation. [4]
- c) Justify-Fast search algorithms gives poorer compression performance than full search algorithms. [4]

***P.T.O.***

**Q4)** Write detailed notes on -(Any three). **[18]**

- a) JPEG - 2000
- b) HVS model
- c) Arithmetic coding
- d) H.263 video format

**SECTION - II**

**Q5)** a) Explain the various factors which can decide the design of Q-Matrix suggested in JPEG standard. Write any typical Q-Matrix. **[8]**

b) Explain Rate-Distortion function. **[4]**

c) Discuss the use of De-blocking & De-ringing filters used in post filtering process. **[4]**

**Q6)** a) What are the important factors to be considered while transmitting the coded video signal. **[8]**

b) Explain the main features of **[8]**

i) Embedded processor

ii) Media processor

**Q7)** a) Discuss the concept of video object, video object plane & shape/motion/texture coding in the MPEG-4 standard. **[8]**

b) What approaches for error resilience are supported by the MPEG-4 syntax? **[8]**

**Q8)** Write notes on- **[18]**

a) Hierarchical motion estimation

b) Video signal processor

c) Video codec interface issues

d) Transform coding



Total No. of Questions : 8]

SEAT No. :

**P4577**

**[4760]-345**

[Total No. of Pages : 2

**M.E. (Electronics) (Digital System)**  
**RECONFIGURABLE COMPUTING**  
**(2008 Course) (Semester - II) (Open Elective -IV)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer sheets.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) State the general purpose computing issues. **[8]**
- b) Give mathematical analysis along with suitable examples for functional density. **[8]**
- Q2)** a) Explain the relation among peak computational density, Instruction density contexts, and data path width. **[8]**
- b) Explain delta delay, intrinsic delay, interconnect delay. **[8]**
- Q3)** a) What are the conventional interconnects? Explain their limitations? **[8]**
- b) Compare the performances of various architectures considering multiplier as an case study. **[8]**
- Q4)** Write short note on (Any Three): **[18]**
- a) Instruction growth Vs interconnect growth.
  - b) Instruction compressibility.
  - c) Effects of interconnect granularity.
  - d) Partial Reconfiguration.

**P.T.O.**

## SECTION - II

- Q5)** a) Compare RISC styled processor, VLIW processor, DSP processor and FPGA with respect to limited instruction and data bandwidth, abstraction overhead data movement consume capacity and coarse grained data path network. [8]
- b) Give the Issues in Reconfigurable Network Design. [8]
- Q6)** a) Explain Rent's Rule? State its importance. [8]
- b) What is need of instruction compression? What are its techniques? Which is best suitable for reconfigurable Devices? [8]
- Q7)** a) Explain the hierarchical interconnect scheme. Which scheme is being used in current FPGA. [8]
- b) How would you modify the present Muticontext FPGA to convert into RFPGA? Explain in brief. [8]
- Q8)** Write short note on (any three): [18]
- a) Reconfigurable ALU
- b) Delays offered by various blocks of FPGA.
- c) RP space area model.
- d) Matrix Architecture.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4578**

**[4760]-346**

[Total No. of Pages : 2

**M.E. (Electronics)**

**EMBEDDED AUTOMOTIVE SYSTEMS**

**(2008 Course) (Semester - II) (Elective -IV - Open) (504205)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are embedded systems? Explain role of embedded system in automotive system? [8]
- b) Explain security and warming system in automotive system? [8]
- Q2)** a) What are different types of interferences? How they can be overcome? [8]
- b) Which sensors and actuators are used in automotive system? Explain about their interfacing? [8]
- Q3)** a) Explain tests of batteries wrt. Need, procedure of test and result of test. [8]
- b) Describe electronic ignition system. [8]
- Q4)** Write short notes on (any three): [18]
- a) Current trends in automobiles.
  - b) Electronic dashboard instruments.
  - c) Crank angle position sensors.
  - d) Electromagnetic compatibility.

**P.T.O.**

## SECTION - II

- Q5)** a) Discuss with block diagram the recent trends in cruise control car. [8]  
b) Explain role of artificial intelligence in engine management. [8]
- Q6)** a) How fuel metering is done? Which are different techniques. [8]  
b) What is engine cranking and warm up control. [8]
- Q7)** a) Describe in details of headlight and side light, Horn, wiper system and traffic indicator. [8]  
b) Classify electronic control systems in open loop and closed system and explain advantage of closed loop system. [8]
- Q8)** Write short notes on any three: [18]
- a) Multiprocessor communication using CAN bus.
  - b) GPS based vehicle tracking system.
  - c) Vehicle speed sensors.
  - d) Solid state ignition system.

*EEE*

Total No. of Questions : 8]

SEAT No. :

P3971

[Total No. of Pages : 2

[4760] - 347

**M.E. (Electronics) (Digital System)**

**DIGITAL SIGNAL COMPRESSION**

**(2008 Pattern) (Semester - II) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain arithmetic coding procedure with example. [8]  
b) The probabilities of the source symbols are  $P(a_1) = 0.2$ ,  $P(a_2) = 0.5$ ,  $P(a_3) = 0.2$  and  $P(a_4) = 0.1$ . Generate an optimal Huffman code. Also calculate the average bit length and minimum variance Huffman code. [10]
- Q2)** a) Give a comparison between lossless and lossy data compression techniques. [8]  
b) Consider a source with symbol probabilities  $P(a_1) = 0.8$ ,  $P(a_2) = 0.05$  and  $P(a_3) = 0.15$ . Find the tag using arithmetic coding for a sequence  $a_1, a_3, a_2$ . [8]
- Q3)** a) Explain Jayant quantizer with the help of neat block diagram. [8]  
b) Explain rate distortion theory? How it minimizes distortion? [8]

**P.T.O.**

- Q4)** a) What is Linear Predictive Coding (LPC)? How LPC is used in speech Coding? [8]  
b) Explain in context with video compression the different sampling formats of YCbCr color space. [8]

## SECTION - II

- Q5)** a) Explain the types of quantization, also Explain the mid thread and mid riser quantization. [8]  
b) What are the features of MP3? Explain with suitable block diagram the structure of MP3 audio coder. [8]
- Q6)** a) Explain methods of silence compression? How it is achieved? [8]  
b) Explain how to decide the transmission rate if the tolerable distortion is given. [8]
- Q7)** a) Explain Discrete Cosine transform and its properties. How the image compression is achieved by coding of DCT coefficients. [8]  
b) What is multi-resolution analysis (MRA)? How Discrete Wavelet Transform (DWT) is used for MRA. Explain how image compression is achieved through multilevel decomposition of the image data. [8]
- Q8)** a) Explain set partition SPIHT? Explain how wavelet coefficient can be classified in LSP and LIP? [9]  
b) Explain with help of diagram of motion compensated video compression. [9]



Total No. of Questions : 8]

SEAT No. :

**P4350**

**[4760] - 348**

[Total No. of Pages : 3

**M.E. (Production) (Semester - I)**  
**MATHEMATICS AND STATISTICS**  
**Advanced Mathematical Method**  
**(2008 Pattern) (Theory) (Credit System)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any THREE questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) Define an Analytic Function of  $W = f(z)$  at the point  $z = z_0$  and show that the function define by  $W = |Z|^2$  For any complex variable  $z$  is differentiable at the origin  $O$  but not Analytic at that point. **[5]**

b) If  $f(z)$  is Analytic, prove that  $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^n = n^2 |f(z)|^{n-2} |f'(z)|^2$  **[6]**

c) Find the Laurent series expansion of  $f(z) = \frac{1}{(z-2)(z-1)}$  in the region  $0 < |z-1| < 1$  **[5]**

**Q2)** a) Evaluate  $\int_C (z - z^2) dz$ , where  $C$  is the upper half of the circle  $|z| \leq 1$ . What is the value of this integral if  $C$  is the Lower half of the above circle? **[5]**

b) Evaluate  $\oint_C |z|^2 dz$  around the square with vertices at  $(0,0), (1,0), (1,1), (0,1)$ . **[6]**

c) Find the bilinear transformation that maps  $z = 0, 1, \infty$  on to  $w = -1, -i, 1$  respectively. **[5]**

**P.T.O.**

**Q3) a)** Determine the displacement  $u(x,t)$  of a string if **[8]**

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}; u(x,0) = \frac{x(10-x)}{100}$$

$u(0,t) = 0, u(10,t) = 0, u(x,0) = 0$  for  $x = 0$  to  $10, t = 0$  to  $5$  taking  $h = k = 1$

**b)** Find the values of  $u(x,t)$  satisfying the parabolic equation  $\frac{\partial u}{\partial t} = 4 \frac{\partial^2 u}{\partial x^2}$

subject to the boundary condition  $u(0,t) = 0 = u(8,t)$  and  $u(x,0) = 4x - \frac{x^2}{2}$

at the point  $x = i, i = 0, 1, 2, 3, \dots, 8$  and  $t = \frac{1}{8} j, j = 0, 1, 2, 3, \dots, 5$ . **[8]**

**Q4) a)** Solve the poisson equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 8x^2 y^2$  for the square mesh of the sides  $-2 \leq x \leq 2, -2 \leq y \leq 2$  with  $u(x,y) = 0$  on the boundary taking  $h = 1$ . **[9]**

**b)** Solve the variational problems **[9]**

$$\int_1^2 \left[ x^2 (y')^2 + 2y(x+y) \right] dx = 0 \text{ given}$$

$$Y(1) = y(2) = 0$$

### SECTION - II

**Q5) a)** Find the curves on which the functional  $\int_0^1 \left[ \left( \frac{dy}{dx} \right)^2 + 12xy \right] dx$  with  $y(0) = 0$

and  $y(1) = 1$  can be extremised. **[8]**

**b)** Using explicit methods solve **[8]**

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 \leq x \leq 1.$$

$$U(0,t) = 0, u(1,t) = 0,$$

$$U(x, 0) = 2x \text{ when } 0 \leq x \leq \frac{1}{2}$$

$$= 2(1-x) \text{ when } \frac{1}{2} \leq x \leq 1$$

And for  $h = 1, k = 0.001$  at  $t = 0.001, 0.002$

**Q6) a)** Express  $J_{\frac{7}{2}}(x)$  in terms of sine and cosine functions. **[6]**

b) Prove that  $P_{n+1}(x) - p_{n-1}(x) = (2n+1)p_n(x)$ . **[5]**

c) For the Legendre's function  $p_n(x)$ , prove that **[5]**

i)  $(n+1)p_n(x) = (2n+1)xp_n(x) - np_{n-1}(x)$ .

ii)  $np_n(x) = xp_n(x) - p_{n-1}(x)$

**Q7) a)** The milaeage which car owners get with a certain kind of radial tyre is a Random variable having and exponential distribution with mean 40,000 km. Find the probabilities that one of these tyres will last **[8]**

i) At least 20,000km and

ii) At most 30,000 km.

b) Assume inter-arrival time X service time Y are exponentially distributed with mean 3 and 2 min. respectively. Simulate the model for 10 minutes by using following random variable. **[8]**

RN for X    0.82        0.23        0.37        0.75        0.15        0.27

RN for Y    0.66        0.31        0.48        0.92        0.38        0.72

**Q8) a)** Based on 15 subgroups each of size 200 taken at intervals of 45 minutes from a manufacturing process the average defective was found to be 0.068. Construct p-chart and np-chart. **[9]**

b) For a markov chain, the transition matrix  $p = \begin{pmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{3}{4} & \frac{1}{4} \end{pmatrix}$  with initial

distribution  $p_0 = \left( \frac{1}{4}, \frac{3}{4} \right)$  find **[9]**

i)  $p_{21}^{(2)}$

ii)  $P^{(2)}12$

iii)  $p^{(2)}$

iv)  $p^{(2)}1$



Total No. of Questions : 10]

SEAT No. :

P3972

[Total No. of Pages :4

[4760]-349

**M.E. (Production Engg.) (Manufacturing Engg. & Automation)**

**CAD/CAM/CIM**

**(2008 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable electronic calculators is allowed*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** A triangular lamina has corners PQR. The coordinates are P (15, 15), Q (35, 20) and R (25, 35). The lamina is rotated about P through  $35^\circ$  in clockwise direction. Obtain **[10]**

- i) The concatenated matrix for the transformation and
- ii) Calculate new coordinates of the triangle.

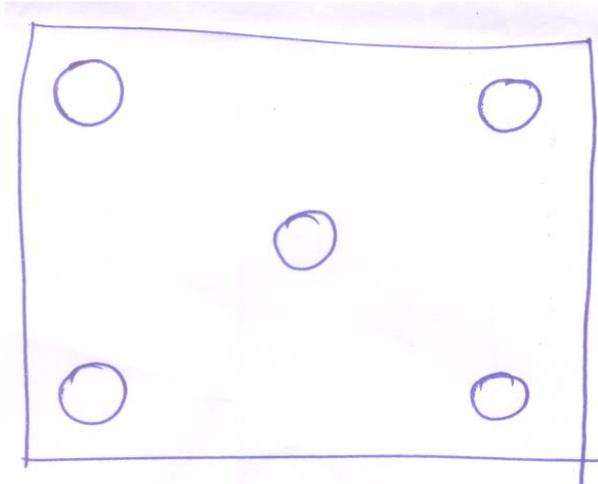
**b)** Explain parametric modeling and variation modeling. **[6]**

**Q2) a)** Explain the steps of generating CNC program from a given part drawing. Also explain Elements of CNC systems. **[8]**

**b)** Explain Types of curves and mathematical representation of curves. **[8]**

**Q3) a)** Write a NC program to drill the work piece as shown in Figure. Be sure to Use the lower left corner as the work zero **[10]**

**P.T.O.**



Blank size  $100 \times 100 \times 20$

Dia = 8mm five Holes

Hole 1 (20,20)

Hole 2 (20,80)

Hole 3 (80,80)

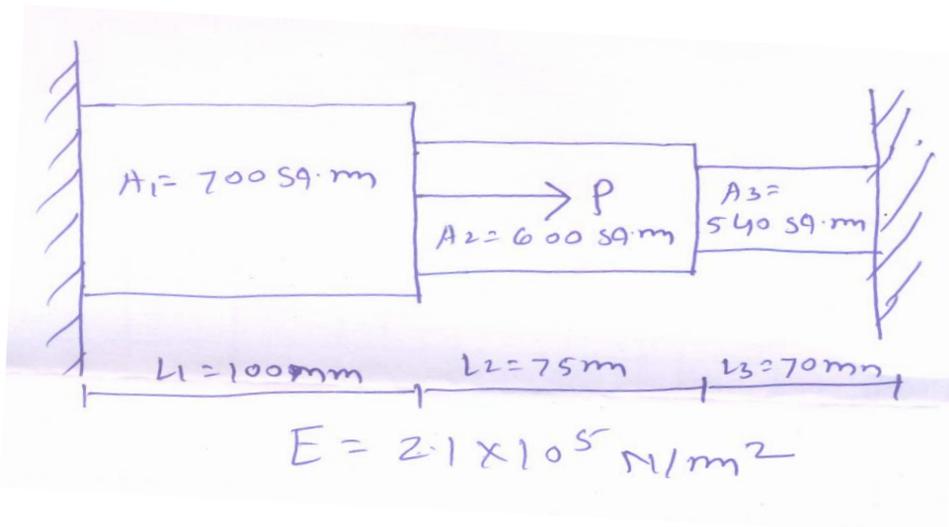
Hole 4 (80,20)

Hole 5 (50,50)

b) Explain the concept recent developments in CNC machine tools. [6]

**Q4) a)** Consider the bar shown in Figure 2. An axial load  $P = 15000 \text{ N}$  is applied as shown. Using Finite Element Method, find the following

- i) Determine the nodal displacements. [10]
- ii) Determine stress in each material.
- iii) Determine the reaction forces.



b) How to carry out assembly design using solid models? [6]

**Q5)** Write short notes on any three of the following. **[18]**

- a) Steps Involved in Finite Element Analysis
- b) Special Code used in CNC Programming
- c) Flexible Manufacturing system
- d) Hybrid Modelling
- e) Visual realism

**SECTION - II**

**Q6)** a) Explain variant type CAPP system and generative approach. **[8]**

- b) Explain geometric modeling for process planning, State any five commonly used CAPP systems. **[8]**

**Q7)** a) Explain with neat sketch, different layouts used in FMS. **[8]**

- b) Explain computer aided material requirement planning. **[8]**

**Q8)** a) Consider the following part - Machine incidence matrix. Apply the Rank Order Clustering (ROC) algorithm to it and identify the part families and Machine groups. **[10]**

| Machine | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------|---|---|---|---|---|---|---|---|---|----|
| M1      | 1 | 1 | 1 | 1 | 1 |   |   | 1 | 1 | 1  |
| M2      |   | 1 | 1 | 1 |   |   |   |   | 1 | 1  |
| M3      | 1 |   |   |   | 1 | 1 | 1 |   |   |    |
| M4      |   | 1 | 1 | 1 |   |   |   | 1 | 1 | 1  |
| M5      | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |   |    |

- b) Explain cellular manufacturing systems. **[6]**

**Q9)** a) Explain the concept quantitative analysis of FMS. **[8]**

- b) Discuss different types of guidance systems available for AGVs. **[8]**

**Q10)** Write short notes on any three of the following.

**[18]**

- a) Product flow analysis
- b) Computer aided quality control
- c) Computer programming languages for CAPP
- d) Computer control system
- e) Non-contact inspection methods



[4760] - 35

**M.E. (Civil - Structures)**  
**STRUCTURAL MATHEMATICS**  
**(2008 Pattern)**

Time : 4 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Attempt three questions from section - I and three questions from section - II.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of non programmable electronic calculator is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) With proper illustration, show that flexibility and stiffness matrix are reciprocal of each other. [4]
- b) Using Flexibility method, analyze the two span continuous beam each loaded centrally as shown. [13]  
 Comment on changes that will have to be incorporated in the analysis procedure if support B sinks by amount 'd'

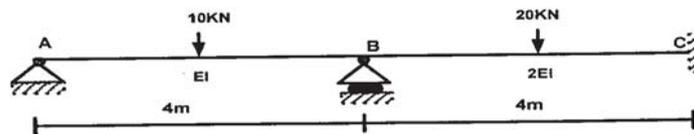


Fig. 1.b

- Q2)** a) Using Flexibility or Stiffness method, analyze the truss shown in the Fig. 2.b. Find the joint displacements, support reactions, bar forces and bar elongations. Take  $AE = 5500 \text{ kN}$  for all the bars. [12]

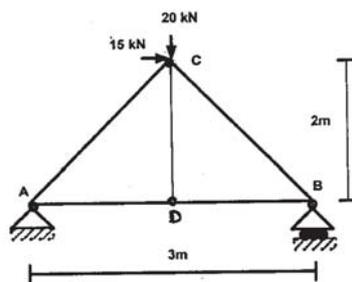


Fig. 2.a

- b) What is the transformation matrix? In matrix methods to solve the equilibrium equation, state few methods of solving large no of equations. [5]

**Q3) a)** For a Space frame member, develop the member stiffness matrix with proper sketches. [8]

- b) The derivative of y with respect to x is given by  $dy/dx = x-y$ .  
At  $x = 0, y = 1$ . Calculate the value of y at  $x = 0.1$  and  $0.2$  using an interval of  $0.1$ . Use Runge kutta method. [8]

**Q4) a)** Find the eigen values and eigen vectors of the following matrix [6]

$$\begin{vmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{vmatrix}$$

- b) Derive the stiffness matrix of a typical space truss element. [7]  
c) Write a note on Inverse of matrix by partitioning. [3]

### SECTION - II

**Q5) a)** For the continuous beam shown in Fig. 5.a, apply central difference formula dividing the beam in four equal parts and find the deflection at nodal points, rotation at the simply supported end and moment at fixed end. [8]

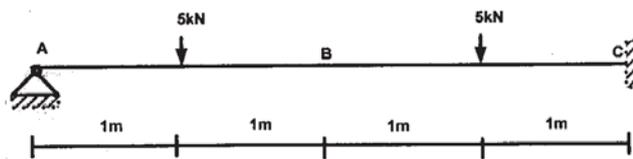


Fig. 5.a

b) A simply supported uniform plate of side length ' $2a \times a$ ' supports a trapezoidal load varying from  $0.5 w$  at one small edge to  $w$  at the opposite small edge, as shown in the Fig. Estimate the deflection at the various nodal points, using a grid interval of  $h = a/2$  using finite difference method. [8]



Fig. 5.b

**Q6) a)** Estimate the lowest buckling load of a uniform pin ended column of length L and flexural rigidity EI using three intervals. **[8]**

b) Find the cubic splines for the following table of values. **[9]**

|    |   |   |    |   |
|----|---|---|----|---|
| X: | 1 | 2 | 3  | 4 |
| Y: | 1 | 5 | 11 | 8 |

Hence evaluate  $y(1.5)$  and  $y'(3)$

**Q7) a)** Discuss the conceptual difference between interpolating technique and regression technique for a set of data. **[4]**

b) For the data given in table, fit a second order polynomial. **[10]**

|    |   |    |    |    |
|----|---|----|----|----|
| X: | 1 | 2  | 3  | 4  |
| Y: | 6 | 11 | 18 | 27 |

c) State Lagrange's interpolation formula. How cubic splines differ from this method of interpolation. **[3]**

**Q8) a)** Explain the methods to evaluate area under the curve. Explain the advantage of Gauss Quadrature over trapezoidal and Simpson's rule. **[6]**

b) Obtain fourier series expansion for  $f(x)$  defined as follows. **[10]**

$$f(x) = x + (\pi/2) \quad -\pi < x < 0$$

$$f(x) = (\pi/2) - x \quad 0 < x < \pi$$



Total No. of Questions : 10]

SEAT No. :

**P4579**

**[4760]-350**

[Total No. of Pages : 3

**M.E. (Production Engineering)**  
**ADVANCED MANUFACTURING PROCESSES**  
**(2008 Revised Course) (Semester-I) (511103)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from each section.*
- 2) *Question 5 & question 10 are compulsory.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data, if necessary.*
- 6) *Figures to the right indicate full marks.*
- 7) *Use non-programmable electronic calculator is allowed.*

**SECTION-I**

- Q1)** a) Explain the mechanism of solidification of pure metals and alloys in casting. **[8]**
- b) Explain the casting defects arising due to different defects in casting design, sand, metal composition, melting & pouring and gating & riser elements. **[8]**
- Q2)** a) Explain the process of inspection of castings. **[8]**
- b) Explain the types of weld joints and applications of each type. **[8]**
- Q3)** a) Explain characteristics of weld pool in welding. **[8]**
- b) Explain the fusion welding process in details. **[8]**

***P.T.O.***

- Q4)** a) Explain Molecular Dynamic Analysis process in machining. [8]  
b) Explain principle of working of Ultrasonic machining process and state the applications. [8]

**Q5)** Write short note on following (Any Three): [18]

- a) Injection molding process.
- b) Vacuum Coating.
- c) Nano-Technology.
- d) Electro Chemical Machining.
- e) Applications of Hot Machining.

### **SECTION-II**

- Q6)** a) Explain the process of numerical analysis in material forming process. [8]  
b) Write a note on upper bound analysis in forming process. [8]

- Q7)** a) Explain the principle of Explosive forming? State the applications of the same. [8]  
b) Explain the process parameters of cup forming. [8]

- Q8)** a) Explain the closed cavity extrusion process. [8]  
b) Explain the process of electromagnetic forming. [8]

**Q9) a)** Explain redrawing operation in sheet metal forming. **[8]**

b) Explain complex stamping sheet metal process. **[8]**

**Q10) Write short notes on (Any Three):** **[18]**

a) Stretch Forming.

b) Macroscopic plasticity.

c) Comparison between Blanking & Punching.

d) High speed hot forging.

e) Fine Blanking.



Total No. of Questions : 12]

SEAT No. :

P4744

[Total No. of Pages : 3

[4760] - 351

**M.E. (Production)**

**(Manufacturing Engg. & Automation)**

**ADVANCED MECHATRONICS**

**(2008 Pattern) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10 and Q11 or Q12.*
- 2) *Neat Diagrams must be drawn whenever necessary.*
- 3) *Assume suitable data, if necessary and state them clearly.*
- 4) *Use of Programmable calculator is not allowed.*

**SECTION - I**

**Q1) a)** Discuss what do you mean by system and define elements of measurement system. **[8]**

b) Compare between tradition design and mechatronics design. **[8]**

OR

**Q2)** Define mechatronics and explain with suitable example different types of measurement and control systems used in mechatronics. **[16]**

**Q3) a)** Explain various types of velocity and motion sensors. **[8]**

b) Describe various types of temperature sensors. **[8]**

OR

**Q4) a)** Describe in detail various position and proximity sensor. **[8]**

b) Suggest a sensor that could be used as a part of the control system, to determine the difference in levels between liquids in two containers. The output is to provide an electrical signal for the control system. **[8]**

**P.T.O.**

- Q5) a)** Explain in detail Pin Configuration of 8085. [12]  
b) Explain working and applications of stepper motor controls used in machine tools. [6]

OR

- Q6) a)** Brief the general internal architecture of a microprocessor with neat sketch. [12]  
b) Explain in detail the issues of interfacing ADC convertor. [6]

### **SECTION - II**

- Q7) a)** Simplify Boolean equations [8]  
i)  $Q = A.B + A.B.D + B.D$   
ii)  $Q = A.B.C + B.D + B.D.E$   
b) Explain following w. r. t. process control systems: [8]  
i) Characteristics functions  
ii) Memory systems

OR

- Q8) a)** Use De Morgan's laws to show that a NOR gate with inverted inputs is equivalent to an AND Gate. [8]  
b) Show the logic gate, truth table, and circuit representation for an alarm horn that will sound if push button PB1 is 1 (ON or depressed) and PB2 is NOT 0 (not depressed). [8]
- Q9) a)** Describe briefly programming languages used in Programmable logic controllers. [6]  
b) Devise a PLC system that could be used with a conveyor belt which is used to move an item to a work station. The presence of the item at the work station is detected by means of breaking a contact activated by a beam of light to the photo sensor. There it stops for 100s for an operation to be carried out before moving on and off the conveyor. The motor for the belt is started by a normally open start switch and stopped by a normally closed switch. [10]

OR

- Q10) a)** Explain how a PLC can be used to handle an Analogue input. [6]

- b) Device circuit that can be used with a domestic washing machine to switch on a pump to pump water for 100s into the machine, then switch off and switch on the heater for 50 s to heat the water. The heater is then switched off and another pump is to empty the water from machine for 100 s. **[10]**

**Q11)** Design a mechatronic system for car park barriers which is having facility to lift and lower based on number of cars existing in the parking. **[18]**

OR

**Q12)** Write Short note on following- **[18]**

- i) Artificial Intelligence in mechatronics.
- ii) Shift Registers.
- iii) Latching circuits.



Total No. of Questions : 11]

SEAT No. :

P4351

[4760] - 352

[Total No. of Pages :6

M.E. (Production Engg.)

RELIABILITY AND FAILURE ANALYSIS

(2008 Course) (Revised) (Semester -I) (Elective - I) (511104)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Figures to the right indicate full marks.
- 6) Use of non-programmable electronic calculator is allowed.

**SECTION - I**

**Q1) a)** Explain with neat sketch *probability mass function (PMF)* and cumulative distribution function (CDF) properties of discrete variables in reliability engineering. **[4]**

b) A series of tests conducted under certain stipulated conditions on 800 electronic Components, the total duration of tests is 15 hrs. The number of components that fail during each hourly interval is noted. The results obtained are tabulated as shown in table **[12]**

|                 |    |     |    |    |    |    |    |    |    |    |    |
|-----------------|----|-----|----|----|----|----|----|----|----|----|----|
| Time(t)         | 00 | 01  | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 |
| No. of failures | 00 | 120 | 85 | 71 | 62 | 53 | 45 | 41 | 37 | 35 | 29 |
|                 | 11 | 12  | 13 | 14 | 15 |    |    |    |    |    |    |
|                 | 50 | 45  | 63 | 35 | 29 |    |    |    |    |    |    |

Based on the failure data or survival test results shown in table. Define & Calculate failure density (fd); failure rate (Z) and Reliability (R).

OR

P.T.O.

**Q2) a)** What do you mean by failure rate and repair rate? **[4]**

b) In order to test the strength of a new glue, ten similar structures constructed using the glue were subjected to a continuous vibratory load, and the duration of survival of each structure was noted, the values obtained the following. **[6]**

|                   |    |    |    |    |    |    |    |    |    |    |
|-------------------|----|----|----|----|----|----|----|----|----|----|
| Specimen Numbers  | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 |
| Hours of Survival | 60 | 62 | 58 | 50 | 61 | 55 | 59 | 62 | 54 | 55 |

Calculate the mean time to failures (MTTF) from this data.

c) In a test involving continuous satisfactory performance of 110 electronic instruments under excessive vibration conditions, the following failure frequencies were observed, the total test period being 8 hrs. **[6]**

|                    |     |     |     |     |     |     |     |     |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Time interval      | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 |
| Number of failures | 3   | 16  | 22  | 42  | 11  | 09  | 04  | 03  |

Calculate the mean time to failures (MTTF) from this data.

**Q3) a)** Explain the concept of “Techno-Physico Constraints” with a conceptual system. **[6]**

b) Construct a fault tree from Fig. 1 such that the top event is a system failure and component failures are basic events. If  $\Pr\{A\} = \Pr\{B\} = 0.9$ ,  $\Pr\{C\} = \Pr\{D\} = 0.8$  and  $\Pr\{E\} = \Pr\{F\} = 0.75$ , compute the probability of the top event. **[10]**

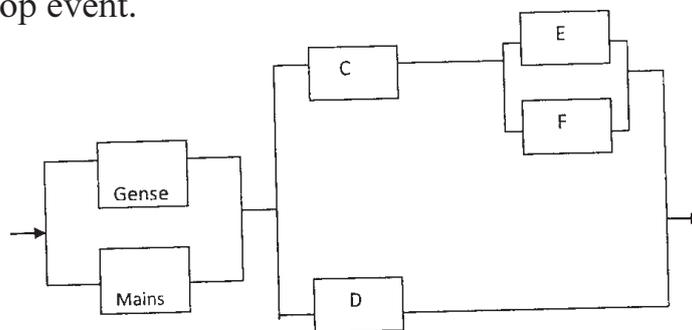


Fig.1  
OR

**Q4) a)** An engineer approximate the reliability of a cutting assembly by [8]

$$R(t) = \begin{cases} \left(1 - \frac{t}{t_o}\right)^2, & 0 \leq t \leq t_o \\ 0, & t \geq t_o \end{cases}$$

- i) Determine the failure rate
- ii) Does the failure rate increase or decrease with time
- iii) Determine the MTTF.

**b)** Construct a reliability block diagram Fig. 2 for given fault tree. [8]

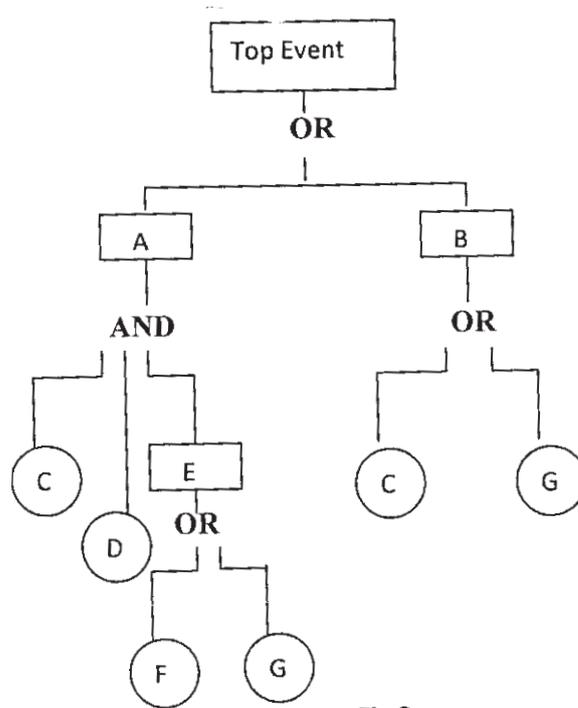


Fig.2

**Q5) a)** Discuss the relationship between quality and reliability. [6]

**b)** In the following table are times (in days) over a six months period at which failure of a production line occurred ( $t_f$ ) and times ( $t_r$ ) at which the plant was brought back on the line following repair: [12]

| i | $t_{fi}$ | $t_{ri}$ | i  | $t_{fi}$ | $t_{ri}$ |
|---|----------|----------|----|----------|----------|
| 1 | 12.8     | 13       | 6  | 56.4     | 57.3     |
| 2 | 14.2     | 14.8     | 7  | 62.7     | 62.8     |
| 3 | 25.4     | 25.8     | 8  | 131.2    | 134.9    |
| 4 | 31.4     | 33.3     | 9  | 146.7    | 150.0    |
| 5 | 35.3     | 35.6     | 10 | 177.0    | 177.1    |

- i) Calculate the six months interval availability from the plant data.
- ii) Estimate MTTF and MTTR from the data
- iii) Estimate the interval availability.

OR

- Q6)** a) Explain with appropriate example Mean time to Failure (MTTF) and Mean time to repair (MTTR). [6]
- b) Find the reliability of the configurations shown below in Fig.3, [8]

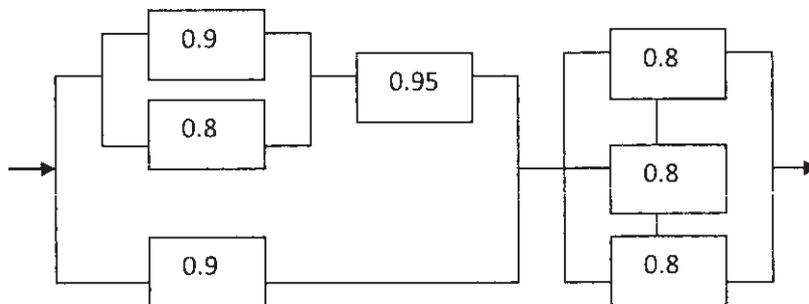


Fig.3

- c) What do you mean by failure rate and repair rate? [4]

### SECTION - II

- Q7)** a) Define Tero-technology and state the importance of the same in evolving the “LCC” of an asset. [6]

- b) Calculate the mean, variance, skewness and kurtosis of the stopping power data given in the following table. [10]

|    | A  | B  | C  | D  | E  | F  | G  |
|----|----|----|----|----|----|----|----|
| 1  | 39 | 54 | 21 | 42 | 66 | 50 | 56 |
| 2  | 62 | 59 | 40 | 41 | 75 | 63 | 58 |
| 3  | 32 | 43 | 51 | 60 | 65 | 48 | 61 |
| 4  | 27 | 46 | 60 | 73 | 36 | 38 | 54 |
| 5  | 60 | 36 | 35 | 76 | 54 | 55 | 45 |
| 6  | 71 | 54 | 46 | 47 | 42 | 52 | 47 |
| 7  | 62 | 55 | 49 | 39 | 40 | 69 | 58 |
| 8  | 52 | 78 | 56 | 55 | 62 | 32 | 57 |
| 9  | 45 | 84 | 36 | 58 | 64 | 67 | 62 |
| 10 | 51 | 36 | 73 | 37 | 42 | 53 | 49 |

OR

- Q8) a)** Explain mean and median ranking method. [8]

- b) The following data refer to 'Mean time to failure' of a equipment used in electric power house installation: [8]

| No. of failure | 1    | 2    | 3    | 4    | 5   | 6   | 7   | 8    | 9    |
|----------------|------|------|------|------|-----|-----|-----|------|------|
| MTTF/MTBF Hrs. | 31.3 | 45.9 | 78.3 | 22.1 | 2.3 | 4.8 | 8.1 | 11.3 | 17.3 |

Plot the reliability against time using the method median statistics. How will values changes with mean statistics?

- Q9) a)** Explain [8]

- i) Inherent availability
- ii) Achieved availability
- iii) Operational availability

- b) Derive an expression  $R_p(t) = e^{-\lambda_1 t} + e^{-\lambda_2 t} - e^{-(\lambda_1 + \lambda_2)t}$ . [8]

OR

**Q10)a)** Derive an expression for techno-economic life of equipment given maintenance function ( $at^n$ ), operating cost per year ( $v$ ) and first cost ( $C$ ). [6]

- b) A device has a decreasing failure rate characterized by a two parameter weibull distribution with  $\theta = 180$  years and  $m = 1/2$ . The device is required to have a design life reliability of 0.90. [10]

- i) What is the design life if there is no wear in period?
- ii) What is the design life if the device is first subject to a wear in period of one month?

**Q11)** Write short note on (Any 3) [18]

- a) Fault tree analysis
- b) Risk priority number in FMEA
- c) Total Productive Maintenance
- d) Censored and Uncensored data.



Total No. of Questions : 8]

SEAT No. :

**P4580**

**[4760] - 353**

[Total No. of Pages :2

**M.E. (Production)**

**SUPPLY CHAIN MANAGEMENT**

**(2008 Course) (Elective - I) (Semester - I) (511104)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Solve any three questions from each section.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Define Supply chain and explain clearly the decision phases in a supply chain. [8]
- b) What is a supply chain? Explain various stages in the supply chain. [8]
- Q2)** a) What are the major drivers of supply chain performance? Explain in details. [8]
- b) Explain the factors that influence network design decisions. [8]
- Q3)** a) Explain Push versus Pull based supply chain models. [8]
- b) What are different logistics functions? Explain the role of each function in detail. [8]
- Q4)** Write short notes on (any three): [18]
- a) Just-in-Time Strategy.
  - b) Aggregate planning in supply chain management.
  - c) Framework for structuring drivers.
  - d) The Bullwhip Effect.

***P.T.O.***

## SECTION - II

- Q5)** a) What are basic considerations in material handling system design for warehouse? [8]  
b) List the factors influencing transport economics and Explain any two. [8]
- Q6)** a) Explain the management of safety inventory in multiechelon supply chain. [8]  
b) Explain the cost structure in transportation economics and pricing. [8]
- Q7)** a) Explain the scope of emerging distributed cooperative tele-manufacturing over internet. [8]  
b) Explain the role of IT in supply chain management. [8]
- Q8)** Write short notes on (any three): [18]  
a) Milk Round System.  
b) Role of Enterprise Resource Planning in SCM.  
c) Warehouse operating principles.  
d) Economic Order Quantity.



Total No. of Questions : 12]

SEAT No. :

**P3973**

**[4760]-354**

[Total No. of Pages : 3

**M.E. (Production)**

**ADVANCE MACHINE TOOL DESIGN**

**(Revised 2008 Course) (Semester - I) (Elective-I) (511104)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of non-programmable electronic pocket calculator and statistical tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in brief the concept of high speed machining in machine tools. **[8]**
- b) Deduce the expression for power in drilling machine and show diagrammatically the forces acting on drill during machining. **[10]**

OR

- Q2)** a) What is meant by building block concept in machine tool design? **[6]**
- b) What are the distinctive features of machining and turning centers? Why are they so versatile? **[6]**
- c) Illustrate with a neat sketch kinematic structure of a radial drilling machine. **[6]**
- Q3)** a) Explain why is the stiffness of machine tool important during machining? **[8]**
- b) What are the broad considerations for design of machine tool elements such as base and table? **[8]**

OR

**P.T.O.**

- Q4) a)** Discuss the importance of following elements in spindle design: [8]
- i) Diameter of front journal bearing
  - ii) Additional spindle support
  - iii) Location of bearing and drive element
  - iv) Balancing
- b) Explain with neat sketches the methods of preloading of bearings. [8]
- Q5) a)** what is meant by regenerative chatter? Explain it with reference to any one type of machine tool. [8]
- b) What do you understand by hydraulic power pack in machine tool? Explain the factors used for selecting fluids for hydraulic system. [8]

OR

- Q6) a)** A nine speed gear box is to be designed for the minimum speed of 100 rpm and maximum speed of 1600 rpm. It is to be driven by an induction motor rotating at 1440 rpm. Draw best structural diagram, optimum ray diagram and gear box layout. [10]
- b) With the help of schematic diagram explain the working principle of any one type of mechanical control system incorporated in machine tool. [6]

### SECTION - II

- Q7) a)** How does a 180° rotation tool changer work? How does a pivot insertion tool changer work in CNC machine? [8]
- b) What procedure is used by the operator to determine the tool length offsets? [8]

OR

- Q8)** a) Compare CNC machine tool and conventional machine tool with respect to: [8]
- i) Accuracy
  - ii) Rigidity
  - iii) Productivity
  - iv) Economy
- b) Explain with neat sketches the five basic types of tool changers? [8]
- Q9)** a) Why is damping of machine tools important? How is it accomplished? [8]
- b) Explain with suitable example dynamic characteristic of the cutting process. [10]

OR

- Q10)** a) What do you understand by stick-slip motion in machine tool? Explain with a suitable example. [8]
- b) With suitable sketches explain the procedure followed in performing acceptance tests on drilling machine. [10]
- Q11)** a) Discuss in detail modern trends in design of machine tools. [8]
- b) Enumerate the different CAD techniques applied in design of machine tool structures. [8]

OR

- Q12)** a) Explain with a suitable example the importance of aesthetics in machine tool design. [8]
- b) Discuss the role of ergonomics in manufacturing of machine tools. [8]

EEE

Total No. of Questions : 8]

SEAT No. :

P3974

[Total No. of Pages : 2

[4760] - 355

**M.E. (Production Engineering)**

**ADVANCED ROBOTICS**

**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) State and explain four main categories in the application of Robot.[9]  
b) Define Industrial Robot and explain Robot anatomy in detail. [9]

- Q2)** a) A camera locates an object and the robot base by following transformation matrices, [8]

$$\text{camera } T_{\text{object}} = \begin{vmatrix} 0 & 0 & 1 & 40 \\ 1 & 0 & 0 & -15 \\ 0 & 1 & 0 & 23 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

$$\text{and } \text{camera } T_{\text{robot}} = \begin{vmatrix} -1 & 0 & 0 & 65 \\ 1 & 0 & -1 & -25 \\ 0 & -1 & 0 & 75 \\ 0 & 0 & 0 & 1 \end{vmatrix}$$

Determine the relation of the object with respect to the robot base. Also determine the transformation matrices of the object and the robot base with respect to the camera, if the camera is rotated by 90° about its own X-axis.

- b) Explain Forward solution and Inverse solution in a robotic manipulator. [8]

**P.T.O.**

- Q3)** a) Explain the various design considerations of mechanical grippers. [8]  
b) Explain the force analysis in gripper system. [8]

- Q4)** a) Explain in brief non-optical and optical position sensors. [8]  
b) Explain with neat sketches PID controller and control stability. [8]

### **SECTION - II**

- Q5)** a) List different Robot Languages and explain any two in detail. [8]  
b) Why there is a need of Sensor? Explain Force and Torque sensors used in robot with neat sketch. [10]

- Q6)** a) What is a machine vision system in Robot? Explain various steps of processing the image in Robotic Vision System. [8]  
b) Classify the Sensors in Robot. Explain Proximity and Range Sensors in detail. [8]

- Q7)** a) Enumerate the considerations for the manipulator design based on the task to be performed. [8]  
b) Explain design of mechanism and manipulator in brief. [8]

- Q8)** a) Compare Newton-Euler and Lagrange-Euler formulations and situations when you will prefer NE formulations/ LE formulations. [8]  
b) What is Jacobian Matrix? Explain its role of Jacobian matrix in the path control strategy. [8]



Total No. of Questions : 8]

SEAT No. :

P3975

[Total No. of Pages : 2

[4760] - 356

**M.E. (Production) (Semester - I)**

**SHEET METAL PROCESSESING**

**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Solve any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

- Q1)** a) Explain importance forming lines in sheet metal product and discuss with suitable example how that lines are considered. [8]  
b) Explain different attributes of material behaviour affecting sheet metal product. [8]
- Q2)** a) Discuss an analytical method for prediction of forming limits. [8]  
b) Describe various steps to be followed from the product design stage to the finished product while manufacturing in a small quantity, a small jar to carry water using Aluminum sheet. [8]
- Q3)** a) Compare Plasma cutting with laser cutting. [8]  
b) Explain different methods for testing of sheet metal product. [8]
- Q4)** Write short notes on any three : [18]  
a) Rate sensitivity and its effect on sheet metal product  
b) Different properties and grades for sheet metal  
c) Drawing of axysymmetric parts.

**P.T.O.**

## SECTION - II

- Q5)** a) Explain different a sheet metal joining process. [8]  
b) Explain different methods for sheet forming by rolling. [8]
- Q6)** a) Explain different selection criteria for presses used in sheet metal forming. [8]  
b) State necessarily of safety devices and their selection at press shop.[8]
- Q7)** a) Discuss the methodology for building a CAD model for sheet metal product. [8]  
b) Explain with suitable example how CAM is used in sheet metal forming metal forming with suitable example. [8]
- Q8)** Write short notes on any three : [18]  
a) Warm forming.  
b) Centre of pressure in press operation.  
c) Numerical analysis of forming processes.



Total No. of Questions : 8]

SEAT No. :

P3976

[Total No. of Pages : 3

[4760] - 357

**M.E. (Production) (Manufacturing and Automation)**

**TOOL & DIE DESIGN**

**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) A reamer is to be used to finish a hole to diameter  $11+0.03\text{mm}$ . Calculate the tolerance on the reamer diameter and the wear allowance, if the oversize cut by the reamer varies from 4 to 10 microns and manufacturing tolerance extends up to 15 micron. Draw the sketch of the tolerance zone for the above reamer diameter and show the dimensions on it. [8]
- b) Explain with neat sketch the tool geometry of twist drill. [8]
- Q2)** a) Explain the aspects of design of strap clamp used in jigs and fixtures. How the effect of workpiece tolerance can be eliminated while using strap clamps. [8]

**P.T.O.**

- b) Calculate the width of the diamond pin for the following data : [8]
- Tolerance on center distance between the holes in the workpiece = 0.060 mm
  - Tolerance on the center distance between locator pins: 0.02 mm
  - Clearance between the diamond pin and hole = 0.15mm
  - Clearance between full pin and hole = 0.012 mm,
  - Radius of both holes = 15mm.
- Q3)** a) Derive an expression to determine the optimum clearance in blanking operation. [8]
- b) A cup of inside radius 40 mm and thickness 5 mm is to be drawn from the blank with a radius of 50 mm. The shear yield stress and maximum allowable stress in the material are 14 MPa and 50 MPa respectively. Determine the drawing force, minimum possible radius of cup which can be drawn from a given blank without causing the fracture. Given  $\beta = 0.05$  and  $\mu = 0.1$ . [8]
- Q4)** Write short notes on : [18]
- a) Effect of various cutting tool angles on tool life.
  - b) Computer aided press tool design.
  - c) Equalizing clamps.

## SECTION - II

- Q5)** a) Explain the function of flash in forging. How the dimensions of flash can be determined? [8]
- b) Describe design procedure of edging impression in forging. [8]
- Q6)** a) Following data apply to the component shown in Figure 1.  
 Material: PVC with density 1.38 gm/cm<sup>3</sup>; Shrinkage 0.96% spatial; Modulus of elasticity:  $3 \times 10^3$  MPa; Number of impressions: 1, Poisson ratio and Modulus of elasticity for mold material are 3.33 and  $2 \times 10^5$  respectively, Coefficient of friction = 0.1, Material constant for PVC = 0.9, Injection pressure 50 MPa, Assume outside dimension of cavity 200×200 mm.

- i) Calculate the mold opening force. [4]
- ii) Calculate the ejection force and the dimensions of the ejection element. [4]
- iii) Determine the gate dimensions, runner dimensions, and runner layout. [4]
- iv) Sketch the assembly of the mold. [4]

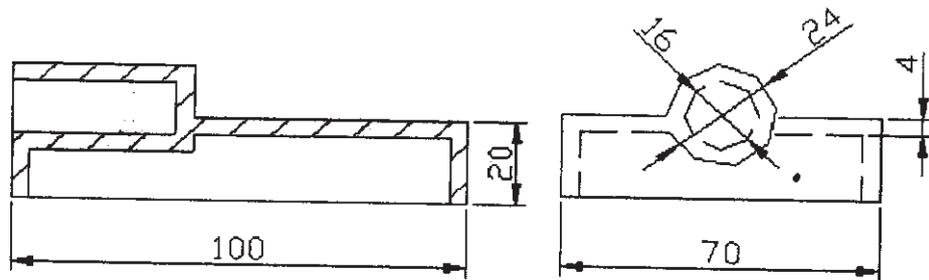


Fig. 1

- Q7) a) Explain with neat sketch the die venting and water cooling in the die casting. [8]
- b) Explain the instrumentation scheme for die casting process in which the molten metal has to enter the die cavity at controlled speed, pressure, and temperature? The die temperature also needs to maintain at specific temperature. [8]
- Q8) Write short notes on : [18]
- a) Stripper plate ejection in injection molding.
  - b) Determination of stock size in forging.
  - c) Cavity balancing for injection molding.



Total No. of Questions : 8]

SEAT No. :

**P4352**

[Total No. of Pages : 2

**[4760] - 358**

**M.E. (Production)**

**ENGINEERING ECONOMICS AND ACCOUNTING**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each Section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in detail the nature and scope of Managerial Economics. [9]  
b) Explain how Micro Economics differs from Managerial Economics? [9]
- Q2)** a) What is Elasticity of Demand? Explain Price, Cross and Income Elasticity of Demand used in managerial decision making process. [8]  
b) State the Law of Demand. What are its exceptions? [8]
- Q3)** a) List and briefly define the four different types of markets that affect pricing decisions. Give an illustration of each type of market. [8]  
b) Explain the positive points and limitations of the mechanism adopted in India for the determination of market prices for petroleum sector. [8]
- Q4)** Write short note (any four) : [16]  
a) Economics and Managerial Decision making  
b) Pricing decisions in private sector  
c) Consumer behavior  
d) Oligopoly  
e) Perfect Competition

**P.T.O.**

## SECTION - II

- Q5)** a) Explain in brief the steps in cost benefit analysis. [9]  
b) Discuss the meaning of 'Public Goods' in brief. [9]
- Q6)** a) Explain different types of cost giving example. [8]  
b) Explain 'Break Even Analysis' concept with example. [8]
- Q7)** a) What are the main drawbacks of the ROI and payback methods of capital investment appraisal? [8]  
b) What advantages do Discounted Cash Flow methods of capital investment appraisal have over Accounting Rate of Return and Payback Period in the evaluation of capital investment projects? [8]
- Q8)** Write short note : [16]  
a) Limitations of discounted cash flow  
b) Forecasting business changes  
c) Depreciation-a non cash expenditure  
d) Standard Cost definition and importance.



Total No. of Questions : 6]

SEAT No. :

P3750

[Total No. of Pages :2

[4760]-36

**M.E. (Civil) (Structures)**  
**Advanced Solid Mechanics**  
**(2008 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections must be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is compatibility of strains? Obtain strain compatibility equation for 2D problem in elasticity? [10]
- b) A Plane passing through point (x, y, z) in a stressed elastic body has its normal 'n' with direction cosines  $\cos(n, x)$ ,  $\cos(n, y)$ ,  $\cos(n, z)$ . Obtain expressions for the stress resultants ( $T_n$ ) and its direction in terms of six independent components at that point. [15]
- Q2)** a) State and explain the Generalized Hook' Law. Hence obtain the Lamé's constants and engineering constants for an elastic isotropic body. [10]
- b) If  $\phi$  is a third degree polynomial function, obtain the stress distribution on the sides of rectangular plate of size  $L \times 2h$ . Neglect body forces. Also check for static equilibrium of the plate under this stress distribution. [15]
- Q3)** a) Explain the concept of Stress Invariants? Hence, discuss the state of pure shear and hydrostatic state of stress? [10]
- b) Find stress components of a cantilever beam loaded with point load at the free end by using Airy's stress function polynomial? [15]

**P.T.O.**

## SECTION - II

- Q4)** a) What is axi-symmetric problem? Obtain the solution for stress distribution  $\sigma_r$  and  $\sigma_\theta$  in a solid cylinder subjected to uniform external pressure ' $p_o$ '? [10]
- b) A thick cylinder of internal radius 100mm and external radius 175 mm is subjected to an internal pressure of 8N/mm<sup>2</sup> and an external pressure of 10N/mm<sup>2</sup>. Determine variation of radial and hoop stresses in the cylinder wall? [15]
- Q5)** a) Derive Poisson's equation for torsion of prismatic bars of non-circular section in terms of stress function  $\phi$  using St. Venants Theory. Neglect body forces. [15]
- b) A shaft of elliptical c/s having semi major axis 75mm and semi minor axis 25mm is subjected to a torque of 1 kN-m, determine maximum and minimum shear stress developed in shaft. [10]
- Q6)** a) Derive differential equation for the elastic line of a beam resting on an elastic foundation? [10]
- b) A semi infinite beam is subjected to a force 'P' and a moment ' $M_o$ ' at one end. Starting from the solution for an infinite beam, obtain the solution at a section 'z' from the beam end for [15]
- i) Deflection 'y'
- ii) Bending moment  $M_x$ .



Total No. of Questions : 12]

SEAT No. :

P4353

[Total No. of Pages : 2

[4760]-360

M.E. (Production Engineering)

MANUFACTURING MANAGEMENT

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answers to the two sections should be written in separate answer books.
- 2) Answer any three questions from each section.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.
- 5) Use of calculator is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

**Unit - I**

- Q1)** a) Describe the importance of manufacturing management. [10]  
b) Describe the scope of manufacturing management for production engineer. [8]

OR

- Q2)** a) What is division of labor in case of manufacturing management? Discuss in brief. [8]  
b) Discuss contribution of any two pioneers in manufacturing management. [10]

**Unit - II**

- Q3)** a) Explain any four functions of Production Planning and Control. [8]  
b) Describe the application of Gantt chart with a suitable example. [8]

OR

- Q4)** a) What is crashing of network? Describe with a good example. [8]  
b) Explain the production work order in detail. Illustrate with a good example. [8]

**P.T.O.**

**Unit - III**

- Q5)** a) What are the manufacturing challenges of information age? [8]  
b) Write a note on agile manufacturing. [8]

OR

- Q6)** a) What is reconfigurable manufacturing? How is it useful for a manufacturing manager? [8]  
b) Write a note on lean manufacturing. Explain the waste concept in detail. [8]

**SECTION - II**

**Unit - IV**

- Q7)** a) Define organizational behavior. Discuss its importance for manufacturing manager. [6]  
b) Explain autocratic and custodial model of organizational behavior. [12]

OR

- Q8)** a) Describe SOBC model of OB in detail. [9]  
b) Describe Organizational commitment in detail. [9]

**Unit - V**

- Q9)** a) Differentiate between primary motives and secondary motives. [8]  
b) Define morale and explain its relationship with productivity. [8]

OR

- Q10)** a) Discuss Herzberg's theory of job loading. [8]  
b) Define leadership and explain its significance from manufacturing management perspective. [8]

**Unit - VI**

- Q11)** a) Differentiate between formal and informal groups. [8]  
b) Discuss theory of group formation in brief. [8]

OR

- Q12)** a) Discuss the strategies for encouraging constructive conflict. [8]  
b) Write a short note on stress management. [8]



Total No. of Questions : 08]

SEAT No. :

P3977

[4760] - 361

[Total No. of Pages :3

M.E.(Production) (Manufacturing and automation)

INDUSTRIAL AUTOMATION

( 2008 Course) (Semester-II)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

Q1) a) In a operation of certain 15 station transfer line, the ideal cycle time is 0.58 min. Breakdown occurs at the rate once every 10 cycles and the average downtime per breakdown ranges between 2 and 9 min,with an average of 4.2 min. How many parts will the line be capable of producing during an average week if the company works for 40 hours per week

[8]

b) The work elements ,their times and precedence constraints are shown in table, for a assembly line. Determine the cycle time and balance delay using Ranked positional weights methods if the number of workstations are to be limited to 3

[8]

| Element | $T_e$ (min) | Preceded by | Element | $t_e$ (min) | Preceded by |
|---------|-------------|-------------|---------|-------------|-------------|
| 1       | 0.4         | -----       | 6       | 0.2         | 3           |
| 2       | 0.7         | 1           | 7       | 0.3         | 4           |
| 3       | 0.5         | 1           | 8       | 0.9         | 4,9         |
| 4       | 0.8         | 2           | 9       | 0.3         | 5,6         |
| 5       | 1.0         | 2,3         | 10      | 0.5         | 7,8         |

P.T.O.

- Q2)** a) A single acting up stroking press having cylinder bore diameter of 400 mm and cycle time of 60 seconds has rapid approach of 180 mm in 10 sec. at 30 bars, pressing operation for 50 mm in 12 sec. at 300 bars and curing in 20 sec. Draw a suitable hydraulic circuit using accumulator and also calculate the size of accumulator and efficiency of circuit. The return is by gravity. [8]
- b) Explain with neat sketch the working of counterbalance valve and draw a typical circuit showing its application. [8]
- Q3)** a) Explain various criteria for selection of suitable pneumatic valves. [8]
- b) Draw the suitable pneumatic circuit using cascade system for sequential extension and simultaneous retraction of three cylinders. [8]
- Q4)** Write short notes on : [18]
- a) proportional hydraulic valves
- b) Transfer line monitoring system
- c) Pneumatic sensors

### SECTION - II

- Q5)** a) Construct ladder logic diagram to perform following tasks; [8]
- a) To allow fluid to flow into tank till it is filled completely
- b) To allow the fluid to flow out of tank after the delay of 120 seconds.
- c) To stop the out flow after 90 seconds.
- b) Write a program for 8085 A  $\mu$ p to find smallest element in a block of 8-bit unsigned binary data, whose number is stored in the memory location A001H and the data are stored in a memory location beginning from A002H. Store the smallest number in a memory location FF00H. [8]
- Q6)** a) Derive an expression for the limiting velocity of escapement of the cylindrical workpiece through a slot [8]

- b) A feeder selector device at one of the stations of an automatic assembly machine has a feed rate of 22 parts/ min and provides a throughput of one part in four. The ideal cycle time of the machine is 10 sec. The feeder stops for 18 parts in feed track and will start while 8 parts in feed track. Determine how long will it take for the feeder to turn on once it is turned off and how long it will take to turn off once it is turned on. [8]

**Q7) a)** State the rules for establishing the link co-ordinate frames of a manipulator. [8]

- b) The linear joint of the industrial robot is actuated by the piston mechanism. The length of the joint when fully retracted is 600 mm, and when fully extended is 975 mm. If the robot controller has 8 bit storage capacity, determine the control resolution of this robot. [8]

**Q8) Write short notes on :** [18]

- a) Industrial applications of expert systems
- b) Vibratory bowl feeder
- c) Servo and non servo manipulators



Total No. of Questions : 10]

SEAT No. :

**P3978**

**[4760]-362**

[Total No. of Pages : 3

**M.E. (Production)**

**PLASTIC PROCESSING**

**(2008 Course) (Semester-II) (Elective-III) (511111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

**Q1)** Explain the typical characteristics of some important plastics: **[16]**

- a) Semi-crystalline plastics (any two).
- b) Amorphous Plastics (any two).

**Q2)** An aluminum cantilever beam is 50mm wide, 80mm long and 2 mm deep. The loading is 200 N spread uniformly over the cantilever. If the beam is to be replaced by one made from acetal and the design criteria is that the end deflections should be the same in each beam after one month, calculate the dimensions: **[16]**

- a) of a solid acetal beam and
- b) an acetal beam with unidirectional ribs. The modulus of the aluminum is 70 GN/m<sup>2</sup>.

**Q3)** a) Explain the general features of twin screw extruders. **[8]**

b) Explain recent developments in Extrusion Technology. **[8]**

**P.T.O.**

- Q4)** a) Explain with respect to Injection moulding process of: [8]
- i) Barrels and Heaters.
  - ii) Clamping system.
- b) Explain blow Moulding. [8]
- Q5)** a) Explain different polymerization techniques. [9]
- b) Explain constructional features: [9]
- i) Cavity material,
  - ii) Fabrication,
  - iii) Layout of runners and gate.

### **SECTION-II**

- Q6)** a) Explain the product considerations for moulded products such as wall thickness, fillets and radii, ribs, under, cuts, drafts, holes and threads. [8]
- b) Explain surface treatment for avoiding warpage. [8]
- Q7)** a) A rectangular box 150 mm long. 100 mm wide and 60 mm deep is to be thermoformed from a flat sheet 150 mm × 100 mm × 2 mm. Estimate the average thickness of the walls of the final product if: [12]
- i) Conventional vacuum forming is used and
  - ii) Plug assisted moulding is used (the plug being 140 mm × 90 mm).
- b) Explain the standards of tolerances on molded articles for Epoxy material. [4]

**Q8) a)** Explain different types of inserts: [8]

i) Leak-proof inserts.

ii) Non metallic Inserts.

**b)** Explain the process for Reaction Injection Molding. [8]

**Q9) a)** Explain various software available optimum gate location. [8]

**b)** Explain the design of component for balanced flow. [8]

**Q10) Write short notes on (Any Three):** [18]

a) Hot dipping process.

b) Economical number of cavities.

c) Compression Molds.

d) Vents.



Total No. of Questions : 8]

SEAT No. :

**P3979**

**[4760]- 363**

[Total No. of Pages :2

**M.E. (Production)**

**PRODUCT LIFECYCLE MANAGEMENT  
( 2008 Course) (Elective- III) (51111) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat Diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data,if necessary.*

**SECTION-I**

- Q1)** a) “Product life cycle management - A need for winning strategy.”Explain. [8]
- b) What are the opportunities of PLM? Elaborate the benefits of PLM. [8]
- Q2)** a) Explain in brief various phases for product life cycle & corresponding technologies. [8]
- b) Explain the following: [8]
- i) Technical feasible study and S curve
  - ii) Financial justification of PDM
- Q3)** a) Explain the barriers in Product Lifecycle Management Implementation. [8]
- b) Give a suitable example of successful Implementation of any industrial product with PLM. [8]

***P.T.O.***

- Q4)** Write short notes on any three **[18]**
- a) Design for X
  - b) Reasons for implementation of PDM
  - c) Concurrent Engineering
  - d) Product Recycle Management

### **SECTION-II**

- Q5)** a) “PLM is a process of guiding a product from concept through retirement as well as process to deliver the most business value to an enterprise and its trading partners.” Explain in brief. **[8]**
- b) What are the human factors considered in product design? **[8]**
- Q6)** a) “PLM enables collaboration between multiple functions, departments, disciplines and between OEM and suppliers. It aims to achieve true interoperability in these domains and have a toolsets and configurability to optimize processes network.” Explain in brief. **[8]**
- b) Explain steps followed in new product development in conventional way and in prototyping way. **[8]**
- Q7)** a) Describe any two quantitative forecasting techniques and their advantages and disadvantages. **[8]**
- b) “And this is one way to do technology forecasting : get a sense of where technology is, and then Anticipate the next upturn.” Explain in brief in the context of mobile communication. **[8]**
- Q8)** Write short notes on any three **[18]**
- a) Morphological curve
  - b) Modeling and simulation in product design
  - c) Design for Manufacture and Assembly
  - d) Future mapping



Total No. of Questions : 12]

SEAT No. :

**P3980**

**[4760]-364**

[Total No. of Pages : 3

**M.E. (Production)**

**WELDING AND JOINING**

**(2008 Course) (Elective-III) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** a) Show the relations of peak temperatures, in various regions of HAZ, on iron-carbon diagram. [9]

b) Explain the effect of welding on parent material. [9]

OR

**Q2)** a) Explain the concept of epitaxial growth in solidification of weld. [9]

b) Explain the phase transformation in welding of carbon steel. [9]

**Q3)** a) Explain Arc Blow, with its causes. [8]

b) Explain rate of electrode polarity on arc behaviour & Arc stability in brief. [8]

OR

**P.T.O.**

- Q4)** a) Explain the electrical characteristics of an Arc. [8]  
b) Differentiate in brief between solid wires & flux cored wires. [8]
- Q5)** a) Discuss the effect of stainless steel manual metal Arc welding (on MAW) fame on human brain & free radical production. [8]  
b) Discuss on Arc instability caused by DC component in AC TIG welding. [8]

OR

- Q6)** a) Discuss three dimensional geometric effect on Residual stress and strain in welding process. [8]  
b) “Increase in electrode diameter consumes more current”. Explain this in context with submerged Arc welding process. [8]

## SECTION-II

- Q7)** a) Explain static-volt ampere characteristics of different types of welding power sources. [8]  
b) Explain duty cycle in brief. [8]

OR

- Q8)** a) How arc length is controlled in mechanised welding process? [8]  
b) What are the different types of rectifiers used in welding? [8]

- Q9)** a) Explain the effect of gravity & surface tension on metal transfer. [9]  
b) What is weld penetration shape factor & weld ripples in case of metal transfer in welding. [9]

OR

- Q10a)** Explain pulse transfer - plasma Arc welding in brief. [9]
- b) Discuss the droplet transfer frequency for steel, using different welding processes. [9]

- Q11a)** Explain ultrasonics welding with its equipments. [8]
- b) What is diffusion welding? What are the different methods in diffusion welding? [8]

OR

- Q12a)** Explain Explosive Welding with its merits & limitations. [8]
- b) Explain Electron Beam Welding process in brief. [8]



Total No. of Questions : 8]

SEAT No. :

**P3981**

**[4760]- 365**

[Total No. of Pages :2

**M.E. (Production)**

**SURFACE TREATMENT PROCESSES**

**( 2008 Pattern) (Semester- II) (51111) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat Diagrams should be drawn wherever necessary.*

**SECTION-I**

- Q1)** a) Discuss the scope of surface engineering in ceramics and composite materials [8]  
b) Explain how the common surfaces will help for initiating engineering failures? [8]
- Q2)** a) Explain in brief the factors for selection of surface cleaning processes. [8]  
b) Explain with neat sketch any two surface coating processes. [8]
- Q3)** a) Explain any two conventional surface modification methods [8]  
b) Compare hot dipping, galvanizing, as a coating process with respective to principle of operation, process parameter, application, advantages, limitations [8]
- Q4)** Write short notes on any three [18]  
a) Mechanism of surface degradation  
b) Electroless deposition  
c) Surface treatment on advanced materials

***P.T.O.***

## SECTION-II

- Q5)** a) Discuss the various characteristics of coated surfaces [10]  
b) Discuss the influence of manufacturing processes on various surface properties of an engineering parts [6]
- Q6)** a) Explain different methods to measure thickness of coating material on surface of engineering material. [8]  
b) Explain different ways for evaluation of surface geometry [8]
- Q7)** a) Explain evaluation of tribological characteristics of surface in nano scale [8]  
b) What is meant by Nano scale? Explain how it will be achieved [8]
- Q8)** Write short notes on any three [18]  
a) Plasma Coating  
b) Surface engineering problems  
c) CVD



Total No. of Questions : 8]

SEAT No. :

P3982

[Total No. of Pages : 2

[4760] - 366

**M.E. (Production) (Manufacturing & Automation)**

**OPTIMIZATION TECHNIQUES**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Formulate an optimization problem for minimum weight design of a spring supporting 6000 N load subjected to constraints on deflection to be less than 2.5 mm and shear stress to be less than 100 MPa. Consider wire diameter, coil diameter, and number of turns as process variables. [8]
- b) What do you understand by local optimum solution and global optimum solution? Explain with neat sketch. [8]
- Q2)** a) Minimize the function  $f(x) = x^3 + (1/x^2)$  using golden section search method within the bounds of 0.5 to 2. [8]
- b) Explain steps for Fibonacci search method and also draw its flowchart. [8]
- Q3)** a) Minimize the function  $f(x) = x_1^2 - 5x_1 + x_2^2 - 3x_2 - 10$  such that  $1 \leq x_1, x_2 \leq 5$ . [8]
- b) Write the algorithm and draw flowchart for Powell's conjugate direction method. [8]

**P.T.O.**

- Q4)** Write short notes on : **[18]**
- a) Parato optimal solutions.
  - b) Hessian matrix of a function.
  - c) Geometric programming.

**SECTION - II**

- Q5)** a) Explain the gradient projection method for constrained optimization problems. **[8]**
- b) Perform one iteration of generalized reduced gradient method for the following problem : Minimize  $f(x) = x_1^2 + x_2^2$  subject to  $x_1x_2 - 9 = 0$ . Consider starting point as  $x_1 = 2$  and  $x_2 = 4.5$ . **[12]**

- Q6)** Solve following mixed integer programming problem using branch and bound method coupled with a graphical method for solving branching problem. **[16]**

Minimize  $f(x) = 4x_1 + 5x_2$

Subject to following constraints :

$$10x_1 + x_2 \geq 10; 3x_1 + 7x_2 \geq 21; 5x_1 + 4x_2 \geq 20; x_1 + 12x_2 \geq 12$$

$x_1 \geq 0$  and integer,  $x_2 \geq 0$ .

- Q7)** a) Explain steps of simulated annealing method and draw its flowchart.**[8]**
- b) What is elite count in genetic algorithm? How it affects performance of genetic algorithm? **[8]**

- Q8)** Write short notes on : **[18]**
- a) Mutation operator in genetic algorithm.
  - b) Difference between traditional methods and genetic algorithm.
  - c) Methods of handling constraints.



Total No. of Questions : 8]

SEAT No. :

P3983

[Total No. of Pages : 2

[4760] - 367

**M.E. (Production-Manufacturing & Automation)**

**RESEARCH METHODOLOGIES**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable electronic calculators is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Distinguish between historical, descriptive and experimental research. [6]  
b) What are the qualities of a good research worker? [5]  
c) What is the importance of formulating a research problem? Describe various ways of defining a research problem. [5]
- Q2)** a) What are the major types of Informal experimental design? [6]  
b) Describe with suitable examples, any two types of probability sampling. [5]  
c) Enumerate the essential characteristics of good experimental design. [5]
- Q3)** a) What are the merits and weaknesses of interview method? [6]  
b) What factors are to be considered while selecting an appropriate method of data collection? [5]  
c) What precautions are to be taken in collection of data? Indicate the limitations of data collection. [5]

**P.T.O.**

- Q4)** Write short notes on any three of the following : **[18]**
- a) Meta analysis.
  - b) Pictorial techniques of data collection.
  - c) Typical applications of experimental design.
  - d) Sample size determination in experimental design.
  - e) Research approaches.

**SECTION - II**

- Q5)**
- a) What does measures of central tendency indicate? Describe the important measures of central tendency. **[6]**
  - b) A survey result of 1600 Face book users indicates that 44% finished at least three years of college. Set the 95% confidence limits on true proportion of all Face book users with this background (z for confidence level of 95% is 1.96). **[5]**
  - c) What do you understand by statistical estimation? **[5]**
- Q6)**
- a) Describe the various measures of relationship often used in the context of research studies. **[6]**
  - b) What are the steps involved in Centroid method of Factor Analysis? **[5]**
  - c) State the basic assumptions of Analysis of Variance. **[5]**
- Q7)**
- a) Describe the steps involved in AHP with the help of a suitable example. **[6]**
  - b) What precautions should be taken while interpretation of the results? **[5]**
  - c) What are the characteristics of a good research report. **[5]**
- Q8)** Write short notes on any three of the following : **[18]**
- a) Different data processing operations.
  - b) Simple regression analysis.
  - c) Significance of Analysis of Variance.
  - d) Path analysis.
  - e) Documentation in context of a research report.



Total No. of Questions : 6]

SEAT No. :

**P4582**

**[4760]-369**

[Total No. of Pages : 2

**M.E. (Production)**

**ENERGY MANAGEMENT**

**(2008 Course) (Semester - II) (Open Elective - IV) (511112)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Draw necessary diagrams wherever necessary.*
- 3) *Use of steam tables and electronic calculator permitted.*

**SECTION - I**

- Q1) a)** Explain a detailed procedure of conducting energy audit. **[9]**
- b) Write relevant expressions and explain **[9]**
- i) Net Present value.
  - ii) Simple payback period.
  - iii) Return on investment.
- Q2) a)** Describe portable and online instruments used in energy audit. **[8]**
- b) Explain the concept of economic thickness of insulation. List the names of insulators and refractories used in industries. **[8]**
- Q3) a)** Write an expression for calculating boiler efficiency by direct and indirect method for an oil fired boiler explaining the terms involved. **[8]**
- b) How use of steam traps achieves energy conservation? What are the different types of steam traps based on working principle. **[8]**

***P.T.O.***

## SECTION - II

- Q4)** a) Explain LED technology and compare it with CFL. [9]
- b) Discuss the losses in electrical motors. How do energy efficient motors overcome them? [9]
- Q5)** a) Draw characteristic curves for pumping systems and explain with the help of these curves how variable frequency drive helps to conserve energy. [8]
- b) Explain the terms free air delivered and isothermal efficiency of air compressors. Discuss the leak detection test in compressed air systems. [8]
- Q6)** a) Discuss how cogeneration system helps conserve energy. Draw sketch of any one type of cogeneration system. [8]
- b) Write expressions for calculating cogeneration efficiency for a diesel engine powered cogeneration system. [8]

*EEE*

Total No. of Questions : 6]

SEAT No. :

P3751

[4760] - 37

[Total No. of Pages :3

M.E. (Civil-Structures)  
STRUCTURAL DYNAMICS  
(2008 Course) (Semester - I)

Time : 4Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any two questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Figures in bold to the right, indicate full marks.
- 4) If necessary, assume suitable data and indicate clearly.
- 5) Use of electronic pocket calculator is allowed.

**SECTION - I**

- Q1)** a) Explain mathematical model with a suitable example. [8]
- b) Determine the equivalent spring stiffness for the system shown in Fig. 1. Consider  $m = 20$  kg and  $k = 2 \times 10^5$  N/m. [10]

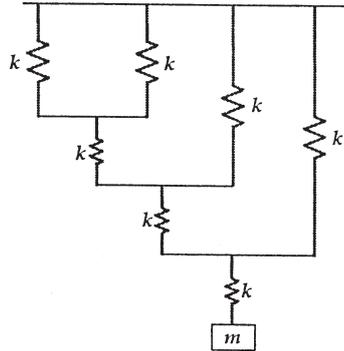


Fig. 1

- c) Write a note on classification of vibrations and also mention suitable examples. [7]
- Q2)** a) A machine of mass  $m = 500$  kg is mounted on a simply supported beam of length  $l = 2$  m having a rectangular cross section - depth = 0.1 m and width = 1.2 m. The Young's modulus  $E = 2.06 \times 10^{11}$  N/m<sup>2</sup>. To reduce the vertical deflection of the beam, a spring of stiffness  $k$  is attached at mid-span. Determine the value of  $k$  needed to reduce the deflection of the beam by 50% of its original value. [15]

P.T.O.

- b) A machine of mass 25 kg is placed on an elastic foundation. A sinusoidal force of magnitude 25 N is applied to the machine. The maximum steady state amplitude of 1.3 mm is observed when the period of response is 0.22s. Determine the equivalent stiffness and damping ratio of the foundation. [10]

- Q3) a)** Use the concept of step response to calculate the response  $x(t)$  of an undamped single degree of freedom system to a rectangular pulse as shown in Fig. 2. [15]

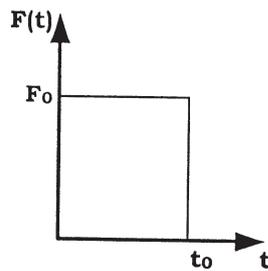


Fig. 2

- b) Write a note on linear acceleration method. [10]

### SECTION - II

- Q4) a)** What are mode shapes? [5]
- b) Obtain the natural frequencies and mode shapes for the system shown in Fig. 3. [15]

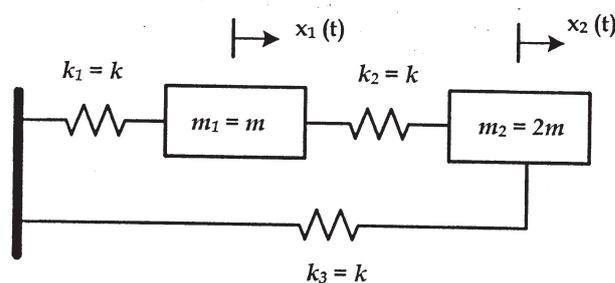


Fig. 3

- c) What is orthogonality of modes? How is it useful? [5]

- Q5)** a) Obtain the solution for a shear building subjected to ground motion. [15]  
b) What is non-linear analysis? [5]  
c) Write a note on Wilson-Theta method. [5]
- Q6)** a) Using Rayleigh quotient method, find the fundamental frequency for a cantilever beam assuming the approximate function as the static deflection curve. [15]  
b) A pin-ended strut of length  $l$  is subjected to a vertical axial load  $P$ . Determine the frequency of free transverse vibration of the strut, and the maximum value of  $P$  for stability. The strut has a mass  $m$  and a second moment of area  $I$ , and is made from material with modulus of elasticity  $E$ . [10]



Total No. of Questions : 10]

SEAT No. :

**P4536**

[Total No. of Pages : 3

**[4760] - 370**

**M.E. Production (CAD/CAM) (Semester - I)**

**COMPUTER AIDED DESIGN**

**(2010 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are the various data exchange systems currently in use? Explain in brief [8]
- b) Why parametric representation of geometrical entities are preferred in CAD software? Explain your answer with non-parametric and parametric equations of appropriate geometric entity. [8]
- Q2)** a) Explain the role quality deployment system in product design [8]
- b) Discuss the stages in product Life cycle and the importance of each stage. Differentiate between Forward Engineering and Reverse Engineering. [8]
- Q3)** a) Find the transformed coordinates when a square (1,1), (1,2), (2,2) and (1,2) is rotated by  $60^\circ$  in clockwise direction about a line passing through one of its vertex (1,1) and another arbitrary point (3,4). [8]
- b) What is rendering? What are the different stages of rendering an image?[8]

**P.T.O.**

**Q4) a)** Define Explicit, Implicit and parametric representation of geometrical entities and their advantages and disadvantages. [8]

b) Develop the equation of Bezier curve, find the points on the curve for  $t = 0, 1/4, 1/2, 3/4$  and 1, and plot the curve for the following data. The coordinates of four control points are given by [8]

$$V_0 = [0,0,0]$$

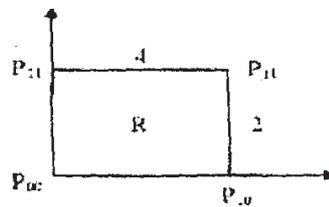
$$V_1 = [0,2,0]$$

$$V_2 = [4,2,0]$$

$$V_3 = [4,0,0]$$

**Q5) a)** Explain the procedure of mass property calculations in CAD software. [9]

b) Find the equation of B-spline surface that covers the region R. Also, find the surface vectors and its mid-point? [9]



## SECTION - II

**Q6) a)** Compare IGES and STEP. [8]

b) Find the minimum distance between: [8]

- i) A point and a surface
- ii) A curve and a surface
- iii) Two surfaces

**Q7) a)** What are the different techniques used to decide assembling sequence to generate assemblies? [8]

b) Why Euler's formula is used in solid modeling? Verify it for tetrahedron and a cube. How can you use a cylinder primitive to generate a sphere? [8]

**Q8) a)** Explain various types of surface entities. Derive parametric equation of analytical surface models. [8]

b) A plane passes through the three points  $P_0(1,2,3)$ ,  $P_1(2,4,5)$ , and  $P_2(4,2,3)$ . Find the surface area that is bounded by the parametric domain  $u = [0,1]$  and  $v = [0,1]$ . Use three point Gauss quadrature. [8]

**Q9) a)** Why do we need NURBS? What are the advantages and problems of NURBS? [8]

b) What are the requirements of Engineering Animation? Explain the Keyframe animation technique. [8]

**Q10)** Write short notes on any three [18]

- a) Types of animations.
- b) Virtual realism.
- c) Hidden surface removal algorithm
- d) Shading algorithm



[4760]-371

**M.E. Production (CAD/CAM)**  
**COMPUTER AIDED MANUFACTURING**  
**(2008 Pattern)**

Time : 3 Hours]

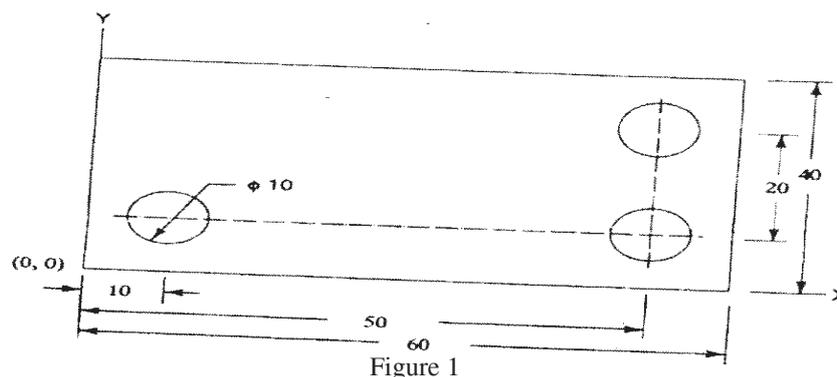
[Max. Marks : 100

*Instructions to the candidates:*

- 1) Answer three questions from each section.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of non-programmable electronic calculators is allowed
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Discuss the advantages and limitations of using ball screw and nut assembly in CNC machines. [6]
- b) Explain the principle functions of DNC. [5]
- c) Describe in brief the major parts of a vertical turning center. [5]
- Q2)** a) Write a NC program to drill three holes (10 mm dia. each) at different places for the work piece as shown in Figure 1. The depth of hole is 10 mm. Z = 00 at the surface of the work piece. The cutting tool is positioned above the work piece.



Assume suitable data if needed.

[10]

- b) What are the requirements of feedback devices in CNC machine tools? [6]

**P.T.O.**

- Q3) a)** Write a complete APT program (Geometric and Motion commands) for the work piece as shown in Figure 2. [10]

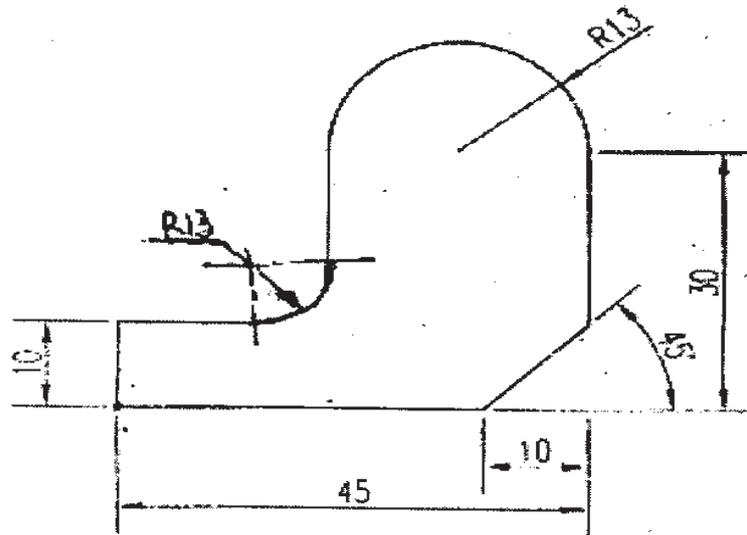


Figure 2

- b) What are the various types of tool magazines used in CNC machine tools? Give their relative merits. [6]

- Q4)** Write short notes on any three of the following. [18]

- Touch trigger probes
- Canned cycles
- CNC Presses
- Feed drives used in CNC machine tools
- Interpolation schemes

## SECTION -II

- Q5)** a) Describe in brief the major components of an ASRS system. [6]  
b) Calculate the number of AGVs required with a vehicle speed of 50 m/min with the average loaded travel distance of 180 m. The average empty travel distance is 120 m. The total time required for loading and unloading is 1 minute. The number of deliveries to be made is 50 per hour. Assume the traffic factor as 0.85. [5]  
c) Describe the measurement system based on photogrammetry principles. [5]
- Q6)** a) Describe the automated inspection principles and methods used in any manufacturing industry. [6]  
b) A eight station assembly machine has an idle cycle time of 6 s. The fraction defect rate at each of the 8 stations is  $q = 0.015$  and the system operates using an instantaneous control strategy. When a break down occurs, it takes 1 min, on average, for the system to be put back into operation. Determine the production rate for the assembly machine, the yield of good product (final assemblies containing no defective components) and the proportion uptime of the system. [5]  
c) What are the factors considered while designing a material handling system in a modern industrial unit? [5]
- Q7)** a) What is a Coordinate Measuring Machine? Explain in brief the four commonly used physical configurations of CMM. [6]  
b) Describe any five commonly used methods for collecting data from shop-floor. [5]  
c) Explain the kind of tasks that people will be required to do in a future automated factory. [5]
- Q8)** Write short notes on any three of the following. [18]  
a) Carousel assembly system  
b) Barcode techniques  
c) The information system in any automated factory  
d) Machine vision  
e) Types of conveyors



Total No. of Questions : 8]

SEAT No. :

**P3985**

**[4760] - 372**

[Total No. of Pages :2

**M.E. Production (CAD/CAM)  
OPTIMIZATION TECHNIQUES  
(2008 Course) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Formulate an optimization problem for minimization of machining cost subjected to constraints of power and surface finish in a turning operation. Consider feed, speed, and depth of cut as process variables. [8]
- b) Solve the non-linear programming problem using Lagrange multiplier method: [8]
- Minimize  $2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$*   
*Subject to:  $x_1 + x_2 + x_3 = 11$  and  $x_1, x_2, x_3 \geq 0$*
- Q2)** a) Minimize the function  $f(x) = 6x^3 - 24x + 100$  using golden section method within the bounds of 0 to 3. [8]
- b) Explain steps for Fibonacci search method for one dimensional minimization problems. [8]
- Q3)** a) Minimize the function  $f(x) = x_1^2 - 5x_1 + x_2^2 - 3x_2 - 10$  such that  $1 \leq x_1, x_2 \leq 5$  Use steepest descent method. [8]
- b) Explain pattern search method. [8]
- Q4)** Write short notes on: [18]
- a) Quadratic interpolation method.
  - b) Conjugate gradient method.
  - c) Evolutionary optimization.

**P.T.O.**

## SECTION - II

- Q5)** a) Minimize:  $x_1^2 + 2x_2^2$  subject to:  $1-x_1 - x_2 \leq 0$  using interior penalty method. [8]  
b) Discuss the algorithm for exterior penalty function method. [8]
- Q6)** a) Explain steps of basic genetic algorithm [8]  
b) What is the probability of accepting new solution (2.4, 3.1) over current solution of (1.8, 2.6) at temperature 300°C for minimizing the function  $x_1^2 + 3x_2^2 - 8x_1x_2 + 360$  with  $1 \leq x_1, x_2 \leq 4$  using simulated annealing? [8]
- Q7)** a) Explain Modeling Return-On-Investment (ROI) in TOC. [8]  
b) Explain nine principles of optimized production technology. [8]
- Q8)** Write short notes on: [18]  
a) Reproduction operator in genetic algorithm.  
b) Limitations of simulated annealing algorithm.  
c) Difference between supervised and unsupervised learning in artificial neural networks.



[4760] - 373

M.E. (Production Engineering) (CAD/CAM)

ADVANCED STRESS ANALYSIS

(2008 Pattern) (Elective - I)

Time : 3 Hours]

[Max. Marks : 100

*Instructions to the candidates:*

- 1) Answers to the two sections should be written in separate answer books.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Square bracketed figures to the right indicate full marks.
- 4) Use of logarithmic tables, slide rule and non-programmable electronic pocket calculator is allowed.
- 5) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Define an octahedral plane. Write an expression of normal shear component of stress tensor on this plane. [8]
- b) Explain stress deviator tensor and its invariants. Express von Mises stress in terms of second invariant of stress deviator tensor. [10]

OR

- Q2)** a) Using castigliano's theorem, determine the deflection of point A of the step shaft as shown in figure 1. The second -area moment of the beam between points A and B is  $I_1$ , and from B to C the second -area moment is  $I_2 = 2I_1$ , The entire beam is made of a material with modulus of elasticity of E. [8]

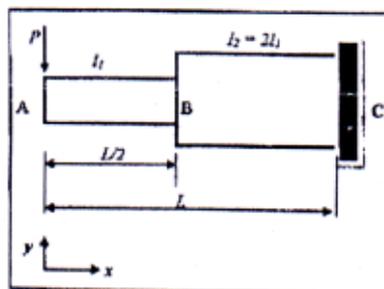


Figure 1 (Shaft fixed at end C)

P.T.O.

b) Determine the stress fields that arise from the following stress functions: [10]

i)  $\phi = Cy^2$

ii)  $\phi = Ax^2 + Bxy + Cy^2$

iii)  $\phi = Ax^3 + Bx^2y + Cxy^2 + Dy^3$

Where A, B, C and D are constants.

**Q3)** Consider the complex potentials  $\gamma(z) = Az, \psi(z) = Bz$ , where A and B are complex constants. Derive the explicit expression for the displacements corresponding to a uniform stress field using fundamental stress combination [16]

$$\sigma_x + \sigma_y = 2(\gamma'(z) + \overline{\gamma'(z)}) = 2(A + \bar{A}) + 4\text{Re} A = 4A_r$$

$$\sigma_y - \sigma_x + 2i\tau_{xy} = 2(\bar{z}\gamma''(z) + \psi'(z)) = 2B = 2(B_r + iB_i)$$

OR

**Q4)** Explain how conformal mapping provides a convenient means to find elasticity solutions to interior and exterior problems of complex shape. [16]

**Q5)** Explain with sketch an experimental stress analysis using [16]

a) Brittle coat method and

b) X-ray techniques.

### SECTION - II

**Q6)** a) Explain the mechanism of fatigue crack initiation and propagation in ductile metals. [8]

b) Consider a flat plate of some metal alloy that is to be exposed to repeated tensile-compressive cycling in which the mean stress is 25 MPa. If:  $a_0 = 0.25$  mm,  $a_c = 5.0$  mm,  $m = 4.0$ ,  $A = 5 \times 10^{-15}$ ,  $Y = 2.0$ , and  $N_f = 3.2 \times 10^5$  cycles calculated using relation.

$$\frac{1}{A\pi^{m/2}(\Delta\sigma)^m} \int_{a_0}^{a_c} \frac{da}{Y^m a^{m/2}}$$

Estimate the maximum tensile stress to yield the fatigue life prescribed. [10]

OR

- Q7)** a) Explain experimental procedure to plot S-N curve. [8]
- b) Consider an unnotched specimen with an endurance limit of 255 MPa. If the specimen was notched such that  $K_f = 1.6$ , what would be the factor of safety against failure for  $N > 10^6$  cycles at a reversing stress of 115 MPa. [10]
- i) Solve by reducing  $S'_e$
- ii) Solve by increasing the applied stress,

**Q8)** A semicircular surface crack in a pressure vessel is 10 mm deep. The crack is on the inner wall of the pressure vessel and is oriented such that the hoop stress is perpendicular to the crack plane. Calculate  $K_1$  if the local hoop stress = 200 MPa and the internal pressure = 20 MPa. Assume that the wall thickness  $\gg 10$  mm. [16]

OR

**Q9)** A structural component made from a high strength steel is subjected to cyclic loading, with  $\sigma_{\max} = 210$  MPa and  $\sigma_{\min} = 70$  MPa. This component experiences 100 stress cycles per day. Prior to going into service, the component was inspected by nondestructive evaluation (NDE), and no flaws were found. The material has the following properties:  $\sigma_{ys} = 1000$  MPa,  $K_{Ic} = 25$  Mpa $\sqrt{m}$ . The fatigue crack growth rate in this material is the same as in problem 9. The NDE technique can find flaws  $> 2$  mm deep. Estimate the maximum safe design life of this component, assuming that subsequent in-service inspections will not be performed. Assume that any flaws that may be present are semicircular surface cracks and that they are small relative to the cross section of the component. [16]

**Q10)** Using the Paris-Erdogan equation for fatigue crack propagation, calculate the number of fatigue cycles corresponding to the combinations of initial and final crack radius for a semicircular surface flaw tabulated below. Assume that the crack radius is small compared to the cross section of the structure. [16]

$$\frac{da}{dN} = 6.87 \times 10^{-12} (\Delta K)^3, \text{ where } da/dN \text{ is in m/cycles and } \Delta K \text{ is in MPa}\sqrt{\text{m}},$$

Also  $\Delta\sigma = 200 \text{ Mpa}$ .

| Initial crack radius in (mm) | Final crack radius (mm) |
|------------------------------|-------------------------|
| 1                            | 10                      |
| 1                            | 20                      |
| 2                            | 10                      |
| 2                            | 20                      |

Discuss the relative sensitivity of  $N_{\text{tot}}$  to :

- Initial crack size and
- Final crack size

(Assume  $\Delta K = 0.663 \Delta\sigma \sqrt{\pi a}$ )



Total No. of Questions : 8]

SEAT No. :

**P4583**

**[4760] - 374**

[Total No. of Pages :2

**M.E. (Production) (CAD/CAM)  
TRIBOLOGY AND SURFACE ENGINEERING  
(2008 Course) (Elective - I) (Semester - I) (511204)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Discuss tribological properties of metallic and non-metallic materials. [12]  
b) What are the various kinds of wear found in case of tribological failure?  
State laws of wear. [4]
- Q2)** a) Differentiate between Hydrostatic and hydrodynamic bearings. State their applications. [8]  
b) Derive Petroff's equation. What are its limitations? [8]
- Q3)** a) Derive Reynolds equation with usual notations. [8]  
b) State and explain pressure distribution in short journal bearing under hydrodynamic conditions. [8]
- Q4)** a) Write a short note on stick-slip Phenomenon. [6]  
b) Explain Bearing performance measurement. [6]  
c) State the characteristics of lubrication oil. [6]

*P.T.O.*

## SECTION - II

- Q5)** a) Discuss the concept and importance of Surface Engineering. [8]  
b) Explain Geometrical Parameters of Superficial Layer. [8]
- Q6)** a) Give the classification of coatings according to various modes. [8]  
b) Explain Electro and electro-less Plating. [8]
- Q7)** a) State and Explain Potential Properties and Parameters of Coatings. [8]  
b) Discuss the service properties of coatings with reference to anti-corrosion and decoration. [8]
- Q8)** Write a short note on:
- a) Physical vapour Deposition. [6]  
b) Ion Implantation. [6]  
c) Sputtering. [6]



Total No. of Questions : 8]

SEAT No. :

**P3986**

**[4760]-375**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)**  
**INDUSTRIAL ROBOTICS & ARTIFICIAL INTELLIGENCE**  
**(2008 Course) (Semester - I) (511204)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Define Robot, and explain **[10]**
- i) Repeatability
  - ii) Compliance
  - iii) Robot Accuracy
  - iv) Spatial Resolution
- b) Explain in brief the applications of robot along with its configuration. **[8]**
- Q2) a)** Differentiate between open-loop and closed-loop servo systems. **[8]**
- b) Explain six degrees of freedom associated with the robot manipulator. **[8]**
- Q3) a)** What is Sensors? List the different types of sensors used in robot. Explain any two Sensors in detail. **[8]**
- b) Explain: **[8]**
- i) Manual mode of programming
  - ii) Lead through mode of programming
  - iii) Textual robot Language
  - iv) Off-line programming mode.

**P.T.O.**

- Q4)** a) Discuss the gripper design considerations in robotics. [8]  
b) Explain in brief: [8]  
i) Mechanical Grippers  
ii) Vacuum Grippers

### **SECTION - II**

- Q5)** a) Define Artificial Intelligence. List steps in the problem formulation in A.I. [10]  
b) What is the role of agents in artificial intelligence? Briefly discuss properties of agents. [8]
- Q6)** a) Explain any two search strategies used in A.I. [8]  
b) Explain forward and backward reasoning in A.I. [8]
- Q7)** a) Differentiate between Proposition logic and Predicate logic. [8]  
b) Explain the term knowledge, information and intelligence. [8]
- Q8)** a) Explain the knowledge engineering process in brief. [8]  
b) Explain forward and backward chaining. [8]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3987**

**[4760]-376**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)  
CONCURRENT PRODUCT DESIGN**

**(2008 Course) (Semester - I) (Elective - I) (511204)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

- Q1)** a) What do you know about benchmarking? Discuss different phases of benchmarking. [8]
- b) Explain suitable example the construction of concurrent design model for a product. [8]
- Q2)** a) What are the functional requirements for any product design? [8]
- b) What is concurrent design? State and explain the role of design team elements in concurrent design? What are benefits of concurrent design?[8]
- Q3)** a) What is meant by robustness? What is the importance of it in design? Discuss the various elements of Taguchi's system of robustness. [8]
- b) Explain different approaches for material and process selection. [8]
- Q4)** Write short notes on any three: [18]
- a) Technology and technology life cycle.
- b) Design for Environment.
- c) Design for aesthetic.

**P.T.O.**

## SECTION - II

- Q5)** a) What are the objectives of Design to Cost? State the elements which are to be considered in designing product cost. [8]
- b) Discuss Life Cycle Cost of product. [8]
- Q6)** a) What is the importance of project management in product development? Explain it. [8]
- b) What are the benefits of Modularity in product design? Discuss various types of modularity with the help of sketches. [8]
- Q7)** a) Differentiate mechanical and electronic product design. [8]
- b) Explain how enhancement in the manufacturability & other attributes of electronic products is done by the concurrent engineering. [8]
- Q8)** Write short notes on any three: [18]
- a) Cost indexes.
- b) Mechanical considerations in product design.
- c) Collaborative product development.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3988**

[4760] - 377

[Total No. of Pages : 2

**M.E.(Production) CAD/CAM  
MECHATRONICS (Elective - II)  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any three questions from section I and any three questions from Section II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 5) *Assumptions made should be clearly stated and justified.*

**SECTION - I**

- Q1)** a) Explain the design process for Mechatronics system. [8]  
b) Enumerate the importance of control system. [8]
- Q2)** a) Explain potentiometer sensor and Hall effect sensor. [8]  
b) Describe the characteristics of commonly used sensors using terms such as range, span, error, accuracy, sensitivity, hysteresis and non-linearity errors. [8]
- Q3)** a) Explain transducer signal conditioning process with suitable example.[8]  
b) Explain the characteristics of Digital to Analog converters. [8]
- Q4)** Write short notes on the following: [18]  
a) Pulse Modulation  
b) Linear feedback control system  
c) Multiplexers  
d) Application of Mechatronics system.

*P.T.O.*

## SECTION - II

- Q5)** a) Enumerate Ladder Logic diagrams used in Programming Logic controllers [8]  
b) Draw a ladder logic diagram for domestic washing machine to switch on a pump to pump water for 200s into the machine, then switch off and switch on heater for 100s to heat the water. The heater is then switched off and another pump is to empty the water from machine for 200s. **10]**
- Q6)** a) Compare microprocessor and microcontroller. [6]  
b) State briefly programming languages used in PLC. Write in assembly language, a subroutine that can be used to produce time delay & which can be set at any value [10]
- Q7)** a) Discuss the sequential logic system with suitable example. [8]  
b) Explain with suitable example mechatronic control in automated system [8]
- Q8)** Write short notes on the following: [16]  
a) Artificial Intelligence.  
b) Instruction sets in microprocessor.  
c) Latching circuit.  
d) PID controllers.



Total No. of Questions : 8]

SEAT No. :

**P3989**

**[4760] - 378**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)  
RAPID PROTOTYPING  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is RP-Rapid prototyping? Explain its benefits and applications. [8]  
b) What is STL file generation, file verification & repair in RP? Explain. [8]
- Q2)** a) Explain in detail Fused Deposition Modeling (FDM). [8]  
b) Explain Fused object manufacturing in brief. [8]
- Q3)** a) What are operational properties in RP? [8]  
b) Explain the concept of Environmental Resistance in Rapid prototyping. [8]
- Q4)** Write short notes on (Any Three) : [18]  
a) Part cleaning & finishing in RP process.  
b) Data acquisition in Reverse Engineering  
c) The photomodulus model.  
d) Rapid Tooling & Rapid manufacturing.  
e) SL with liquid thermal polymerization.

**P.T.O.**

## SECTION - II

- Q5)** a) What is minaturization in RP? Explain. [8]  
b) Explain applications of RP in poleontology & Torensic science? [8]
- Q6)** a) Describe bilateral Exposure of thin sample. [8]  
b) Explain the working curved equation in brief. [8]
- Q7)** a) What are the different alternative processes used in place of RP? [8]  
b) Explain RP economics in present context. [8]
- Q8)** Write short notes on (Any Three) [18]
- a) Laser Additive Non laser fabrication.
  - b) Biomedical Applications of RP.
  - c) The line sprade function of scanned Gaussian Laser Beam.
  - d) Design considerations in RP.
  - e) RP models form & fit checking



Total No. of Questions : 6]

SEAT No. :

**P4584**

**[4760] - 379**

[Total No. of Pages :2

**M.E. (Production) (CAD/CAM)  
ENERGY MANAGEMENT  
(2008 Pattern) (Semester - I) (Elective - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Use of steam tables permitted.*
- 3) *Figures/block diagrams for descriptive questions expected.*

**SECTION - I**

- Q1)** a) Explain a detailed procedure of conducting energy audit. [9]
- b) Write relevant expressions and explain [9]
- i) Net Present value
  - ii) Simple payback period
  - iii) Return on investment
- Q2)** a) Describe portable and online instruments used in energy audit. [8]
- b) List the names of insulators and refractories used in industries. [8]
- Q3)** a) Explain the terms: [8]
- i) Boiler efficiency on direct basis,
  - ii) Boiler efficiency by indirect method
- Write their units and expressions.
- b) Discuss mechanical and thermodynamic steam traps using sketches.[8]

*P.T.O.*

## SECTION - II

- Q4)** a) Write a note on energy efficient illumination stating various illumination options and their luminous efficacy. [9]
- b) Discuss the specific features of energy efficient motors? [9]
- Q5)** a) Discuss significance steps for implementing energy conservation for compressed air systems. [8]
- b) Discuss significance and steps for implementing energy conservation for HVAC systems. [8]
- Q6)** Explain the following with the help of schematics.
- a) Cogeneration in sugar industry. [8]
- b) Diesel engine based cogeneration. [8]



Total No. of Questions : 6]

SEAT No. :

**P3927**

**[4760] - 38**

[Total No. of Pages :2

**M.E. (Civil) (Structures)**

**ADVANCED DESIGN OF CONCRETE STRUCTURES**

**(2008 Course) (Elective - I) (Semester - I)**

*Time : 4Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of IS 456, IS 1343, IS 3370 & non programmable calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Draw yield lines for the following: **[8]**
- i) Square slab with fixed supports on two adjacent sides with remaining sides unsupported and having column at intersection of these shorter unsupported sides.
  - ii) Equilateral triangular slab fixed at two adjacent sides and free at third side.
- b) Design a RCC slab for a square hall of sides 6m using Yield Line Theory. Assume the peripheral support thickness 230 mm. The slab is simply supported Use M25 Fe500 take Live load = 4kN/m<sup>2</sup> & floor finish load = 1.5 kN/m<sup>2</sup>. Draw details of reinforcement. **[10]**
- c) Differentiate between the Yield line theory & Hillerborg's strip method. **[7]**
- Q2) a)** Design a intermediate panel of flat slab for a hall with column spacing 5.5 m × 5.5 m c/c. the size of the column diameter is 450 mm each Use M20 Fe500 take Live load = 4.5 kN/m<sup>2</sup> & floor finish load = 1.5 kN/m<sup>2</sup>. Draw reinforcement details. **[10]**
- b) Design a grid slab for a floor of hall 12 × 15 m c/c having square grid of 1.5 m. Use M20 Fe500 take Live load = 4.5kN/m<sup>2</sup> & floor finish load = 1.5 kN/m<sup>2</sup>. Apply the required check & Draw reinforcement details. **[15]**

***P.T.O.***

**Q3)** Design a staging for circular type ESR for 3.5 lakh liters with staging height 10 m using M25, Fe500 in earthquake zone IV. Safe bearing capacity is 180 kN/m<sup>2</sup>. Design of container is not required. Assume approx dimension of container, wall, top, bottom slab thickness, beams sizes & number of columns. Design must include calculations of vertical loads and horizontal force Design the bracings, columns and foundations. Draw the reinforcement details. [25]

### SECTION - II

**Q4)** a) Write detailed note on classification Deep beam. [5]  
b) Design a bell type RCC shear wall for length 4m, thickness 230 mm for the following Axial forces of 2000kN and 240kN due to dead & live load and due to seismic load respectively.  
Bending moment of 300 kNm and 4000kNm due to dead & live load and due to seismic load respectively.  
Use M25 Fe500. Draw reinforcement details. [20]

**Q5)** A two span prestressed concrete continuous beam ABC having cross section 230 × 750 mm simply supported at A & C and continuous over B. The eccentricities at A & C = 0, at B = 250 mm upward and at midspan of AB & BC = 200 mm downwards. Material used is M45 and multistrand cables 2 Nos 9T13 (having 7 strands for 100 mm<sup>2</sup> with  $f_y = 1950 \text{ N/mm}^2$ ), stressed to 75% of  $f_y$ , each span is of 18m, superimposed load on both the spans 13 kN/m, Assume 20% loss of prestress. [25]  
a) Determine primary, secondary moment at support at prestress and dead load.  
b) Draw the resultant line of thrust at working load.  
c) Calculate shift and stress in extreme fibers at working load.

**Q6)** Design post tensioned prestressed concrete slab for a floor for the following: Flat interior panel of 7.5m × 9.5m, live load on slab 5 kN/m<sup>2</sup>, floor water proofing load on slab = 2 kN/m<sup>2</sup>, concrete grade M45, Multi-strand cables S3 (having 3 strands of 100 mm<sup>2</sup> with  $f_y = 1950 \text{ N/mm}^2$ ) stressed up to 75% of 'fy'. Design cables to serve as beams. Assume 3 panels in each direction. Width of the beam on periphery of floor 600 mm and column size 600 mm × 600 mm. Design must include check fiber stresses in concrete and deflection. Draw sketches showing cable profiles. [25]

Total No. of Questions : 10]

SEAT No. :

**P4730**

**[4760] - 380**

[Total No. of Pages : 3

**M.E. (Production) (CAD/CAM)**

**CAD/ CAM/CAE SOFTWARE DEVELOPMENT**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any three questions from each section.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is API? How to design good API? What it matters? [8]
- b) What is customization of CAD software? What is the need for CAD customization? What are benefits of CAD customization? [8]
- Q2)** a) Discuss the use of general programming interfaces. [8]
- b) What are the tools for customization of CAD software? Discuss Object Orient Programming (OOP). [8]
- Q3)** a) What are the different phases of the system engineering process? Explain each in brief. [8]
- b) Explain system dependent programming interfaces for pro-programming (Pro-Engineer). [8]
- Q4)** a) Discuss the waterfall software process model. [8]
- b) Explain software product development life cycle. [8]

***P.T.O.***

- Q5) a)** Discuss the following with reference to software project management:[9]
- i) Proposal writing
  - ii) Project planning and scheduling
  - iii) Project cost
  - iv) Project monitoring and review
  - v) Personnel selection and evaluation
  - vi) Report writing and presentation
- b) Write short note on Application frameworks. [9]

### **SECTION - II**

- Q6) a)** Discuss core issues in rapid software development process. [8]
- b) How software prototyping helps in software development process? [8]
- Q7) a)** Discuss Euler operation with reference to solid modeling. [8]
- b) Discuss Extreme Programming used for rapid software development.[8]
- Q8) a)** Explain creation of 2D entities in any CAD software using API. [8]
- b) A software is to be developed for drawing and manipulation of line, arc circle and polygon. Design graphical user interface for the same. [8]
- Q9) a)** What is conventional animation? What are the different steps used in conventional animation in creation of animated film? [8]
- b) Explain the basic fundamentals of solid modeling representation in any CAD software. [8]

**Q10)** Write notes on any three of the following:

**[18]**

- a) Automated drafting and dimensioning using customization.
- b) Computer aided software engineering.
- c) Software testing.
- d) User interface design.



Total No. of Questions : 8]

SEAT No. :

P4585

[Total No. of Pages : 4

[4760] - 382

**M.E. (Production) CAD/CAM  
FINITE ELEMENT ANALYSIS  
(2010 Pattern)**

Time : 3 Hours]

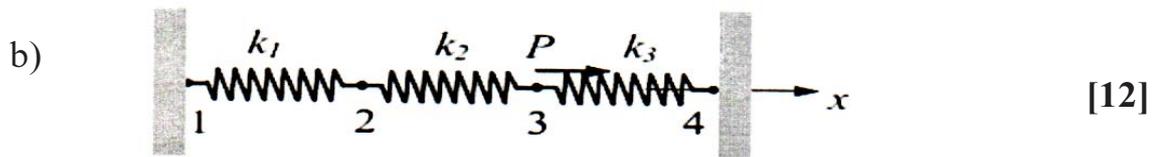
[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from Section I and any three questions from Section II.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Use of electronic pocket calculator is allowed.
- 4) Assumptions made should be clearly stated and justified.

**SECTION - I**

Q1) a) Explain the concept of functional. What is the principle of minimum potential energy? [6]



Given: For the spring system shown above,

$$k_1 = 100 \text{ N / mm}, k_2 = 200 \text{ N / mm}, k_3 = 100 \text{ N / mm}$$

$$P = 500 \text{ N}, u_1 = u_4 = 0$$

- Find:
- a) the global stiffness matrix
  - b) displacements of nodes 2 and 3
  - c) the reaction forces at nodes 1 and 4
  - d) the forces in the. spring ?

P.T.O.

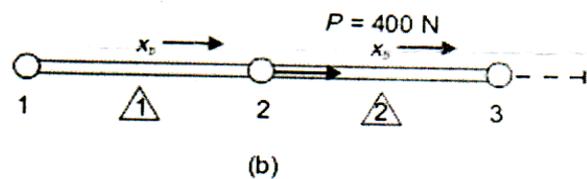
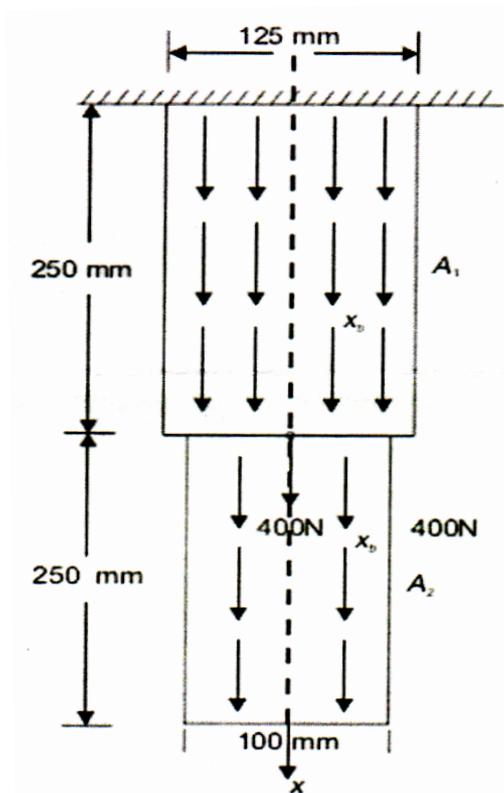
**Q2) a)** By direct stiffness matrix approach, determine stiffness matrix for beam element neglecting axial deformation [6]

b) A beam of length 15 m, fixed at one end and supported by a roller at the other end carries a 20kN concentrated load at the centre of the span. By taking the modulus of elasticity of material as 100 GPa and moment of inertia as  $20 \times 10^{-6} \text{ m}^4$ . Determine: [10]

- i) Deflection under load
- ii) Shear force and bending moment at mid span
- iii) Reactions at supports

**Q3) a)** State and explain Hamilton's principal [6]

b) The thin plate of uniform thickness 20 mm is as shown in Fig. In addition to the self weight, the plate is subjected to a point load of 400N at mid-depth. The Young's modulus  $E = 2 \times 10^5 \text{ N/mm}^2$  and unit weight  $\rho = 0.8 \times 10^{-4} \text{ N/mm}^2$ . Analyze the plate after modeling it with two elements and find the stresses in each element. [10]



- Q4) a)** Give the concept of ‘Shape Functions’ and explain its properties. [8]
- b)** Write short notes on.(Any two) [8]
- i) Geometric isotropy / Geometric Invariance
  - ii) Rayleigh-Ritz method
  - iii) variational principles.
  - iv) Connectivity conditions

### SECTION - II

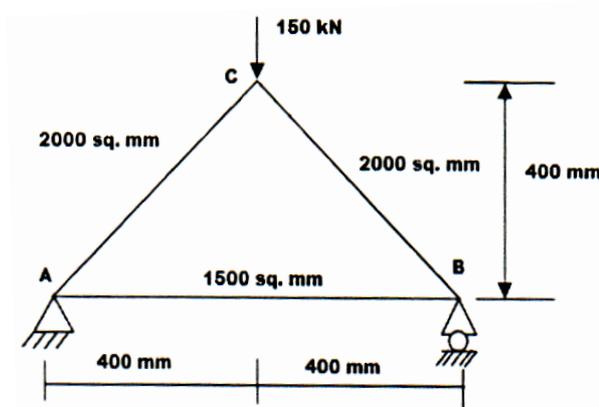
- Q5) a)** Solve the Differential equation by following methods. [12]

$$\frac{d^2u}{dx^2} + 9u + 6x = 0 \quad \text{B.C.s : } u(0) = 0 \quad u(1) = 0$$

- i) Rayleigh-Ritz method
  - ii) Petro Galerkin method
- b)** Derive stiffness equation for a spar element oriented arbitrarily in a 2-dimensional plane. [6]

- Q6) a)** Derive expression for load vector for frame element. [6]

- b)** For the three-bar truss shown in figure below. Determine the nodal displacement and stress in each member. Find the support reactions also. Take  $E = 200\text{GPa}$ . [10]



**Q7)** a) Derive the expression for consistent load vector due to self weight in a CST element. [6]

b) The thermal conductivity of a stainless steel rod of 0.1 m length and area of cross section of  $1 \text{ cm}^2$  is  $20 \text{ W/m-}^\circ\text{C}$ . The rate of heat generation in the rod is  $10^5 \text{ W/m}^3$ . One end of the rod is kept at  $0^\circ\text{C}$  and the other end at  $100^\circ\text{C}$ . The rod is insulated except at the ends. Using finite element with two elements, find out the temperature at the mid-point of the rod. Also, find out the heat flow at the ends of the rod using FEM. Compare the results with the exact solution. [10]

**Q8)** Attempt any two [16]

- a) FEA Package
- b) Isoparametric elements.
- c) lumped loads and consistent loads.
- d) Sources of error in FEA analysis



Total No. of Questions : 8]

SEAT No. :

P3990

[4760] - 383

[Total No. of Pages :3

**M.E. (Production) (CAD/CAM)  
ADVANCED MATHEMATICS  
(2010 Course) (Semester -II) (511210)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from Section-I and 3 questions from Section -II.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1) a)** Solve the integral equation: **[8]**

$$\int_0^{\infty} f(x) \cos \lambda x dx = e^{-\lambda} .$$

b) If  $A = \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$  show that  $(I - A)(I + A)^{-1}$  is a unitary matrix. **[8]**

**Q2) a)** Show that the transformation **[8]**

$$y_1 = x_1 - x_2 + x_3$$

$$y_2 = 3x_1 - x_2 + 2x_3$$

$$y_3 = 2x_1 - 2x_2 + 3x_3$$

is regular, write down the inverse transformation.

b) Solve the boundary value problem

$y'' + y + x = 0$  ( $0 \leq x \leq 1$ ),  $y(0) = y(1) = 0$  by Galerkin's method. Compare your solution with the exact solution. **[8]**

**P.T.O.**

**Q3) a)** Two masses  $M_1$  and  $M_2$  are connected by an inextensible string which passes over a fixed pulley. Using Lagrange's equations show the acceleration of either mass is numerically  $= (m_1 - m_2)g / (m_1 + m_2)$ . [8]

b) Solve by the method of Laplace transform the equation

$$y''' + 2y'' - y' - 2y = 0 \text{ with } y(0) = y'(0) = 0 \text{ and } y'(0) = 6. \quad [8]$$

**Q4) a)** Reduce the quadratic form  $2x_1x_2 + 2x_1x_3 - 2x_2x_3$  to the canonical form by an orthogonal reduction and discuss its nature. Also find the modal matrix. [6]

b) Find the curve on which the functional  $\int_0^1 [(y')^2 + 12xy] dx$ , with  $y(0) = 0$  and  $y(1) = 0$  can be extremised. [6]

c) Find the Fourier transform of  $e^{-x^2}$ . [6]

### SECTION - II

**Q5) a)** For a chi-square distribution with n.d.f establish the following recurrence relation between the moments. [9]

$$\mu_{r+1} = 2r (\mu_r + n\mu_{r-1}), r \geq 1. \text{ Hence find } \beta_1 \text{ \& } \beta_2.$$

b) The ends A and B of a rod 20cm long have the temperature at 30°C and 80°C until steady state prevails. The temperature of the ends are changed to 40°C and 60°C respectively. Find the temperature distribution in the rod at time 't'. [9]

**Q6) a)** Solve  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  for,  $0 < x < \pi$ ,  $0 < y < \pi$ , given that

$$u(0, y) = u(\pi, y) = u(x, \pi) = 0, u(x, 0) = \sin^2 x. \quad [8]$$

b) Discuss the state variable model and its advantage's over differential equation model. [8]

- Q7) a)** A random variable  $X$  has uniform distribution over  $(-3, 3)$ , find 'k' for which  $p(x > k) = \frac{1}{3}$ . Also evaluate  $p(x < 2)$  and  $p[|x - 2| < 2]$  [8]
- b) The height of six randomly chosen sailors are (in inch): 63,65,68,69,71,72. Those of 10 randomly chosen soldier's are 61,62,65,66,69,69,70,71,72,73. Discuss the light that these data thrown the suggestions that sailors are on the average taller than soldier's. [8]
- Q8) a)** A tightly stretched Flexible string has its ends fixed at  $x = 0$  and  $x = l$ . At a time  $t = 0$ , the string is given a shape defined by  $f(x) = \mu x(l - x)$ , where  $\mu$  is a constant and then released, find the displacement of any point  $x$  of the string at any time  $t > 0$ . [9]
- b) Describe in brief types of simulation approaches. [9]



Total No. of Questions : 8]

SEAT No. :

**P3991**

**[4760]-384**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)**  
**PRODUCT LIFE CYCLE MANAGEMENT**  
**(2008 Course) (Elective-III) (511211 (A)) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Solve any three questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of electronic pocket calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a) What are the opportunities and benefits of PLM? [8]**

b) What are the principal of PLM strategies? And how are they prepared?  
[8]

**Q2) Write short notes on: [18]**

- a) Bottom up design.
- b) Concurrent Engineering.
- c) Modular design.

**Q3) a) Define product modeling & explain its fundamental issues. [8]**

b) Explain suitable example mathematical modeling vs. physical prototyping.  
[8]

**Q4) a) What factor should be considered in developing PLM vision? [8]**

b) Explain & state the guidelines of 'Design for assembly'. [8]

***P.T.O.***

## SECTION-II

**Q5)** Write short note on: **[18]**

- a) Failure mode effect analysis.
- b) Taguchi method.
- c) Design for disassembly.

**Q6)** a) What are the basic reasons of implementing Product Data Management (PDM) system? **[8]**

b) Explain the operational phase of product development. **[8]**

**Q7)** a) What is mean by intelligent information system? Explain it. **[8]**

b) Explain how soft computing facilities are used in product development process. **[8]**

**Q8)** Write short notes on: **[16]**

- a) Design for manufacturing.
- b) Architectures of PDM.
- c) Quality factor deployment.



Total No. of Questions : 8]

SEAT No. :

**P3992**

**[4760]-385**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)**

**ADVANCED MATERIALS AND PROCESSING**

**(2008 Course) (Semester - II) (Elective - III) (511211 (b))**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Explain in short **[8]**
- i) Dual phase steel
  - ii) TRIP steel
- b) What is supper alloy? What metals or combinations of metals form the base of the supper alloy? **[5]**
- c) What is high strength low alloy steel? How it is designated? **[5]**
- Q2) a)** What is nanomaterial? Why are they being developed? **[8]**
- b) What is smart material? Explain in short their application. **[8]**
- Q3) a)** Explain the method of processing and industrial application of WC and  $Al_2O_3$ . **[8]**
- b) What is ceramic? How is it produced? Explain its properties and applications. **[8]**

**P.T.O.**

- Q4)** a) List the name of few of the magnetic and photoelectric material and how they are produced? [6]
- b) Explain recycling of plastic vs. The development of biodegradable plastic. [6]
- c) What effect does additives have on polymer? [6]

### SECTION - II

- Q5)** a) Explain some of the techniques used to cut fiber reinforced composite. [8]
- b) State the properties and application of [8]
- i) MMC
  - ii) SMC
  - iii) BMC
  - iv) Composite material
- Q6)** a) What are the functions of dielectric? List the name of dielectric used in electro chemical machining. And how electrolyte flow is designed? [8]
- b) Explain ultrasonic machining with neat sketch. What are the process parameters of USM? And how it affects the process? [8]
- Q7)** a) What is thermal spraying and plasma spraying? Note down the difference between them. [8]
- b) Explain with neat sketch the mechanism of electrochemical grinding. [8]
- Q8)** a) Explain different types of solid state fabrication technique. [6]
- b) Explain EDM with sketch. [6]
- c) Explain principle of magnetic abrasive finishing process. [6]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3993**

**[4760]-386**

[Total No. of Pages : 3

**M.E. (CAD/CAM)**

**MANUFACTURING SYSTEMS DESIGN**

**(2008 Course) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*
- 6) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1) a)** Explain with specific reasons, why system yield is lower than machine cycle in a manufacturing system. **[8]**

b) What characteristics attributable to design and manufacturing contribute to the quality of a manufactured product? Why do machining operations have an optimum (non-zero, non-infinite) cutting speed? **[8]**

**Q2) a)** Explain the following: **[8]**

i) Mass Customization.

ii) Modes of Production.

b) Discuss the attributes and appropriate applications for the different transmissions used in machine tools. What are the motivations for introducing automation into a manufacturing system? **[8]**

**Q3) a)** What is a route sheet. What is the difference between a basic process and a secondary process. Explain the term precedence constraint in process planning. **[8]**

***P.T.O.***

- b) Suppose a turning operation is to be performed with HSS tooling on mild steel, with Taylor tool life parameters  $n = 0.125$ ,  $C = 70$  m/min. the work part has length = 500 mm and diameter = 100 mm. Feed = 0.25 mm / rev. Handling time per piece = 5.0 min, and tool change time = 2.0 min. cost of machine and operator = Rs. 1500. hr, and tooling cost = Rs. 150 per cutting edge. find [8]
- i) Cutting speed for maximum production rate, and
- ii) Cutting speed for minimum cost.

- Q4)** a) What are the criteria for evaluation of manufacturing optimization? Explain? [10]
- b) Define the terms 'Average Cycle time', Throughput Rate' 'Reentrant Flow' and 'Work in Process' in Manufacturing System design? [8]

## **SECTION - II**

- Q5)** a) Explain the role of simulation in manufacturing system design? Explain with an example? [8]
- b) Explain the general design framework and evaluation procedures used in simulation of manufacturing systems? [8]
- Q6)** a) Define 'Group technology' and 'Part Family'. What is the composite part concept in Group Technology. [8]
- b) What is a flexible manufacturing system. What makes an automated manufacturing system flexible? Name some of the FMS software and control functions. [8]
- Q7)** a) Distinguish between Lean Manufacturing and Agile Manufacturing (any six features) with examples. [8]
- b) Explain the following database structures: [8]
- i) Hierarchical    ii) Network    iii) Relational

**Q8)** Write a short note on any three of the following:

**[18]**

- a) Automatic data collection systems.
- b) Hollier method for GT cell layout.
- c) Computer systems in manufacturing systems analysis.
- d) Criteria for Line Balancing.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3994**

**[4760]-387**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)**

**QUALITY & RELIABILITY ENGINEERING**

**(2008 Course) (Semester - II) (Elective - III) (511211)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section I and any three questions from section II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assumptions made should be clearly stated and justified.*

**SECTION - I**

**Q1) a) Describe Tolerance design strategy. [6]**

b) What is meant by matrix experiment? How it effects parameter set?[10]

**Q2) a) Discuss the steps in designing performance in process. [6]**

b) A bread-stuffing producer is comparing the calorie content of the original process with a new process. Which has the lower content and what is the difference? results are: [10]

|          |     |     |     |     |
|----------|-----|-----|-----|-----|
| Original | 130 | 135 | 128 | 127 |
| Light    | 115 | 112 | 120 | 113 |

**Q3) a) Explain one sample and two sample test. [6]**

b) Identify parameters affecting surface finish of work piece machined on milling and carry out parameter design to improve the process parameters. [10]

***P.T.O.***

**Q4)** Write short notes on the following (Any two): **[18]**

- a) S/N ratio
- b) ANNOVA
- c) Estimation of factor effects
- d) Factorial design

**SECTION - II**

**Q5) a)** What are the methods to quantify reliability? Explain RPN in detail with the help of example. **[8]**

b) Compare FMECA and why-why analysis. **[8]**

**Q6) a)** Explain the terms MTTF, MTBF, FMECA, FTA **[8]**

Assume that a product has a constant failure rate of  $\lambda = 0.002$  per hour. What is the probability that it will survive or be reliable during the first 1000 hours of operation?

b) Draw the failure rate curve for industrial product and explain its shape. An element has a probability of successful operation over a given period of 70%. If such elements are connected in series estimate the improvement factor. **[8]**

**Q7) a)** Explain system reliability and its types in detail. **[6]**

b) Describe the various approaches available to increase the reliability of Multiple component complex system.

Perform process FMEA to anticipate what you could do to eliminate any problems in process of walking up in the morning and going to work. **[10]**

**Q8)** Write short notes on following (Any two): **[18]**

- a) Central limit theorem.
- b) Chebyshev inequality.
- c) Time-dependent Hazard models.
- d) K-out-of-m models.



Total No. of Questions : 10]

SEAT No. :

P4732

[Total No. of Pages : 3

[4760]-388

M.E. (Production - CAD/CAM)

**COMPUTER AIDED PRODUCTION PLANNING  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt three questions from Section - I.*
- 2) *Attempt three questions from Section - II.*
- 3) *Answers to two sections should be written in two different answer books.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain ALDEP use in facility planning. [6]  
b) The demand for the product for last 8 years is given below. Estimate the demand for next two years by regression method. [10]

| Year  | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|-------|------|------|------|------|------|------|------|------|
| Units | 42   | 50   | 65   | 55   | 60   | 71   | 85   | 68   |

- Q2)** a) Discuss different measures of forecast errors. [8]  
b) Discuss GT benefits and limitations. [8]
- Q3)** a) Explain how the GT cell is formed? Discuss with example. [8]  
b) Discuss use of quadratic assignment model adding new machines to existing facility. [8]
- Q4)** a) Explain Generative type of Computer Aided Process Planning (CAPP). [8]  
b) Discuss the development of CAPP and its limitations. [8]

**P.T.O.**

**Q5)** Write short notes (Any Three) :

**[18]**

- a) Software for facility planning.
- b) Parts classification and coding.
- c) Assignment method for adding a new facility planning.
- d) Exponential Smoothing.
- e) Operations management.

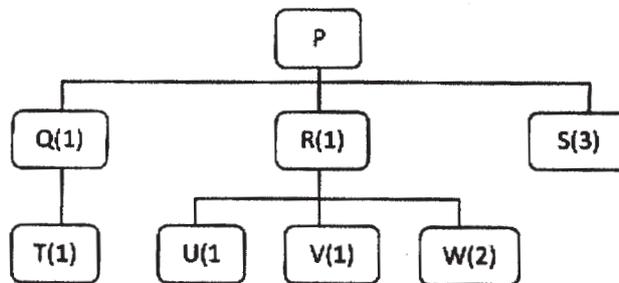
**SECTION - II**

**Q6)** a) How capacity planning is done?

**[6]**

b) Product structure is as below :

**[10]**



Inventory status of individual components are as shown

| Product | Lead Time | EOQ  | Opening stock | On Order |
|---------|-----------|------|---------------|----------|
| P       | 2         | 400  | 40            | 0        |
| Q       | 5         | 600  | 100           | 0        |
| R       | 4         | 800  | 20            | 0        |
| S       | 3         | 2000 | 1000          | 0        |
| T       | 6         | 1200 | 0             | 0        |
| U       | 2         | 900  | 70            | 0        |
| V       | 3         | 1000 | 0             | 0        |
| W       | 2         | 3000 | 2300          | 0        |

The demand for the product 'P' is 400 on day 16. Prepare MRP for all items.

- Q7)** a) Discuss objectives of the MRP system. [6]  
 b) Four jobs are to be processed using three machines. The time required on machine 'j' for job 'i' is given in the table below : [12]

| Job | Time required on |           |           |
|-----|------------------|-----------|-----------|
|     | Machine A        | Machine B | Machine C |
| 1   | 5                | 8         | 20        |
| 2   | 6                | 30        | 6         |
| 3   | 30               | 4         | 5         |
| 4   | 2                | 5         | 3         |

How should the jobs be scheduled so as to minimize the total time required to complete all the jobs?

- Q8)** a) Discuss ERP implementation issues. [8]  
 b) Find the sequence that will minimize total time required to complete the following tasks [8]

| Task       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|------------|---|---|---|---|---|---|---|---|
| Machine I  | 2 | 5 | 4 | 9 | 6 | 8 | 7 | 5 |
| Machine II | 6 | 8 | 7 | 4 | 3 | 9 | 3 | 8 |

- Q9)** a) Discuss evaluation of heuristics in view of Production scheduling. [8]  
 b) The weekly demand for the product has the following distribution : [8]

|             |      |      |      |      |      |      |
|-------------|------|------|------|------|------|------|
| Demand      | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
| Probability | 0.03 | 0.17 | 0.27 | 0.28 | 0.18 | 0.07 |

Simulate for 10 weeks and find expected demand. (Use random numbers from calculator).

- Q10)** Write short notes (Any Three) : [18]
- Random number generation.
  - CDS algorithm for sequencing.
  - Software for ERP.
  - Gantt chart.
  - MRP II.



Total No. of Questions : 8]

SEAT No. :

P3995

[Total No. of Pages : 2

[4760] - 389

**M.E. Production (CAD/CAM)**

**TECHNOLOGY MANAGEMENT**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) “What are the strategic and operational objectives of an organization? Explain in brief. [8]
- b) What are the principles for technology management strategy? [8]
- Q2)** a) Explain in brief various steps the organizations take for promotion of IPR. [8]
- b) Explain the following : [8]
- i) Compare Process technology and product technology.
  - ii) Critical issues in technology management.
- Q3)** a) Discuss the effect of fast pace of technology change on human resources. [8]
- b) “Technology contributes to the competitive levels of a country.” Explain in detail. [8]

**P.T.O.**

- Q4)** Write short notes on any three : **[18]**
- a) Technology Models.
  - b) Issues in industry institute interaction.
  - c) Technology transfer in private & public enterprises.
  - d) Economics and management on Innovation.

**SECTION - II**

- Q5)** a) What are broad steps to be followed in procedure for world patenting? **[8]**
- b) Describe the role of WTO in international business. **[8]**
- Q6)** a) What are the objectives of innovation foundation? What are recent government policies for it? **[8]**
- b) Explain your views on central government policy for “Make in India”. **[8]**
- Q7)** a) Discuss co-relations for functional capability and level of innovation in technology assessment. **[8]**
- b) Explain the procedural steps followed in Analytical Hierarchical Process (AHP) with an example. **[8]**
- Q8)** Write short notes on any three : **[18]**
- a) IPR.
  - b) Items which cannot be patented.
  - c) Technological leadership.
  - d) Limitations of AHP.



Total No. of Questions : 6]

SEAT No. :

**P3752**

**[4760]-39**

[Total No. of Pages : 3

**M.E. (Civil) (Structures)**  
**STRUCTURAL DESIGN OF CONCRETE BRIDGES**  
**(2008 Course) (Elective-I) (Semester-I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

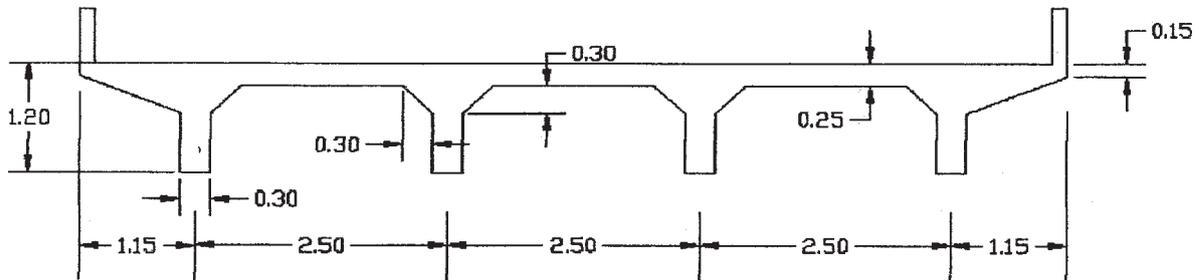
- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of IRC codes, IS 1343, IS 456-2000 & non programmable calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Assume any other data if necessary.*

**SECTION-I**

- Q1)** a) Classification of bridges. **[8]**
- b) What are the factors affecting the span of bridge? Derive the conditions for 'Economical span' of bridge stating the assumptions made. **[8]**
- c) Loading for railway bridges. **[9]**
- 
- Q2)** a) Compare simply supported RCC girder with balanced cantilever PSC girder in following respect: **[10]**
- i) Ease of construction.
  - ii) Launching.
  - iii) Economics.
- b) Design the culvert with the data: **[15]**
- Clear span of the culvert = 5.6m
- Clear carriage way width = 7.5m
- Size of kerb = 150 mm × 600 mm
- Average thickness of wearing coat 80mm
- Use material M25, Fe 500
- Culvert is on the national high way.
- Draw the cross section showing details of reinforcement at mid-span and at junction of the slab are kerb.

**P.T.O.**

- Q3)** Design slab, cross girder and main girder of RCC T-beam and slab girder deck for the crossing of a national highway. The cross section is as shown in figure Fig 1. Consider interior panel of the deck slab. Place the loads so as to produce critical SF and BM in the deck slab and girder. Draw neat sketches showing details of reinforcement in plan and elevation. [25]



**Fig1** (All dimensions are in meters)

Size of RCC kerb = 150mm × 600 mm

Effective span of longitudinal girder = 12m

Live load = IRC-Class AA

Thickness of wearing coat = 80mm.

Spacing of cross-girders = 3m c/c.

Width of carriageway = 7.5 (c/c dist between outer girders)

Number of longitudinal girders = 4, spaced at 2.5m c/c.

Materials: M25 concrete, Fe 500 steel.

## SECTION-II

- Q4)** a) Draw detailed cross section of typical box section post tensioned Prestressed concrete girder Name all components. [8]
- b) Design criteria for rigid frame bridges. [8]
- c) Describe different types of bridge foundations mentioning the situations for particular type are used stating merit and demerits of each type. [9]

**Q5) a)** Check the stability of the abutment for the following: **[15]**

Top width of abutment = 1m

Height of abutment = 5m

Front face of abutment is vertical and the back face is battered at 1:6.

Material of abutment stone masonry.

Unit Weight of soil = 18 kN/m<sup>3</sup>

Angle of repose = 28°

Superstructure: A Team-bridge with span 15m, Type of loading: IRC class AA.

b) List the steps involved in the design of simply supported deck type post tensioned prestressed concrete bridges. **[10]**

**Q6) a)** Write a detailed note on metallic bearing showing sketches. **[8]**

b) Design a reinforced elastomeric bearing at a pinned end of a plate girder of a bridge with following data. **[17]**

Maximum vertical load = 1000 kN

Dynamic vertical load = 80 kN

Transverse lateral load = 40 kN

Longitudinal load = 60 kN

Longitudinal total translation 12 mm

Rotation at support 0.003°

Shear modulus of elastomeric bearing = 1.2 N/mm<sup>2</sup>

Allowable comp. stress for concrete = 8 N/mm<sup>2</sup>

Allowable comp. stress for elastomer = 10 N/mm<sup>2</sup>



Total No. of Questions : 12]

SEAT No. :

**P4754**

[Total No. of Pages : 2

**[4760] - 390**

**M.E. (Production) (CAD/CAM) (Semester - II)**

**DESIGN OF EXPERIMENTS & RESEARCH METHODOLOGY**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer Q1 OR Q2, Q3OR Q4, Q5OR Q6, from section I and Q7,OR Q8, Q9OR Q10, Q11 OR Q12 from section II.*
- 2) *Assume suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

**Q1) a)** Explain in brief the difference between mathematical research and [8]  
experimental research.

b) Explain different types of research. [8]

OR

**Q2) a)** Explain nature and objectives of research. [8]

b) Explain research process with flow chart. [8]

**Q3) a)** Enlist different types of data analysis methods and explain any two in short. [8]

b) What are the techniques of interpretation? [8]

OR

**Q4) Write short notes on following: [16]**

- a) Group problem solving techniques for idea generation.
- b) Brain storming and Delphi Method,
- c) Creative problem solving process.
- d) Motivation in research.

**P.T.O.**

- Q5)** a) What is simulation and what are the application and classification of simulation models. [8]  
b) What is mathematical modeling? What are the principles of modeling?[10]

OR

- Q6)** a) Explain process of simulation with steps, feature and validation process. [10]  
b) Explain data consideration and testing of models. [8]

**SECTION - II**

- Q7)** a) What are the steps in design of experimentation? [8]  
b) What are the applications of experimental design? [8]

OR

- Q8)** a) Explain Replication, Randomization and Blocking. [8]  
b) Define: Errors in experiments. [8]

- Q9)** a) How the Analytical Hierarchy process is used for decision making? [10]  
b) Explain Taguchi approach to parameter design. [8]

OR

- Q10)**a) Explain application of experimental design. [8]  
b) Explain: Data Envelope Analysis (DEA) [10]

- Q11)**a) Explain format of publication in research journals. [8]  
b) What are the principles of report writing? [8]

OR

- Q12)**a) What precautions one has to take while writing the research report? [8]  
b) Explain format in report writing. [8]



Total No. of Questions : 8]

SEAT No. :

**P4737**

**[4760] - 391**

[Total No. of Pages : 2

**M.E. (Production) (CAD/CAM)  
COMPUTATIONAL FLUID DYNAMICS  
(Elective - IV)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve Section - I and Section - II in separate answer books.*
- 2) *Solve any three Questions from each section.*
- 3) *Figure on the right indicates full marks.*

**SECTION - I**

- Q1)** Explain various Numerical Discretization Methods in CFD. **[16]**
- Q2)** a) What are the Navier Stokes Equations for Newtonian fluid? Explain. **[10]**  
b) Explain Differential and integral forms of the general transport equations. **[6]**
- Q3)** a) Explain Upwinding and Central Difference Schemes in Numerical methods for Convection. **[8]**  
b) Explain any one Higher order differencing scheme in CFD. **[8]**
- Q4)** Write short note on any three of the following : **[18]**
- a) FEM
  - b) Inviscid flows and viscous flows
  - c) Diffusion Equations
  - d) Primitive variable vs. conservation form

**SECTION - II**

- Q5)** Discuss the numerical methods for Inviscid flows. **[16]**
- Q6)** Comment on SIMPLE, SIMPLER, SIMPLEC and PISO. **[16]**

**P.T.O.**

- Q7)** a) Explain k- $\epsilon$  Models. [6]  
b) Explain effect turbulence on time-averaged Navier Stokes Equations. [10]

**Q8)** Write short note on any three of the following : [18]

- a) Numerical methods for Inviscid flow
- b) Poisson equation for Pressure
- c) Reynolds stress equation model
- d) Mixing length model



Total No. of Questions : 8]

SEAT No. :

P4354

[Total No. of Pages : 3

[4760]-392

M.E. (Computer Engineering & Computer Networks)

APPLIED ALGORITHMS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any three questions from each section.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data if necessary.

**SECTION - I**

- Q1)** a) Suppose we receive 500 items from Factory A and 1000 items from Factory B. Factory A has a defective rate of 1%, whereas Factory B has a defective rate of 0.5%. What is the probability a randomly chosen item is defective? [8]
- b) i) Prove that [8]  
 $1^2 + 2^2 + 3^2 + \dots + n^2 = n(n + 1)(2n + 1)/6$   
For all positive integers n.
- ii) State applications of 'Counting and probability' in computer engineering.
- Q2)** a) Assume that a source code is of 250 statements. Out of these 65 are syntactically correct and 45 statements having syntactic errors. 24 statements are selected at random for checking, find the probability that at least one statement is with syntactical errors. [8]
- b) Compare the Merge sort and Quick sort, elaborate example which compare the average and worst case complexities for these two algorithms. [8]
- Q3)** a) Write a procedure which finds the mode and frequency of an unsorted array. Analyze its computing time. Is your method better than sorting?[8]
- b) Write an algorithm for depth first search in graph using suitable data structure. What is the complexity of the algorithm? Is it possible to implement the same algorithm with another data structure, if yes, state its complexity? [8]

**P.T.O.**

- Q4)** a) Show that if all internal nodes in a tree have degree  $K$  then the number of external nodes  $n$  is such that  $n \bmod (K-1) = 1$ . [6]
- b) Elaborate in short : [12]
- i) Knapsack problem.
  - ii) 8 Queens problem.
  - iii) Traveling salesman problem.

### SECTION - II

- Q5)** a) Obtain a nondeterministic algorithm of complexity  $O(n)$  to determine whether or not there is a subset of then numbers  $a_i, 1 \leq i, \leq n$ ; that sums to  $M$ . [8]
- b) Write a recursive binary search algorithm. Determine its time complexity. [8]
- Q6)** a) Let  $G = (V, E)$  be an undirected graph. A node cover of  $G$  is a subset  $U$  of the vertex set  $V$  such that every edge in  $E$  is incident to at least one vertex in  $U$ . A minimum node cover is one with the fewest number of vertices. [8]

Consider the following greedy algorithm for this problem:

Procedure COVER( $V, E$ )

$U \leftarrow \phi$

loop

let  $v \in V$  be a vertex of maximum degree

$U \leftarrow U \cup \{v\}; v \leftarrow v - \{v\}$

$E \leftarrow E - \{(U, W) \text{ such that } u=v \text{ or } w = v\}$

until  $E = \phi$  repeat

return ( $U$ )

end COVER

Does this algorithm always generate a minimum node cover?

- b) Prove that Prim's method generates minimum cost spanning trees. [8]

- Q7)** a) Write CRCW and EREW algorithms for parallel computers [8]  
b) What are the advantages of Greedy algorithmic strategy? Analyze an single source shortest path algorithm with time and space complexity using Greedy approach. [8]
- Q8)** Write short notes on : [18]  
a) Pointer doubling  
b) Parallel computational model  
c) Brent's Theorem



Total No. of Questions : 8]

SEAT No. :

P3996

[Total No. of Pages :2

[4760]-393

**M.E. (Computer) & (Computer Networks)**  
**EMERGING TRENDS IN COMPUTER ARCHITECTURE**  
**(2008 Pattern) (Semester - I) (Specialization)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Attempt any three questions from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of calculator is allowed.*
- 6) Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the features of IA-64. [8]  
b) List various architectural differences of MPP, SMP and Cluster. [8]
- Q2)** a) Explain various system interconnects with pros & cons. [8]  
b) Draw and Explain TCP/IP protocol stack. [8]
- Q3)** a) Discuss the thread synchronization mechanism with suitable. Case study. [8]  
b) What are the various cluster designing issues? Explain in detail. [8]
- Q4)** Write short notes on. [18]  
a) Various data formats in TCP/IP suite.  
b) IBM power PC architecture.  
c) Different types of distributed memory architectures.

**P.T.O.**

## SECTION - II

- Q5)** a) Why is the message-passing model superior to the shared-variable model with respect to synchronization, semantic and portability issues. [8]
- b) Discuss blocking and non-blocking communication with suitable case study. [8]
- Q6)** a) Discuss the various web services and their standards for Grid computing. [8]
- b) Explain with neat diagram storage area Network (SAN) architecture and data access mechanism involved. [8]
- Q7)** a) Give differences between Direct attached storage (DAS) and Network attached storage (NAS). [8]
- b) Explain briefly communication function implemented as a part of MPI. [8]
- Q8)** Write short notes on. [18]
- a) Explicit data parallel models.
- b) Multicore architecture with suitable case study
- c) Grid Computing models.



Total No. of Questions : 8]

SEAT No. :

**P4355**

**[4760] - 394**

[Total No. of Pages :2

**M.E.(Computer and Computer Network)**  
**PRINCIPLES AND PRACTICES FOR IT MANAGEMENT**  
**( 2008 Course) (Semester- I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section*
- 2) *Answer to the two sections should be written in separate books*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

**SECTION-I**

**Q1) a)** What are the processes of IT Management? Describe each in detail.

**[10]**

b) Enlist and explain the Ethical and Social Responsibilities of IT business.

**[8]**

**Q2) a)** Define the WBS. Explain components of the WBS in detail. Why you need a WBS?

**[8]**

b) What are the different methods of Data and Information collection? Explain with their examples.

**[8]**

**Q3) a)** Describe the phases of Team Development for IT project. What are the commended steps to resolve the conflict between Team members?

**[8]**

b) Define the project constraints.Explain the different project constraints in detail.

**[8]**

**Q4) a)** How to calculate the Cost- performance and To-Compute performance?Describe each with suitable example and formula.

**[8]**

**P.T.O.**

- b) Write short notes on the followings (any two) [8]
- i) Need for Revision of IT project
  - ii) Risk Management
  - iii) Tools of Strategy Management

**SECTION-II**

- Q5)** a) How do you handle Team member who are disgruntled and unpleasant? [8]
- b) Define and explain the process of Energy Management and Energy audit in detail. [10]
- Q6)** a) As a project Manager, what is your definition of Quality of project? How can be assessed the Quality of IT project. Explain with the diagram of Iron Triangle. [8]
- b) Describe the PCMM standard in detail [8]
- Q7)** a) How would you control Quality of through MIS support? Explain with example of any one Service Sector application of IT management. [8]
- b) Explain the Healthcare and Insurance company application of IT management [8]
- Q8)** Write a short note on the followings [16]
- a) Supply Chain Management
  - b) Reasons for delay in project implementation
  - c) Cyber Laws
  - d) IPR



Total No. of Questions : 8]

SEAT No. :

**P3997**

**[4760]-395**

[Total No. of Pages : 2

**M.E. (Computer Engineering)**

**ADVANCE SOFTWARE ENGINEERING**

**(2008 Course) (Semester - I) (Elective - I) (510104 A)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the general software process activities. **[8]**
- b) Explain the requirements elicitation process with use cases. **[8]**
- Q2)** a) What is the significance of user interface design? Explain with the UI design process. **[8]**
- b) Explain any two distributed system architectures. **[8]**
- Q3)** a) What is iterative development? Explain with a process model. **[8]**
- b) Explain how reuse is achieved with component based development. **[8]**
- Q4)** Explain the following (Any three): **[18]**
- a) Prototyping.
  - b) Object oriented design.
  - c) System engineering.
  - d) Formal specification.

***P.T.O.***

## SECTION - II

- Q5)** a) What is control structure testing? Give methods for testing a module. [8]  
b) Explain the quality factors of software product. [8]
- Q6)** a) What is an agile process? Explain with a process model. [8]  
b) Explain clean room software engineering process. [8]
- Q7)** a) Explain the function point estimation method. [8]  
b) Explain risk analysis and management. [8]
- Q8)** Explain the following (Any three): [18]  
a) Critical systems.  
b) Software process Assessment.  
c) Cost estimation.  
d) Configuration Management.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4356**

**[4760] - 396**

[Total No. of Pages :2

**M.E. (Computer)**

**INTELLIGENT SYSTEMS**

**(2008 Course) (Semester -I) (Elective -I) (510104 B)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section -I and 3 questions from Section - II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain a goal-based agent with a neat diagram and example. [8]  
b) Explain the properties of task environments. List the examples of task environments. [8]
- Q2)** a) What is problem formulation? Explain the different types of problems with suitable examples. [8]  
b) How search strategies are evaluated? Explain the iterative deepening search algorithm with example. [8]
- Q3)** a) Explain A\* search with the suitable example. What is heuristic function? Write heuristic function for 8-puzzle problem. [10]  
b) Explain the hill-climbing algorithm with the application. [8]
- Q4)** a) Explain the difference between problem solving and planning. Solve the blocks world problem. [8]  
b) Describe how states, goals and actions are represented using STRIPS language. [8]

**P.T.O.**

## SECTION -II

- Q5)** a) Write and explain a partial-order planning algorithm (POP). [8]  
b) Explain a partial order plan for solving the shoes and socks problem. [8]
- Q6)** a) Explain hierarchical decomposition with the example. [8]  
b) Explain resource constraints with example. [8]
- Q7)** a) Explain execution monitoring and re-planning agents. [6]  
b) Compare between conditional planning and replanning. [6]  
c) Explain fully integrated planning and execution. [6]
- Q8)** a) What is the use of Bayesian Network in probabilistic reasoning? Explain a simple Bayesian Network with the example. [8]  
b) Explain with example, first order logic and associated inferences. [8]



Total No. of Questions : 8]

SEAT No. :

**P3998**

**[4760]-397**

[Total No. of Pages : 2

**M.E. (Computer Engineering)**  
**INTERNET ROUTING DESIGN**

**(2008 Course) (Semester - I) (Elective - I (c)) (510104)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain IP protocol stack architecture in detail. [8]
- b) Write and explain in detail the main differences between shortest path routing and widest path routing? [8]
- Q2)** a) Compare the Bellman-ford algorithm and the Dijkstra's algorithm. [8]
- b) Write and explain dijkstra's shortest path first algorithm with distributed approach. [8]
- Q3)** a) Compare distance vector and link state protocols. [8]
- b) What are the sub protocols of link state protocol? [8]
- Q4)** a) Draw and explain packet format of RIPv1 and RIPv2. [9]
- b) Explain the key features of IS-IS protocol. Compare it with OSPF. [9]

***P.T.O.***

## SECTION - II

- Q5)** a) List and explain OSPF sub-protocols. [8]  
b) Explain in detail BGP decision process. [8]
- Q6)** a) Explain with example tree bitmap method of IP lookup. [8]  
b) Explain in detail the architectural components of a router. [8]
- Q7)** a) Explain in detail Source-Based QoS Routing with Path Caching. [8]  
b) Explain in detail grid of tries method of packet classification algorithms. [8]
- Q8)** a) Write a short note on VPN traffic engineering. [6]  
b) Write a short note on longest prefix matching. [6]  
c) Write a short note on voice over MPLS. [6]

*EEE*

Total No. of Questions : 8]

SEAT No. :

P4357

[4760] - 398

[Total No. of Pages :2

M.E. (Computer)

MOBILE COMPUTING

(2008 Course) (Semester - I) (Elective -I) (510104 D)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section I & 3 from Section II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Assume suitable data, draw neat diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** With neat diagram explain the GSM subsystems in brief. **[16]**

**Q2)** Draw the format of messages over (any four). **[16]**

- a) Air-Interface (LAPD<sub>m</sub>, GSM 04.08)
- b) Abis-Interface (LAPD, GSM 08.98)
- c) A-Interface (SS7,SCCP, GSM 08.06, GSM 08.08)
- d) Format for MAP over all NSS interfaces (SS7, SCCP)
- e) Format for ISUP messages between MSCS and ISDN.

**Q3)** What are the different data stored on SIM, Explain in brief. **[18]**

**Q4)** With respect to a MS explain the meaning of the following terms: (any four)[16]

- a) IMSI attached
- b) Roaming

**P.T.O.**

- c) Location updating
- d) Handover
- e) Locating

**SECTION -II**

**Q5)** Explain in brief the base station subsystem for its three elements: BTS, BSC & TRAU. **[18]**

**Q6)** Write a short note on WEP, WPA & WPAZ security measures in wireless communication. **[16]**

**Q7)** Explain SCCP in brief. **[16]**

**Q8)** Write a short note on Quality of service in mobile communication; How to determine the QOS of a GSM network. **[16]**



Total No. of Questions : 8]

SEAT No. :

**P4358**

[Total No. of Pages : 2

**[4760] - 399**

**M.E. (Computer Engineering)  
INFORMATION AND NETWORK SECURITY  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Enlist different security mechanisms and Explain how these different security. Mechanisms are related to security services? [7]
- b) What are the principals of data security architecture? Explain in brief.[7]
- c) Explain the model for network security? [4]
- Q2)** a) Explain DES Design Criteria and purpose of the S-boxes in DES? [8]
- b) Explain authentication protocol based on symmetric and asymmetric cryptosystems. [8]
- Q3)** a) What is the difference between an SSL connection and an SSL session? What are the basic protections provided by secure socket layer? [8]
- b) Describe how AH is used in transport and tunnel modes in IPSec protocol. [8]

**P.T.O.**

**Q4) Write Short Notes on (Any Three) :** **[16]**

- a) Fragmentation vulnerabilities.
- b) Privacy and data protection.
- c) DMZ networks.
- d) ARP explosions and slow links.

**SECTION - II**

**Q5) a) Explain in brief key localization in SNMP.** **[7]**

b) List ways in which password transmitted over a telnet connection can be captured. Discuss secure alternatives. **[7]**

c) Explain in brief, what is session key management? **[4]**

**Q6) a) Explain different type of attacks, that are possible on packet- filtering firewalls?** **[8]**

b) Explain in detail source masking and hidden channels. **[8]**

**Q7) a) Enlist and explain different methods and procedures for security in wireless networks.** **[8]**

b) Explain two party Diffie-Hellman Key exchange with suitable example?[8]

**Q8) Write Short Notes on (Any Three) :** **[16]**

- a) Discrete logarithm problem.
- b) PKI components and applications.
- c) DNS certificates.
- d) Privacy enhanced mail.



Total No. of Questions : 8]

SEAT No. :

**P3738**

**[4760]-4**

[Total No. of Pages : 2

**M.E. (Civil) (Construction Management)  
NEW CONSTRUCTION MATERIALS  
(2008 Course) (Elective-I (a)) (Semester-I) (501104)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 6) Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** Briefly discuss all types' modern day concrete. Explain replacement of cement by fly ash as construction material in concrete. **[18]**

**Q2)** Explain properties of various types of bitumen and also explain with flow chart manufacturing process of CMBR. **[16]**

**Q3)** What is silica fume concrete? Where it is used? What are its advantages? Which are special ingredients used to prepare SFC. **[16]**

**Q4)** Explain in detail: **[16]**

- a) Construction Chemicals.
- b) Construction Admixtures.

**P.T.O.**

## SECTION-II

- Q5)** Discuss the concept of smart cities with special reference to Smart materials. Explain any 3 smart construction materials along with their applications in construction. **[18]**
- Q6)** Enlist materials used in nuclear- containment structures. Explain any 4 of them in detail. **[16]**
- Q7)** What is Glenium Concrete and Fiber Reinforced concrete? Differentiate them with reference to manufacturing process and suitability of use. **[16]**
- Q8)** Write a note on: **[16]**
- a) New roofing Materials.
  - b) Polymer as a construction material.
  - c) Special Ingredients in concrete.
  - d) Fly ash and its use in construction.



Total No. of Questions : 6]

SEAT No. :

**P3753**

**[4760]-40**

[Total No. of Pages : 2

**M.E. (Civil-Structure)**

**DESIGN OF COMPOSITE CONSTRUCTION  
(2008 Course) (Elective-I) (Semester-I) (501404)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain provisions in India, BS & Euro code with reference to flexural behavior of composite used in Construction. [9]
- b) Explain Elastic behavior of Composite Beam made up of two materials. [8]
- c) State steps in design of composite construction. [8]
- Q2)** a) Explain types of sheeting used for composite construction; Explain its utility, applications, its material properties. [9]
- b) Explain structural behavior of composite sheets for longitudinal shear, longitudinal slip, deflection, vertical shear. [8]
- c) Explain structural failure patterns and its possible reasons, in composite beam. [8]
- Q3)** a) Explain behavior of concrete filled column under axial load with circular section. [8]
- b) What is profiled decking system, Write steps in design of Profiled decking. [8]
- c) Write steps in design of composite slab. [9]

***P.T.O.***

## SECTION-II

- Q4)** a) Explain composite truss, Explain its advantages and disadvantages. [8]  
b) Explain design of composite truss with shear connectors. [9]  
c) Draw structural arrangement in composite truss with details of connectors. [8]
- Q5)** a) How the fire protection is taken care of in composite construction? [8]  
b) What is geometric imperfections, why they are induced, how are they are eliminated in composite construction. [8]  
c) Sketch typical composite foundation showing important connection details. [9]
- Q6)** a) Sketch typical composite bridge deck slab and detail it. [8]  
b) Write design steps of composite beam with all necessary checks as per codal provisions. [8]  
c) Design composite simply supported beam of span 6.5 meters to carry load 5.5 kN/m. Use composite constructions. Select appropriate constituents for composite construction. Assume their appropriate properties for design. Apply suitable code provisions and checks. [9]



Total No. of Questions : 12]

SEAT No. :

**P4359**

[Total No. of Pages : 3

**[4760] - 400**

**M.E. (Computer Engineering)**

**ADVANCED COMPILERS**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with the help of example, how compiler for high level language can be constructed automatically using LEX and YACC tool. [10]
- b) What are analysis phases of Compiler? Explain in detail. [6]

OR

- Q2)** a) Explain the role of symbol table . Explain with example how symbol table is used at every phase of compiler. [8]
- b) What are different types of parsers. Make use of suitable examples. [8]

- Q3)** a) Explain the tree rewriting technique used in Code generator generators. [8]
- b) Explain “Peephole optimization” in detail with suitable example. [8]

OR

- Q4)** a) With respect to code generation phase of compiler explain Basic blocks, flow graphs, next use information with example. [8]
- b) Explain the phase “code generation” for pipelined machines. [8]

***P.T.O.***

- Q5)** a) Explain construction of Static Single Assignment form and explain its application to Code optimization. [10]
- b) Explain in detail the classical theory of data flow analysis. What are bi-directional data flows? [8]

OR

- Q6)** a) Explain in detail various code optimization techniques with the help of example. [8]
- b) Explain unified algorithm for data flow analysis with suitable example. [10]

### **SECTION - II**

- Q7)** a) What is a motivation for designing parallel compiler. Give the Overview of parallel Compilers. [8]
- b) Explain in detail how to compute data dependence using direction vector in parallel compiler. [8]

OR

- Q8)** a) Explain loop carried and loop independent dependencies during parallelism detection. [8]
- b) Explain the Structure of a Parallelizing compiler. [8]

**Q9)** Explain the following with respect to Compilation for distributed machines: [16]

- Data partitioning
- Instruction scheduling
- Register allocation

OR

**Q10)** Explain the following with respect to Compilation for distributed machines: [16]

- Basic compilation and optimization
- Dynamic compilation

**Q11)** Write short note on :

**[18]**

- Front end and back end of Compiler
- Parallel Compilers in use today
- Error detection and recovery at various phases of compiler

OR

**Q12)** Write short note on :

**[18]**

- How Just in Time Compiler optimizes code
- Auto scheduling Compilers
- Role of automated tools in advanced compiler



Total No. of Questions :12]

SEAT No. :

**P3999**

[Total No. of Pages :3

**[4760] - 401**

**M.E. (Computer) (Semester - I)**

**WEB SERVICES AND SOA (Elective - II)**

**(2008 Pattern)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) List the elements of WDSL documents and Draw the block diagram of WDSL document structure. [6]
- b) Write short note on : [12]
- i) SOAP
  - ii) UDDI
  - iii) Business Process Execution Language for Web Services.

OR

- Q2)** a) Explain the Web Services Security and Web services security specifications in detail. [10]
- b) Compare SOA to Client Server Architecture and Distributed Architecture. [8]
- Q3)** a) Write note on SOA Enterprise Software Models and IBM on Demand operating environment. [8]
- b) Write note on Service Oriented Architecture and functional components of SOA. [8]

**P.T.O.**

**OR**

- Q4)** a) Explain SOA characteristics and misperceptions about SOA. [8]  
b) Write short notes on : [8]  
i) Evolution of SOA and Business Value of SOA.  
ii) Enterprise Service Bus.

- Q5)** a) Explain SOA Life Cycle. [6]  
b) Explain in detail determining nonfunctional requirements. [6]  
c) Write short note on SOA Delivery Strategies. [4]

**OR**

- Q6)** a) Explain business centric SOA and its advantages. [6]  
b) Write short note on Service modeling, Basic modeling building blocks. [6]  
c) Write short note on Enterprise solution assets (ESA). [4]

**SECTION - II**

- Q7)** a) Explain in detail Service-oriented design process. [6]  
b) Write detail note Tools available for appropriate designing in SOA Design. [6]  
c) Write short note importance of the choosing appropriate Web services standards? [6]

**OR**

- Q8)** a) Explain Quality assurance in SOA. [6]  
b) Explain determining services and tasks based on business process model. [6]  
c) How security implementation is done in SOA? Explain. [6]

- Q9)** a) Write short notes on [8]
- i) Role of ESB in SOA governance
  - ii) Impact of changes to services in the SOA lifecycle.
- b) What is Web services management? Explain distributing service management and operational management challenges. [8]

**OR**

- Q10)**a) Explain QoS compliance in SOA governance. [6]
- b) Explain in detail SOA governance with reference to policies, critical success factors, and metrics for SOA governance. [10]
- Q11)**a) Explain in detail Ajax with applications of Ajax. [8]
- b) What is Blog? Explain various types of blogs. [8]

**OR**

- Q12)**a) Write short note on Java Script? List and explain various applications of JavaScript in detail. [8]
- b) Write short notes on [8]
- i) RSS Feed.
  - ii) Wikis.



Total No. of Questions : 8]

SEAT No. :

**P4000**

[4760] - 402

[Total No. of Pages : 2

**M.E. (Computer Engineering)  
EMBEDDED SYSTEM DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Compare microprocessors, Microcontrollers and DSP processor architecture. Which architecture are more suitable to develop embedded system & how? [8]
- b) Discuss the use of signal conditioners and data converters in embedded system. [8]
- Q2)** a) Discuss the functions and applications of Real time clock & watch dog timer of ARM - 7. [8]
- b) Explain the architecture & features of MIPS R5000 Processor. [8]
- Q3)** a) Compare ARM7 with ARM9 in terms of features & Architecture [6]
- b) Discuss the interfacing of ADC/DAC with ARM7 and describe the I/O map. [6]
- c) Illustrate with example the serial & Parallel Communication and interfacing with ARM7. [6]
- Q4)** a) Explain the interfacing of Timer/counter or stepper motor and applications in embedded system. [9]
- b) Explain / Discuss the serial communication protocol architecture of Rs 485 and CAN. [7]

***P.T.O.***

## SECTION - II

- Q5)** a) Explain how interrupts are handled in RTOS. [8]  
b) Explain the design & architecture of Mobile phone as an embedded system. [8]
- Q6)** a) How the C/C++ program is converted into ROM image. Explain the steps. Explain the architecture & features of MIPS R5000 Processor. [8]  
b) Explain the use of stacks & queues data structures in embedded system software. [8]
- Q7)** a) Discuss important features of VxWorks in detail. [6]  
b) State the system functions & system tasks defined under VxWorks. [6]  
c) Explain interprocess synchronization and communication w.r.t. embedded O.S. [6]
- Q8)** a) Explain with example the embedded Program structure in terms of breaking into leader files, configuration files, functions & Modules. [8]  
b) Explain the use of function Pointers & function queues in embedded programming. [8]



Total No. of Questions : 8]

SEAT No. :

**P4001**

[Total No. of Pages : 3

**[4760]- 403**  
**M.E. (Computer Engg.)**  
**DISTRIBUTED SYSTEMS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain, in detail, the challenges encountered during the design of distributed systems. **[8]**
- b) What do you mean by physical model of distributed system? Explain following physical models in detail- **[10]**
- i) Baseline Physical model
  - ii) Early distributed systems
  - iii) Internet-scale distributed systems
  - iv) Contemporary distributed systems
  - v) Distributed systems of systems

- Q2)** a) Explain the characteristics of interprocess communication. **[6]**
- b) Define - **[10]**
- i) External data representation
  - ii) Marshalling and Unmarshalling

Discuss three approaches for External data representation and marshalling.

**P.T.O.**

- Q3)** a) Discuss the following elements in detail - [8]
- i) Clock
  - ii) Clock skew and clock drift
  - iii) Coordinated universal time
  - iv) Events and history of process
- b) Describe Chandy and Lamport's 'snapshot' algorithm for determining global states of distributed systems. [8]

- Q4)** Write short notes on- [16]
- a) Client-server communication.
  - b) Java RMI
  - c) Mutual exclusion
  - d) Synchronizing physical clocks

**SECTION - II**

- Q5)** a) Explain the goals of Global Name Service. Explain as an example of name service, Internet Domain Name System (DNS). [8]
- b) Draw schematic of the File Service Architecture. Explain the following modules of this architecture. [10]
- i) Flat file service
  - ii) Directory service
  - iii) Client module
  - iv) Flat file service interface
- Q6)** a) What are the different threats and attacks for computer systems? [8]
- b) Explain the use of cryptography in- [8]
- i) Secrecy and Integrity
  - ii) Authentication
  - iii) Digital Signatures

- Q7)** a) Explain sequential consistency model in detail. [8]  
b) With the help of a neat schematic, explain the main data structures of Universal Description, Discovery and Integration Service (UDDI). [8]

**Q8)** Write short notes on- [16]

- a) Access Control Mechanisms
- b) Coordination of web service
- c) Release consistency
- d) Sun Network File System



Total No. of Questions : 8]

SEAT No. :

P4360

[Total No. of Pages : 2

[4760]-404

**M.E. (Computer Engineering/Computer Networking)**  
**HIGH PERFORMANCE DATABASE SYSTEMS**  
**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Answer to each section should be written on different answer sheets.*
- 3) *Assume suitable data, if necessary.*
- 4) *Draw neat diagrams wherever required.*

**SECTION - I**

- Q1)** a) Discuss tunable parameters and different techniques used for tuning of databases. [6]  
b) Explain TP-monitor Architecture. [6]  
c) Explain various TPC benchmarks. [4]
- Q2)** a) Explain hash join algorithm with example. [6]  
b) Discuss the role of low level primitive operations incase of Query optimizations. [6]  
c) Discuss how materialized view are important in query optimization. [4]
- Q3)** a) Discuss the differences between Optimistic & Pessimistic locking for concurrency control. [6]  
b) Discuss the choice of indexing (B-tree or hash file) for a relation. Justify your answer. [6]  
c) Discuss flat and Nested transactions. [4]
- Q4)** a) Explain data warehouse Architecture. [6]  
b) Explain various data warehouse schemas with examples. [6]  
c) Explain OLAP operations with example. [6]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain Aggregations in SQL. [6]  
b) How XML integration is achieved with SQL servers. [6]  
c) Discuss about SQL 3 standards, objected oriented and security features. [4]

- Q6)** a) Given the following transactional data : [6]

| Sr.No. | Transaction Id (TIDs) | List of Items (IDs) |
|--------|-----------------------|---------------------|
| 1      | T100                  | I1, I2, I5          |
| 2      | T200                  | I2, I4              |
| 3      | T300                  | I2, I3              |
| 4      | T400                  | I1, I2, I4          |
| 5      | T500                  | I1, I3              |
| 6      | T600                  | I2, I3              |
| 7      | T700                  | I1, I3              |
| 8      | T800                  | I1, I2, I3, I5      |
| 9      | T900                  | I1, I2, I3          |

Find candidate and frequent itemsets using APRIORI algorithm where minimum support count is 2.

- b) Explain decision tree induction & write basic algorithm for inducing decision tree from training tuple. [6]  
c) List and explain Data mining applications. [4]
- Q7)** a) Explain Active and Deductive databases. [6]  
b) Explain merits and demerits of main memory database. [6]  
c) Brief about Semantic database. [4]
- Q8)** Write a short note on (any three) : [18]  
a) LDAP.  
b) XML.  
c) Multimedia Database.  
d) Hibernate.



Total No. of Questions : 8]

SEAT No. :

**P4002**

**[4760] - 405**

[Total No. of Pages :2

**M.E. (Computer Engineering)**  
**NETWORK DESIGN, MODELLING AND ANALYSIS**  
**(2008 Course) (Semester -II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain in detail Binomial distribution with its suitable example? [8]  
b) Discuss in detail Failure probability in establishing network connection. [8]
- Q2)** Describe following with respect to network applications (Any Two). [16]  
a) Delay in Communication Subnet.  
b) Little's Theorem  
c) Network Simulation
- Q3)** Write a short note on [18]  
a) Jackson's Theorem  
b) Non-Preemptive Service  
c) Analysis of M/M/2 queue on vacation
- Q4)** a) Analyze M/M/1 queuing system using state transition diagram. [8]  
b) We want to draw random samples of two gaskets from a box containing 10 gaskets, three of which are defective. Find the probability function of random variable X= Number of defectives in the sample. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain duties and responsibilities of Network Administrator. [6]  
b) Solve Terminal Assignment problem for given data. [10]

Weight of node = 01

Max. capacity of concentrator = 03

|   | G | H  | I  | K |
|---|---|----|----|---|
| a | 9 | 5  | 1  | 5 |
| b | 8 | 6  | 4  | 2 |
| c | 6 | 4  | 8  | 3 |
| d | 8 | 11 | 5  | 1 |
| e | 5 | 2  | 10 | 4 |
| f | 6 | 5  | 11 | 6 |

- Q6)** a) Describe different network security tools. Explain importance of it. [8]  
b) Explain Sharma's algorithm with example. [8]

- Q7)** a) Explain with neat diagram architecture of network node. [8]  
b) Differentiate between subnetting and supernetting. [8]

**Q8)** Write a short notes on (Any Three): [18]

- a) Network Planning and Implementation
- b) Impact of Virtualization on Network
- c) Tools for BW management
- d) Open Queues and Closed Queue.



Total No. of Questions : 8]

SEAT No. :

**P4361**

**[4760] - 406**

[Total No. of Pages :3

**M.E. (Computer)**

**SOFTWARE DESIGN AND ARCHITECTURE**

**(2008 Pattern) (Semester - II) (Theory) (Elective-III) (510111 A)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Explain any four with examples.

**[16]**

- a) Code view concepts: testing; configuration management
- b) Software increments and software versions
- c) Use of class diagrams for object oriented design
- d) Software design representation using ERD, state diagrams
- e) Data flow diagrams, structure charts
- f) Performance and security

**Q2) a)** Explain what you understand by stepwise refinement. Consider a simple problem of taking input of individual marks of all students of class and finding average marks and printing the average. Show how to apply stepwise refinement to above problem. **[4]**

b) Explain concept of components and interfaces with an example. **[4]**

c) Write on peer to peer architectural style. **[4]**

d) What do you understand by polymorphism, class inheritance? **[4]**

**P.T.O.**

- Q3)** a) What are software modules and software subsystems? [4]  
b) What are the advantages of 3 tier client server systems? [4]  
c) Write on concepts: model, view, controller. [4]  
d) What is the use of java applets, jdbc technology? [4]

**Q4)** Explain ANY SIX in brief with examples to illustrate. [18]

- a) Jackson structure programming
- b) Software development lifecycle
- c) Global analysis
- d) Model driven architecture
- e) Observer pattern
- f) User interface design
- g) Security tactics available to an architect
- h) Execution view

## SECTION - II

**Q5)** Discuss in brief. [16]

- a) User friendly features in GMAIL (or any other online email system)
- b) Role and responsibilities of a server in client server systems
- c) Documenting behavior using sequence diagrams with an example
- d) Software connectors: procedure calls, event

**Q6)** Imagine that you have to design a hypothetical social networking website for your college... For this website discuss [16]

- a) What requirements will you consider, what ARCHITECTURAL STYLE.
- b) Give webpage design for home page of your site (show just how it will look)

- c) What will be your responsibilities as an architect
- d) Show how login, strong passwords will help secure the website

**Q7)** Illustrate any four of the following concepts with examples of your own. **[16]**

- a) Documenting interfaces completely
- b) Remote procedure calls
- c) Components and connectors
- d) IS 2000
- e) How does the client server architectural style work
- f) Layered architecture

**Q8)** Write short notes on (Any Three). **[18]**

- a) Design patterns and iterator pattern
- b) Object oriented concepts
- c) Structured analysis and structured design
- d) Technologies for developing websites
- e) Software design
- f) Archetype patterns and product pattern
- g) Importance of software architecture.



Total No. of Questions : 8]

SEAT No. :

**P4003**

**[4760] - 407**

[Total No. of Pages :2

**M.E.(Computer Engineering)  
PATTERN RECOGNITION & MACHINE VISION  
( 2008 Course)(Semester-II)(510111(B)) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figure to the right side indicates full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Define feature, pattern, classification and regression with reference to pattern recognition. [8]  
b) Explain cross validation techniques in detail. [8]
- Q2)** a) Explain the nearest neighbor approach for multi category classification. [8]  
b) Explain Bayesian classifier and its criterion for classification. [8]
- Q3)** a) What is multi-category classification? Explain Levenberg-Marquardt algorithm. [8]  
b) Define within -class scatter matrix & between-class scatter matrix.Discuss the discriminant analysis for 2-class problem. [8]
- Q4)** Write a short notes on any three [18]  
a) Active shape models  
b) Unbiased modeling and prediction  
c) Dimension reduction methods  
d) Non-linear kernel methods

***P.T.O.***

## SECTION - II

- Q5)** a) Define tracking and state its applications? Discuss linear 1-D Kalman filter for motion estimation. [8]
- b) Discuss the main properties of the essential and fundamental matrices? Discuss eight point algorithm. [8]
- Q6)** a) Discuss Interpretation tree with example. [8]
- b) What are the intrinsic and extrinsic parameters of a stereo system [8]
- Q7)** a) What is mean by invariants? Discuss on Invariant based recognition algorithms. [8]
- b) Explain Object recognition using geometric hashing. [8]
- Q8)** Write a note on any three [18]
- a) Object recognition applications
  - b) Motion based segmentation
  - c) A simple stereo system
  - d) Graph matching



Total No. of Questions : 8]

SEAT No. :

**P4004**

**[4760] - 408**

[Total No. of Pages :2

**M.E.(Computer )**

**NETWORK PROGRAMMING**

**( 2008 Course)(Semester-II)(510111(C)) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) How port number allocation is done? Explain concurrent servers in detail. [8]  
b) With neat labeled diagram explain TCP connection establishment and termination process. [8]
- Q2)** a) Explain in detail socket functions in TCP. [8]  
b) Explain crashing and rebooting of server host. [8]
- Q3)** a) Explain routing sockets in detail. [8]  
b) Write a program for TCP echo client-server. [8]
- Q4)** a) Write a short note on IPv4 and IPv6 socket address structures. [6]  
b) Write a short note on data-link socket address structure. [6]  
c) Write a short note on address conversion functions. [6]

***P.T.O.***

## SECTION - II

- Q5)** a) Describe in detail the interoperability between IPv4 client and IPv6 sever. [8]  
b) With neat labeled diagram explain IPv4 and IPv6 headers. [8]
- Q6)** a) Compare and explain multicasting and broadcasting. Explain multicast socket options. [8]  
b) Explain SNTP protocol in detail. [8]
- Q7)** a) Compare and explain TCP iterative and concurrent server in detail. [8]  
b) Write a program for TCP based echo server using Threads. [8]
- Q8)** a) Write a short note on NTP protocol. [6]  
b) Write a short note on TCP pre-forked server. [6]  
c) Write a short note on IPv6 multicast address. [6]



Total No. of Questions : 8]

SEAT No. :

**P4005**

**[4760] - 409**

[Total No. of Pages :2

**M.E.(Computer Engg.)**

**ADVANCED INTERNET PROGRAMMING**

**( 2008 Course)(510111(D)) (Elective-III) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**SECTION-I**

- Q1)** a) Explain the evolution of HTML. Explain the role of standards bodies like IETF,W3C etc in this evolution process. **[8]**
- b) Explain in detail need and working of UDP. Explain the functions of UDP. **[8]**
- Q2)** Describe in detail following typical Java2 platform, Enterprise Edition roles:**[16]**
- i) J2EE Product provider
  - ii) Application Component provider & Application Assembler
  - iii) Deployer
  - iv) System Administrator
- Q3)** a) List out the control statements in JavaScript. Demonstrate use of any one control statement with an example. **[6]**
- b) Explain Advantages and disadvantages of an Applet. **[4]**
- c) With the help of an example, explain the use and working of an applet.**[8]**
- Q4)** Write short notes on **[16]**
- a) J2EE architecture
  - b) URL & Browsers
  - c) Components of an Applet
  - d) W W W

**P.T.O.**

## SECTION - II

- Q5)** a) Write a suitable code skeleton to demonstrate the use of a simple servlet which calculates the multiplication of two numbers. [10]
- b) Explain the following JSP elements in detail: [6]
- i) Directive
  - ii) Action
  - iii) Scripting
- Q6)** a) Write a sample code fragment to demonstrate how to convert the input into response using JSTL <c:out> action. [8]
- b) Compare PHP,JSP,ASP. [8]
- Q7)** a) Explain the role of following elements of a JMS API: [12]
- i) Connection Factories
  - ii) Connections
  - iii) Sessions
  - iv) Messages
  - v) Message producers
  - vi) Message Consumers
- b) Briefly explain following core JNDI packages [6]
- i) javax.naming
  - ii) javax.naming.directory
  - iii) javax.naming.event
  - iv) javax.naming.ldap
- Q8)** Write short notes on [16]
- i) JSR 168
  - ii) Evolution of portals
  - iii) Components of a servlet
  - iv) JDBC

Total No. of Questions : 6]

SEAT No. :

**P3754**

**[4760]-41**

[Total No. of Pages : 2

**M.E. (Civil) (Structure)**  
**DESIGN OF FOUNDATION**  
**(2008 Pattern) (Elective-I) (Semester-I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Your answers will be valued as a whole.*
- 5) *Use of electronic pocket calculator is allowed & IS codes are not allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1) a) Explain the following: [15]**

- i) ISCS.
- ii) A-line chart.
- iii) Teng's correlations.
- iv) Soil structure Interaction.
- v) Proportioning of Footing.

b) For a multiplex structure, a column footing of size 2m × 3m, transmits a pressure of 150 kN/m<sup>2</sup>, at its base embedded in sand 1.8m, below G.L. Total depth of sand below G.L. is 3.8m, underlain by 2m deep clay. Assuming suitable pressure distribution, compute the consolidation settlement at the middle of clay layer. Use following data, [10]

- i) For sand,  $\gamma = 19 \text{ kN/m}^3$  &  $\gamma_{\text{sat}} = 22 \text{ kN/m}^3$ .
- ii) For clay,  $\gamma_{\text{sat}} = 18 \text{ kN/m}^3$ ,  $e_o = 0.90$ ,  $C_c = 0.28$ ,  $w = 40\%$ ,  $G = 2.7$ .  
Assume GWT at 2.8m below GL.

**Q2) a) Discuss the different types of raft & its in-situ need. [9]**

b) Explain the design steps, with sample calculations for, [16]

- i) Flat slab Raft.
- ii) Beam & Raft (slab) Foundation.

**P.T.O.**

- Q3)** a) Differentiate between the design criteria for foundations of impact & rotary machines as per IS-2947-Pt-II-1966. [15]
- b) Resonance occurred at frequency of 22 cycles/sec in a block vibration test of  $1\text{m} \times 1\text{m} \times 1\text{m}$ . Determine the  $C_u$  of the soil when the wt. of oscillator is 650 N and the force produced by it at 12 cycles/sec is 1 kN. Also compute the amplitude in vertical direction at 12 cycles/sec. Assume  $\gamma = 22 \text{ kN/m}^3$ . [10]

### SECTION-II

- Q4)** a) Compute the settlement of a pile group to carry a load of 3000 kN with pile cap width = 5m, depth of clay = 20m, length of clay pile = 10m,  $\phi = 0.5\text{m}$ ,  $q_u = 70 \text{ kN/m}^2$ . Pressure distribution =  $30^\circ$ , LL = 60%, FOS = 3. [15]
- b) Discuss the following: [10]
- i) PSF & NSF.
  - ii) Feld's Rule.
- Q5)** a) Design an RCC precast pile to sustain a working load of 800 kN.  $L = 10\text{m}$ ,  $\phi = 0.4\text{m}$ ,  $q_u = 70 \text{ kN/m}^2$ . Design with suitable reinforcement & check for handling stresses. [15]
- b) Explain the steps for 'Rees & Matlock' method, for analysis of LLP. [10]
- Q6)** a) Explain with sample calculations, the steps for 'Design of pile cap'. [9]
- b) Discuss the different types of 'shell foundations', stating their suitability & IS code Recommendations. [8]
- c) Compare, conical & Hyperbolic, RC shell foundations with & without edge beams. [8]



Total No. of Questions : 8]

SEAT No. :

**P4006**

[Total No. of Pages : 2

**[4760]-410**

**M.E. (Computer Engineering)**

**SOFTWARE PROJECT MANAGEMENT**

**(Elective - IV) (Semester - II) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answers to the two sections should be written in separate answer books.*
- 2) Answer any three questions from each section.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right side indicate full marks.*
- 5) Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the significance of Software Project Management with its activities. [8]  
b) Explain the major challenges in project management and how to overcome them? [8]
- Q2)** a) Explain the tools and methods used for Software Project Planning.[8]  
b) How Risk analysis helps in project management? [8]
- Q3)** a) Explain the method to estimate the schedule in project management.[8]  
b) Explain the complex project management review. [8]
- Q4)** Explain the following.(Any three) [18]  
a) Project Management practices  
b) Risk assessment  
c) Work break down structure  
d) Quality factors

***P.T.O.***

**SECTION - II**

- Q5)** a) Explain the procurement and contract management. [8]  
b) Give the role of stakeholders in project management. [8]
- Q6)** a) Explain the data and transactional sizing in estimation. [8]  
b) Explain the estimation using function point analysis. [8]
- Q7)** a) Explain the different types of Risks considered in project management? [8]  
b) Explain the different metrics used in project management. [8]
- Q8)** Explain the following. (Any three) [18]  
a) Cost planning  
b) Project plan  
c) Tracking schedule  
d) Risk mitigation

**XXXX**

Total No. of Questions : 8]

SEAT No. :

P4007

[Total No. of Pages : 2

[4760]-411

M.E. (Computer)

INFRASTRUCTURE MANAGEMENT

(2008 Pattern) (Elective - IV)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Solve any *THREE* questions from each section.
- 2) Answers to each section should be written on separate sheet.
- 3) Figures to the right side indicate full marks.

**SECTION - I**

- Q1)** a) Define System Management. Explain in detail how the growth of internet has affected the system management. [8]  
b) Discuss the complexity of today's computing environment. [8]
- Q2)** a) How to determine the customer requirements? Explain the effect of customer requirement on the infrastructure management. [8]  
b) Identify some benefits and possible problems of using IT Service Management best practices. [8]
- Q3)** a) Explain activities, methods & techniques in Financial management.[8]  
b) Explain following items in brief with respect to Availability Management [4]  
i) Input & Output  
ii) Critical success factors & Risks  
c) Explain [6]  
i) Objectives  
ii) Scope  
iii) Business value of capacity management process.
- Q4)** Write Short notes on ANY TWO : [16]  
a) Current business demands  
b) Service level Management  
c) Information Technology Infrastructure Library (ITIL)

P.T.O.

## SECTION - II

- Q5)** a) What are the activities, methods and techniques in Incident management process. Provide incident management diagram. [12]  
b) In problem management many problem analysis, diagnosis and solution techniques are available. Explain following techniques in detail. [6]  
i) Brainstroming  
ii) Ishikawa diagrams  
iii) Pareto analysis
- Q6)** a) With the help of a diagram (workflow) explain the interface of change management process with configuration management. [8]  
b) Enlist following items in the context of release management [8]  
i) Inputs & Outputs  
ii) Metrics  
iii) Challenges for implementation  
iv) Critical success factors and Risks
- Q7)** a) What is LDAP? Explain the LDAP data interchange format. [8]  
b) What do you mean by intrusion? What is the impact of these intrusions on infrastructure of an organization? Explain how a firewall can help to prevent the intrusion. [8]
- Q8)** Write short notes on : [16]  
a) Service level Agreements  
b) Space management  
c) Service Desk  
d) NAS & SAN

**XXXX**

Total No. of Questions : 10]

SEAT No. :

**P4008**

[Total No. of Pages : 2

[4760] - 412

**M.E. (Computer Engineering)**

**DATA WAREHOUSING AND DATA MINING (Elective - IV)  
(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Section I : Q1 is compulsory. Solve Any Two questions out of Q2,Q3,Q4,Q5.*
- 5) *Section II: Q6 is compulsory. Solve Any Two questions out of Q7,Q8,Q9,Q10.*

**SECTION - I**

- Q1)** a) Explain Data Warehouse Load Manager (ETL process) in details. [8]  
b) Design snowflake schemas for financial services data warehouse. [8]
- Q2)** a) Define Multidimensional Model. Explain different OLAP servers. [9]  
b) Explain various guidelines for designing fact table and dimension table in conceptual modeling schemas. [8]
- Q3)** a) Describe Market Basket problem using Apriori Association Rule mining algorithm. [9]  
b) Describe data mining primitives with suitable example. [8]
- Q4)** a) Write a short Note on : [12]  
i) Data Decretization  
ii) Materialized View  
b) Explain correlation analysis technique with suitable example. [5]

**P.T.O.**

**Q5)** a) Explain mining Multi-level Association Rules from Relational Database and Data Warehouse. [9]

b) Describe dimensionality reduction techniques in data warehouse [8]

### **SECTION - II**

**Q6)** a) Define Classification and Prediction. Explain decision tree based classification method with suitable example. [8]

b) Define Information Retrieval System. Describe keyword based association text mining. [8]

**Q7)** a) Describe K-Nearest Neighbor classifiers with suitable example. [9]

b) Define Outlier. Explain any two methods for outlier detection and handling. [8]

**Q8)** a) Explain DBSCAN density Clustering algorithm with suitable example. [9]

b) Write a short Note on : [8]

i) Spatial association

ii) Web usage mining

**Q9)** a) Explain Naïve Bayesian classification algorithm for email classification. [9]

b) Describe K-Means clustering technique with suitable example. [8]

**Q10)** a) Explain neural network approach used for model based clustering. [9]

b) Explain Page rank algorithm in web and text mining. [8]

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4009**

**[4760]-414**

[Total No. of Pages : 2

**M.E.(Computer) (Computer Networks)  
INTERNET ROUTING DESIGN  
(2008 Pattern)(Elective-I)(510304 (A))(Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Identify the key differences between the differentiated search architecture and the integrated services architecture. **[8]**
- b) Explain in detail the IP protocol stack architecture and its relation to the OSI reference model. Discuss the protocol layering in the IP architecture. **[8]**
- Q2)** a) How the path selection process and aggregation and dissemination is carried out in BGP? Explain in brief. **[8]**
- b) Give the comparison of the Bellman-Ford algorithm and Dijkstra's Algorithm with their complexities and example of the same. **[8]**
- Q3)** a) Why do some routing protocols message identification at above the transport layer while some others do so directly over the IP layer. Explain. **[8]**
- b) Explain Distance vector protocol based on Diffusing computation with Coordinated update. **[8]**

**P.T.O.**

- Q4)** a) Discuss the role of Ases ( Autonomous systems) and BGP in routing. Describe the current architectural view of the internet. How ases are related to ISPs? [10]
- b) Identify the functionality in OSPF that allows a static route to be injected into an OSPF domain. [8]

### **SECTION-II**

- Q5)** a) Explain constrained shortest path routing and its variations when you consider different attributes. [8]
- b) Why would a stub AS use uRPF at its border router? Explain. [8]
- Q6)** a) How does bandwidth guarantee required by services affect the performance it receives in a heterogeneous bandwidth environment? [8]
- b) What is the maximum time allowed for a look up in a router to sustain a data rate of 20 Gbps with an average packet size of 100 bytes? Assume that the router requires 15 ns per packet for other operations in the packet. [8]
- Q7)** a) How is QoS routing different from best-effort routing. [8]
- b) Discuss where and how MPLS based IP/MPLS traffic engineering is different from “pure”IP traffic engineering. [8]
- Q8)** Write a short note on (any three): [18]
- a) IGRP Protocol.
- b) Network algorithms.
- c) Routing/Traffic engineering for Voice over MPLS.
- d) PSTN call routing managed IP approach.



Total No. of Questions : 8]

SEAT No. :

**P4010**

**[4760] - 415**

[Total No. of Pages :2

**M.E. (Computer) (Computer Network)**

**ADVANCED TCP/IP**

**(510304 B) (Elective - I) (Semester - I) (2008 Course)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with examples how to obtain information about hosts, Network, Protocols and network services in a client server environments? [8]
- b) Explain the system calls for addressing DNS, IP address manipulation, obtaining and setting hostname. [8]
- Q2)** a) How DHCP exchange different messages? Find the efficiency of a BOOTP packet versus RARP packet. [8]
- b) Explain two step bootstrap procedure in BOOTP. [8]
- Q3)** a) Compare and contrast DNS structure with the UNIX directory structure. [10]
- b) Explain the mechanism of TELNET, how it forces the remote operating system to respond to control functions quickly. [8]
- Q4)** a) What is DNS query and response message? Discuss response message in detail. [8]
- b) Explain the TELNET standard and find out how the SYNCH operation works. [8]

***P.T.O.***

## SECTION - II

- Q5)** a) Show the FTP commands and response to store a image (binary) file from the client directory/usr/local/image/file1. [8]  
b) Explain various TELNET options. How option negotiation takes place? [8]
- Q6)** a) Differentiate between HTTP and HTTPS. Explain under what condition proxy cache web pages uses HTTPS. [8]  
b) Explain Real Time transport control protocol (RTCP). [8]
- Q7)** a) Explain about Mail Transfer Agent in detail. [8]  
b) Explain SMTP mail Transfer phases with example? [8]
- Q8)** Write short notes: [18]  
a) VOIP.  
b) SMTP.  
c) Network Virtual Terminals (NVT).  
d) TFTP.



Total No. of Questions : 8]

SEAT No. :

**P4011**

[Total No. of Pages : 3

[4760] - 416

**M.E. (Computer) (Computer Networks)**  
**WIRELESS TECHNOLOGY (Elective - II)**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is multipath propagation and what are its effects? List the factors that influence small scale fading. [8]
- b) What are the main benefits of spread spectrum system? How can spreading be achieved? Explain DSSS and FHSS with Examples? [8]
- Q2)** a) Derive an expression for antenna efficiency in terms of radiation resistance. [8]
- b) Explain the different techniques of improving coverage and capacity in cellular system. [8]
- Q3)** a) Explain the operation of a piconet in terms of the states of operation during link establishment and maintenance using Bluetooth state transition diagram. [8]
- b) What are the basic building blocks of 802.11 network explain it with different types of network. [8]

***P.T.O.***

**Q4)** Write short notes on (Any Three)

**[18]**

- a) Diversity Techniques
- b) GSM Architecture
- c) Frequency Reuse Factor
- d) Hard Hand-off Algorithm

**SECTION - II**

**Q5) a)** Explain 'Bluetooth protocol stack' with neat diagram.

**[8]**

- b) What are the requirements for converting a computer wired LAN based laboratory into a typical mobile wireless laboratory. Analyze the requirements, regarding s/w & h/w.

**[8]**

**Q6) a)** Name the inefficiencies of mobile IP regarding data forwarding from a correspondent node to a mobile node. What are optimizations and what additional problems do they cause?

**[8]**

- b) Draw a typical 802.11 MAC frame showing various fields. Expand the frame control field into its subfields. State what is the significance of type, subtype fields and ToDS, FromDS bits.

**[8]**

**Q7) a)** What is the use of NAV? Explain significance of Duration field.

**[8]**

- b) What are the design flaws of the WEP system? State what is meant by integrity check value.

**[8]**

**Q8)** Write short note on any **THREE** of the following

**[18]**

- a) IEEE 802.11 Frame Control field
- b) WEP's design flaws
- c) EAP Methods
- d) Wi-Fi Vs Wi-Max



Total No. of Questions : 8]

SEAT No. :

**P4012**

[4760] - 417

[Total No. of Pages : 2

**M.E. (Computer Network)**  
**INFORMATION SECURITY AUDIT AND MANAGEMENT**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Attempt any three questions from Section - I and three questions from Section - II.*
- 2) *Answer of Section - I and Section - II should be written on separate answer sheets.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat diagram wherever necessary.*
- 5) *Make suitable assumptions wherever necessary.*

**SECTION - I**

- Q1)** a) What is the C.I.A. triangle? Explain in detail key concepts of information security. [8]
- b) Define Project Management. Why is project management of particular interest in the field of information security? [8]
- Q2)** a) What terms are used to describe the control measure that reduces security incidents among members of the organization by familiarizing them with relevant policies and practices in an ongoing manner? [8]
- b) List the seven-step CP process as defined by the NIST. Why is it recommended standard approach to the process? [8]
- Q3)** a) List and describe in detail six stages guidelines for effective policy. [8]
- b) What function constitute a complete information security program? [8]

**P.T.O.**

**Q4) Write short note on (Any Three) :** **[18]**

- a) SETA program
- b) SysSP
- c) SDLC and SecSDLC
- d) IR planning steps

**SECTION - II**

**Q5) a) What are the essential processes of access control?** **[8]**

b) What is a performance measure in the context of information security management? **[8]**

**Q6) a) What is risk identification? List different organizational assets used in the IT systems.** **[8]**

b) What are the four risk control strategies? **[8]**

**Q7) a) Explain the key difference between symmetric and asymmetric encryption. Which can the computer process faster? Which lowers the costs associated with key management?** **[8]**

b) What functions does the security manager perform and what are the key qualification and requirement for the position? **[8]**

**Q8) Write short note on (any three)** **[18]**

- a) Risk Management
- b) Wireless Networking protection
- c) Privacy laws
- d) Project management tools.



Total No. of Questions : 8]

SEAT No. :

**P4013**

[Total No. of Pages : 2

**[4760] - 418**

**M.E. (Computer ) (Computer Network)**

**OPERATING SYSTEM DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is operating system? Explain functions of Operating system. [8]
- b) What is Process? Explain Process State transition Diagram. [8]
- Q2)** a) What is Context of a process? Explain Context Switch Process with diagram. [8]
- b) What is deadlock? Explain with Example. [8]
- Q3)** a) What are the different Scheduling Criteria? Explain different Uniprocessor Scheduling Algorithm with example. [8]
- b) What is IPC? Explain different IPC mechanisms and Blocking and Non-Blocking IPC Types. [8]

***P.T.O.***

- Q4)** a) Explain System Call Mechanism using some Example. [8]  
b) What are the different types of group communication Explain following points related to one to many communication. [10]  
i) Group Management.  
ii) Group Addressing.  
iii) Message Delivery to Receiver Process.

### **SECTION - II**

- Q5)** a) Explain Difference Between Process and Thread. [8]  
b) What is Semaphore? Explain different types of semaphore and explain producer-consumer problem using semaphore. [8]
- Q6)** a) Write short note on: [10]  
i) Deadlock Avoidance.  
ii) Deadlock Detection.  
iii) Resource Allocation Graph.  
b) Explain Bankers Algorithm with the help of Example. [8]
- Q7)** a) What is Synchronization? What are classic Problem of Synchronization? Explain Reder-Writer Problem with Solution. [8]  
b) Explain Different Services Provided by File System on Multiprocessor System. [8]
- Q8)** a) Explain Difference between: [8]  
i) Active and Passive Attack  
ii) Virus and Worms  
b) What is Pipe? Explain Named and Unnamed Pipe, Write any program using pipe. [8]



Total No. of Questions : 8]

SEAT No. :

**P4014**

**[4760] - 419**

[Total No. of Pages :2

**M.E. (Computer Networking)**  
**ADVANCED SOFTWARE ENGINEERING**  
**(2008 Course) (Semester -II) (510310)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Describe the most important distinction between Reliability & safety with proper example. **[8]**
- b) Suggest why it is important to make a distinction between developing the user requirements and developing system requirements in the requirements engineering process. **[8]**
- Q2)** a) What is user interface prototyping? What are the different approaches that you can use for user interface prototyping. **[8]**
- b) With suitable example, explain how you will do object identification in the object-oriented design process? **[8]**
- Q3)** a) Explain why a software system that is used in a real-world environment must change or become progressively less useful? **[8]**
- b) What are the fundamental differences between components and web services? Explain in detail. **[8]**
- Q4)** Suggest appropriate reliability metrics, reasons for your choice of metric and appropriate values for it for the following system **[18]**
- a) A system that monitors driving speed of the car;
- b) An automated vending machine control system.

**P.T.O.**

## SECTION - II

- Q5)** a) Why is software configuration management crucial to the success of large software product? [8]  
b) With a suitable example show how to find cyclomatic complexity of any software? [8]
- Q6)** a) Explain how testing is done in extreme programming? [6]  
b) State differences and similarities in verification and validation. [6]  
c) Write short note on Clean Room software Engineering. [6]
- Q7)** a) What are the advantages and disadvantages of using a goal-based rather than a practice-based maturity model? [8]  
b) Explain in detail the popular cost estimation model used in IT industry. [8]
- Q8)** Write short notes on (any two): [16]  
a) Software Quality.  
b) Software Maintenance  
c) Risk components and drivers.



Total No. of Questions : 6]

SEAT No. :

**P3755**

[Total No. of Pages : 2

[4760] - 42

**M.E. (Civil - Structures)**

**ADVANCED DESIGN OF METAL STRUCTURE**

**(2008 Pattern) (Elective - I) (Semester - I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator and relevant IS codes is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

**Q1)** Suggest structural configuration of hoarding structure to be installed at height of 20 m above ground level. The display board is of dimensions 20 m wide, 10 m height. Calculate the loads due to wind on the members of support structure. Draw free body diagram of structures showing the forces and reactions. **[25]**

- Q2)** a) Explain fabrication of beams into castellated beam. **[9]**  
b) What are the advantages and disadvantages of castellated beam? **[6]**  
c) Explain behavior of castellated beam in flexure and shear. **[10]**

- Q3)** a) Compare steel and aluminum structural sections. And applications. **[7]**  
b) Compare and Draw stress-strain diagram of aluminum and steel. **[7]**  
c) Find flexural and shear stresses in IS ALB 150 at 12.1 kg/m when loaded with udl of 20 KN /m on span of 4 m. **[11]**

**SECTION - II**

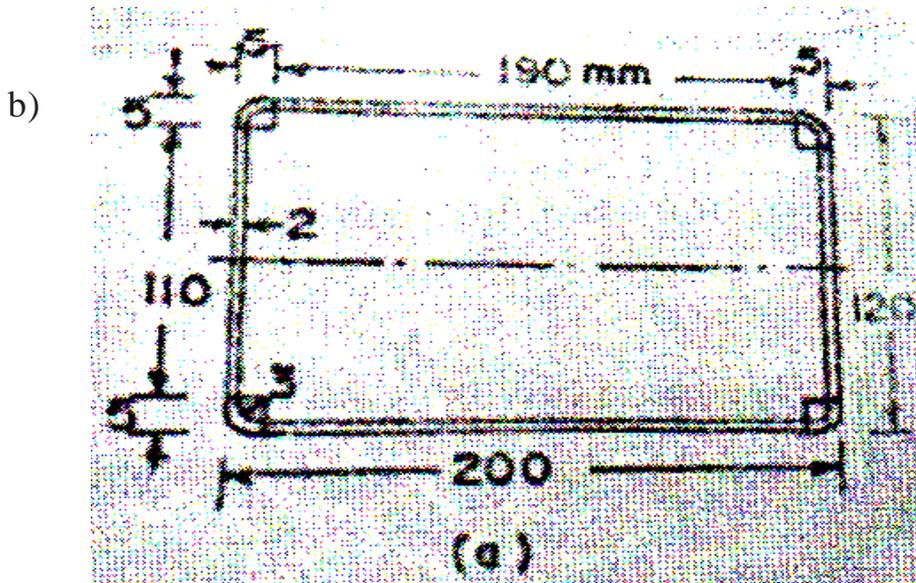
- Q4)** a) Differentiate geometry and structure of Microwave tower and transmission tower carrying high tension electric wire. **[5]**  
b) Draw typical structural arrangement of both **[5]**  
c) Draw typical Free body diagram with conventional loads on each type of tower. **[5]**

**P.T.O.**

- d) Design the foundation bolt for transmission tower .one of the four legs with angle section has to transfer tensile reaction of 750 KN to foundation block. The cross- section of tower leg is ISA 125.125.10. Draw design details of connection. [10]

- Q5) a) State advantages and disadvantages of tubular structural sections used in steel structures [6]  
 b) What are the design considerations of tubular structure [6]  
 c) Design scaffolding support structure for RCC slab 220 mm thick ,span between beams is 4 m. [13]

- Q6) a) Explain manufacturing of light gauge structural members. [10]  
 Enlist its advantages over conventional sections



Find the allowable load for the rectangular tubular column section show in fig. The effective length of column is 3.3 m. Take  $f_y=235\text{N/mm}^2$ . [15]



Total No. of Questions : 8]

SEAT No. :

**P4015**

**[4760]- 420**

[Total No. of Pages :2

**M.E. (Computer) (Computer Network)  
NETWORK PROGRAMMING  
( 2008 Pattern) (Semester- II)(Elective-III) (510311)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat Diagrams should be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION-I**

- Q1)** a) What are the limitations of size of IP datagrams? How they affect the data an application can transmit? Explain in detail. [8]  
b) Explain TCP state transition diagram in detail with connection establishment & termination. [8]
- Q2)** a) Explain TCP Echo server program with main function and TCP Echo server program with str\_echo function. [8]  
b) What is the largest length that we can pass to send to for a UDP/IPv4 socket,i.e.what is the largest amount of data that can fit into a UDP/IPv4 datagram? What changes with UDP/IPv6? Justify. [8]
- Q3)** a) State the structure of a routing socket. Explain various messages exchanged across a routing socket. [8]  
b) Explain various interface name and Index function used with IPv4 API. [8]
- Q4)** Write short note on (any THREE) [18]  
a) Resource records in DNS.  
b) Crashing and rebooting of server host.  
c) Advanced Name and Address conversions function.  
d) Significance of port numbers in computer in networks.

***P.T.O.***

## SECTION-II

- Q5)** a) Explain in detail IPv6 server on dual stack host serving IPv4 and IPv6 clients. [8]  
b) Explain with neat diagram a scenario of processing of clients requests depending on address type and socket type. [8]
- Q6)** a) Differentiate multicasting and broadcasting on a LAN in detail. [8]  
b) Explain Simple Network Time Protocol (SNTP) with example. [8]
- Q7)** a) Explain FIVE basic threads functions and explain how they used to recode TCP client/server instead of fork. [10]  
b) Explain TCP Echo server program using threads. [6]
- Q8)** Write short notes on (any THREE) [18]  
a) UPV6 multicast address  
b) TCP prethreaded server  
c) IPv6 address testing macros  
d) Race condition and shared data access.



Total No. of Questions : 8]

SEAT No. :

**P4362**

**[4760] - 421**

[Total No. of Pages :2

**M.E. (Computer) (Computer Networks)  
NETWORK DESIGN, MODELING AND ANALYSIS  
(2008 Pattern) (Semester - II) (Elective-III) (510311 B)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Write short note on “Application of Probability theory in Network Analysis”. [8]  
b) Explain in brief Gaussian Probability Density Function. [8]
- Q2)** a) Messages arrive to a system at the rate of 10 per minute. Length of the messages is exponentially distributed with average of 3600 characters on a transmission channel of 9600 bps. Compute [8]  
i) Average service time  
ii) Service rate  
iii) Utilization of server  
iv) Probability that there are two messages in the system  
b) Analyze M/M/1 queuing system using state transition diagram. [8]
- Q3)** a) Prove that “Probability of system being idle is 1 minus utilization of server”. [8]  
b) What do you mean by delay in communication subnet? Describe component of delay? [8]

***P.T.O.***

**Q4)** Write short notes on (Any three). **[18]**

- a) Little's Theorem and its proof
- b) Poisson inter arrival time and random variable
- c) Modeling and Performance Evaluation of Networks
- d) D/D/1 Queue

**SECTION - II**

**Q5)** a) Explain in detail Bin Packing algorithm with proper example. **[8]**

- b) There are 6 terminals in a city with weights 7,9,14,5,17 and 8. What are the best possible solutions, using in packing algorithm, for capacities 30 and 20? **[8]**

**Q6)** a) What is QoS? Explain QoS parameters. **[8]**

- b) What is congestion? List various network parameters affected due to congestion? **[8]**

**Q7)** a) Explain duties and responsibilities of network Administrator. **[8]**

- b) What is traffic shaping? How is it used in congestion control? **[8]**

**Q8)** Write short notes on (Any Three). **[18]**

- a) ESAU-William's algorithm.
- b) Performance analysis of Data Link Layer
- c) Tools for BW and security management
- d) CMST algorithm.



Total No. of Questions : 8]

SEAT No. :

**P4016**

[Total No. of Pages : 2

[4760] - 422

**M.E. (Computer) (Computer Networks) (Semester - II)**  
**INFRASTRUCTURE MANAGEMENT (Elective - IV)**  
**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Solve any THREE questions from each section.*
- 2) *Answers to each section should be written on separate sheet.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain in detail, the current business demands and IT systems issues.[8]  
b) Explain evolution of systems since 1960s and their effect on the management discipline. [8]

- Q2)** Explain in detail. [16]  
a) Factors to consider in designing IT organizations.  
b) Factors to consider in designing IT infrastructure.

- Q3)** a) In the context of Service Level Management, explain in detail. [6]  
i) Objective & Goals  
ii) Scope  
iii) Value for business  
b) In the context of Service Level Management, explain in detail. [10]  
i) Activities, methods and techniques  
ii) Interfaces  
iii) Metrics & Implementation

**P.T.O.**

- Q4)** Write notes on. **[18]**
- a) Value of Systems management for business
  - b) The design process for information systems
  - c) Availability Management

**SECTION - II**

- Q5)** a) In the context of Change management, explain in detail. **[8]**
- i) Change
  - ii) Objective & Goals
  - iii) Scope
  - iv) Business value
- b) Explain, with the help of a diagram, specific activities to manage individual changes. **[8]**

- Q6)** a) In the context of Service Desk, explain in detail. **[8]**
- i) Justification and role of a service desk
  - ii) Organizational structure of a service desk
- b) In the context of Access Management, explain in detail. **[8]**
- i) Scope and Business value
  - ii) Access management activities

- Q7)** a) What are the threats and attacks for infrastructure of an organization. Suggest a method to prevent/avoid each attack. **[8]**
- b) Explain the importance of Storage management for an organization. Compare and contrast between Backup & restore AND Archive & retrieve. **[8]**

- Q8)** Write notes on. **[18]**
- a) Incident Management
  - b) Space Management
  - c) Information Technology Infrastructure Library (ITIL)

**XXXX**

Total No. of Questions : 8]

SEAT No. :

P4017

[Total No. of Pages : 2

[4760] - 423

**M.E. Computer (Computer Networks) (Semester - I)**

**CONVERGENCE TECHNOLOGIES**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain ISDN Reference Points and Functional Groupings with figure. [8]
- b) Draw the figure of Frame Structure of LAPD and explain in detail its Address field and control field in detail. [8]
- Q2)** a) What is a Technological Convergence? Explain various Benefits of it. [8]
- b) Compare the protocol architecture of frame-mode bearer service with that of X.25. [8]
- Q3)** a) What is the need for different AALs in ATM? Explain the AAL2 in brief. [8]
- b) Draw the graphs showing the effect of congestion for load verses Throughput and delay. Also explain how CIR and DE bits helps in Congestion control in Frame Relay Networks. [8]

**P.T.O.**

- Q4)** Write a short notes on **[ANY THREE]** **[18]**
- a) SS7 Architecture
  - b) Call establishment process using VC's & VP's in ATM
  - c) Broad Band Services
  - d) ATM Cell Format

**SECTION - II**

- Q5)** a) Explain the ATM Signaling reference model and discuss the role of different protocols in this model. **[8]**
- b) Though Circuit Emulation Services are available why we required DBCES? **[8]**
- Q6)** a) During traffic contract management what is the role of CAC? Justify that the CAC mechanism acts as a preventive congestion control mechanism. **[8]**
- b) Explain various types of media gateways that are controlled by MGCP. Also explain in brief the interconnection of MGCP with PSTN, H.323 & SIP. **[8]**
- Q7)** a) Explain a call setup based on SIP signalling. **[8]**
- b) Explain various Open Issues in Internet Telephony. **[8]**
- Q8)** Write a short notes on **[ANY THREE]** **[18]**
- a) Cell Delineation State Diagram
  - b) H.323 Protocol
  - c) Benefits of IP Telephony
  - d) Functional architecture of MEGACO/H.GCP

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4018**

[Total No. of Pages : 3

[4760] - 425

**M.E. (Chemical) (Semester - I)**

**APPLIED STATISTICS FOR CHEMICAL ENGINEERS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.

**SECTION - I**

**Q1)** A consignment of 180 articles is classified according to the size of the article as under **[16]**

|                            |    |    |    |    |    |     |     |     |     |     |
|----------------------------|----|----|----|----|----|-----|-----|-----|-----|-----|
| Measurement<br>(more than) | 90 | 80 | 70 | 60 | 50 | 40  | 30  | 20  | 10  | 0   |
| No.of articles             | 0  | 5  | 14 | 34 | 65 | 110 | 150 | 170 | 176 | 180 |

Calculate.

- a) Mean ( $\bar{x}$ )
- b) S.D( $\sigma$ )
- c) Mode
- d) Median
- e) Quartiles & quartile deviation

**Q2)** From the following data of wages of 50 workers of a factory compute first four moments about mean & also the values of  $\beta_1, \beta_2$ . State nature of kurtosis of the data. **[16]**

|                    |         |         |         |         |         |         |         |
|--------------------|---------|---------|---------|---------|---------|---------|---------|
| Weekly wages (Rs.) | 100-120 | 120-140 | 140-160 | 160-180 | 180-200 | 200-220 | 220-240 |
| No.of workers      | 1       | 3       | 7       | 20      | 12      | 4       | 3       |

- Q3)** a) A six-faced dice is thrown 324 times and odd points score appeared 180 times. Is the dice fair with 5% LOS? (Define the hypothesis as-the dice is fair and calculate S.E., Which is then compared with difference between actual & true value). Take standard difference of 1.96 at 5% LOS. **[5]**
- b) In a random sample of 600 men taken from a big city 400 are found to be smokers. In another sample of 900 men taken from another city 450 are smokers. Do the data indicate that there is a significant difference between in the habit of smoking in the two cities. Take standard difference of 2.58 at 1% LOS. **[5]**

**P.T.O.**

- c) In a sample of 1000 items the mean is 17.5 & the s.d. 2.5. In another sample of 800 the mean is 18 & s.d. 2.7. Assuming that the samples are independent discuss whether the two samples can have come from a population which have the same s.d.? [6]

**Q4)** Write short notes on the following- [18]

- a) Student's t - distribution  
 b) Chi - square distribution  
 c) F - distribution

**SECTION - II**

**Q5) a)** In a village 'A' out of random sample of 1000 persons 100 were found to be vegetarians while in another village 'B' out of 1500 persons 180 were found to be vegetarians. Do you find significant difference in the food habits of the people of the two villages? (Take LOS = 5%) [8]

b) Prices of shares of a company on different days in a month are given below. Discuss whether the prices of the shares be 65 (Use t - test with  $t_{0.05} (v = 9) = 2.262$ ) [8]

**Q6) a)** From the data given below about the treatment of 250 patients suffering from a disease, state whether the new treatment is superior to the conventional treatment? [8]

| Treatment    | No. of Patients |                |       |
|--------------|-----------------|----------------|-------|
|              | Favourable      | Not favourable | Total |
| New          | 140             | 30             | 170   |
| Conventional | 60              | 20             | 80    |
| Total        | 200             | 50             | 250   |

(Take degree of freedom = 1 &  $\chi^2_{0.05} = 3.84$ ).

b) A set of 5 coins is tossed 3200 times and the number of heads appearing each time is noted the results are given below. [8]

|              |    |     |      |     |    |    |
|--------------|----|-----|------|-----|----|----|
| No. of heads | 0  | 1   | 2    | 3   | 4  | 5  |
| Frequency    | 80 | 570 | 1100 | 900 | 50 | 50 |

Test the hypothesis that the coins are unbiased.

(Use  $\chi^2$  test with  $\chi^2_{0.05} (v = 5) = 11.07$ )

**Q7) a)** Two samples are drawn from two normal population. From the following data test whether the two samples have the same variance at 5% level. **[8]**

$X_1$  60 65 71 74 76 82 85 87  
 $X_2$  61 66 67 85 78 63 85 86 88 91

(Use F test with  $F_{0.05}(v_1 = 9, v_2 = 7) = 3.68$ )

**b)** Perform a two-way ANOVA on the following data; **[8]**

| Plots of land | Treatment |    |    |    |
|---------------|-----------|----|----|----|
|               | A         | B  | C  | D  |
| I             | 38        | 40 | 41 | 39 |
| II            | 35        | 42 | 49 | 36 |
| III           | 40        | 38 | 42 | 42 |

(Use  $F_{0.05}(3,6) = 4.76, F_{0.05}(2,6) = 5.14$ )

**Q8)** Write short notes on the following **[18]**

- Latin square design of experiments
- Randomized block design of experiments
- Assignment problem.



Total No. of Questions : 8]

SEAT No. :

**P4363**

[Total No. of Pages : 2

[4760] - 426

**M.E. (Chemical) (Semester - I)**

**MANAGEMENT OF RESEARCH AND DEVELOPMENT IN  
CHEMICAL INDUSTRIES**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answers any three questions from each section.*
- 2) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Discuss steps involvd in the risk analysis of success of an R & D project in typical chemical industry. **[17]**

**Q2)** Explain in detail how financial management plays crucial role in managing research? **[17]**

**Q3)** Why management of research is needed? How is it important in the survival of industry in the long run? **[16]**

**Q4)** What is Inter-disciplinary research? Explain with atleast one example, the nature of difficulties involved in managing interdisciplinary research than for a purely conventional chemical engineering? **[17]**

**SECTION - II**

**Q5)** What are the developments in research to save the earth from Green House effect? **[17]**

**P.T.O.**

**Q6)** Explain the use of PERT and CPM techniques in financial control of R & D project by taking suitable example from Chemical process industry? [17]

**Q7)** Discuss the status of research & development in Indian Chemical Industry? Explain in detail the role of International and National Prizes in revitalizing R & D? [17]

**Q8)** Write short notes on : [16]

- a) Research for modifications in existing chemical processes.
- b) Pollution free technologies.
- c) Industrial research vs Academic research.
- d) Role of Mathematical Modeling in the advancement of engineering research.



Total No. of Questions : 8]

SEAT No. :

**P4019**

**[4760] - 427**

[Total No. of Pages :2

**M.E. (Chemical)**

**ADVANCED SEPARATION PROCESSES**

**(2008 Pattern) (Semester - I) (509103)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) Classify conventional and non conventional separation processes.

b) Explain recent advances in separation.

**[16]**

**Q2)** a) What are the two types of cross flow filtration equipment?

b) Explain the regimes in cross flow electro filtration.

**[16]**

**Q3)** a) Explain the principle of working in electro dialysis.

b) Explain foam separation.

**[16]**

**Q4)** Write notes on

**[18]**

a) Economics of membrane operation

b) Affinity chromatography

**P.T.O.**

## SECTION - II

**Q5)** a) Explain the principle of working of Ion chromatography.

b) What is kinetics of ion-exchange.

**[16]**

**Q6)** Explain Adsorption and Adsorption Hysteresis.

**[16]**

**Q7)** Discuss industrial effluent treatment by modern technique, with example. **[18]**

**Q8)** Write short note on.

**[16]**

a) Pervaporation

b) Lyophilisation.



Total No. of Questions : 8]

SEAT No. :

**P4020**

**[4760] - 428**

[Total No. of Pages :3

**M.E. (Chemical)**

**COMPUTATIONAL FLUID DYNAMICS**

**(Elective - I) (2008 Course) (509104) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Explain Lagrangian and Eulerian approaches of fluid flow analysis. Are they related with each other? **[6]**
- b)** Explain the following CFD terms with appropriate mathematical expressions **[10]**
- i) Local derivative.
  - ii) Convective derivative.
  - iii) Substantial derivative.
  - iv) Velocity vector.
  - v) Stress tensor.
  - vi) Diffusive flux.

**Q2)** Using differential analysis, derive 3- Dimensional equation of motion for horizontal fluid flow. **[16]**

**Q3) a)** Classify the following PDEs stating order, linearity and parabolic/elliptic/hyperbolic type. **[8]**

i)  $u_t = u_{xx}$

ii)  $u_t = u_{xx} + u_{yy}$

iii)  $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} + xy u_x + y^2 u_y = 0$

iv)  $u_{tt} = u_{xx}$

**P.T.O.**

- b) Starting with Taylor series, discretize the following PDE using finite difference method. Show the FDM Grid. [8]

$$T_{xx} + T_{yy} = 0 \quad 0 < x < a \quad \text{and} \quad 0 < y < b$$

BCs:

$$T(0, y) = 50$$

$$T(a, y) = 5$$

$$T(x, 0) = 10$$

$$T(x, b) = 20$$

**Q4)** Write short notes on (any three): [18]

- Errors in all stages of CFD simulation.
- Grid generation methods.
- Thomas Algorithm.
- CFL Condition.
- Preprocessing and Post-processing in CFD simulation.

## SECTION - II

**Q5)** a) Explain the turbulence phenomena in detail. The continuity, equation is given as: [10]

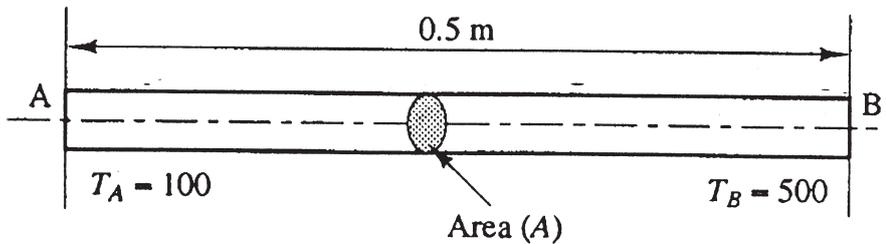
$$\left( \frac{\partial \rho}{\partial t} \right) + \frac{\partial \rho}{\partial x} + \frac{\partial \rho}{\partial y} + \frac{\partial \rho}{\partial z} = 0$$

Apply averaging technique to derive Reynolds Averaged Continuity Equation for turbulent fluid flow.

- b) Describe k-e model for turbulence flow. [6]

**Q6)** Consider the problem of source-free heat conduction in an insulated rod whose ends are maintained at constant temperatures of 100 °C and 500 °C respectively. The one-dimensional problem sketched in following figure is governed by [16]

$$\frac{d}{dx} \left( k \frac{dT}{dx} \right) = 0$$



Calculate the steady state temperature distribution in the rod using Finite Volume Method. Thermal conductivity  $k$  equals 1000 W/m/K, cross-sectional area  $A$  is  $10 \times 10^{-3} \text{ m}^2$ .

**Q7)** Sketch and explain different flow patterns observed in multiphase flows? Describe in detail the separated flow modeling with assumptions and relevant equations. [16]

**Q8)** Write short notes on (any three): [18]

- a) Reynolds stresses.
- b) Peclete Number in FVM analysis.
- c) Governing Equations in Cartesian co-ordinates and associated BCs.
- d) Finite Volume Method.
- e) Turbulence Modeling.



Total No. of Questions : 8]

SEAT No. :

**P4586**

**[4760] - 429**

[Total No. of Pages :2

**M.E. (Chemical)**

**PROCESS DESIGN AND SYNTHESIS**

**(509104) (2008 Course) (Elective - I) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any Three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Write note on concept and principles in process synthesis. [6]  
b) What are flow simulators? What is its significance in designing of process design? [6]  
c) Write note on the process flow sheet models? [6]
- Q2)** a) What are the stages involved for life cycle assessments of process? Discuss in brief. [8]  
b) Discuss important input parameters in design of reactor. [8]
- Q3)** a) Write note on optimization techniques used in design of flowsheeting. [8]  
b) What are environment concerns need to be considered for life cycle assessment? Discuss in brief. [8]
- Q4)** a) What is the significance of pinch approach in designing of heat exchange network? Discuss in brief. [8]  
b) Write note on engineering ethics. [8]

*P.T.O.*

## SECTION - II

- Q5)** a) Write note on HENS basics and graphics. [6]  
b) What are performance targets, trade-off & utilities for design of heat exchanger network? [6]  
c) What is heat and power integration? [6]
- Q6)** a) Explain construction of composite curve and its significance. [8]  
b) Explain distillation column sequencing for 4 components mixture. [8]
- Q7)** a) What are the techniques used for detection of binary azeotropes? Discuss in detail. [8]  
b) Write note on binary VLLE. [8]
- Q8)** a) What is attainable region approach used in reactor design network? Discuss in brief. [8]  
b) How reactions are useful for separation of components. Discuss the approach with example. [8]



Total No. of Questions : 6]

SEAT No. :

**P4739**

[Total No. of Pages : 3

[4760] - 43

**M.E. (Civil Structures) (Semester - I)**

**STRUCTURAL DESIGN OF STEEL BRIDGES (Elective - II)**

**(2008 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Attempt any two questions form section I and II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams should be drawn wherever necessary.*
- 5) *If necessary, assume suitable data.*
- 6) *Use of electronic pocket calculator, relevant IS code and steel table are allowed.*
- 7) *Use of cell phone is prohibited in examination hall.*

**SECTION - I**

- Q1) a)** State and explain different factors for the selection of type of steel bridges. **[15]**
- b) Explain in details, classification of steel bridges as per structural layout of main load carrying element with sketches. **[10]**
- Q2) a)** State and explain type of floor system for plate girder railway bridge. **[5]**
- b) A deck type plate girder railway bridge of span 20 m is provided for a single broad gauge track. The self weight of stock rails and check rails are 0.8 and 0.4 kN/m respectively. The self weight of sleepers is 3.2 kN/m. Design a economical cross section of plate girder and horizontal truss bracing. Draw the design sketches for the bridge structures. The EUDL for B M is 2027 kN, for S F is 2224 kN and impact factor is 0.588. **[20]**
- Q3) a)** Draw the sketch showing different component of through type truss girder railway steel bridge. **[5]**

**P.T.O.**

- b) A through type railway truss girder bridge consists of two Pratt trusses as shown in Fig. 3 b. The bridge supports an equivalent uniformly distributed live load 125 kN/m. The dead load transmitted to each truss inclusive of self weight is 20kN/m. Design central top chord and bottom chord members using channel section only. [20]

Assume the impact factor to be 15%.

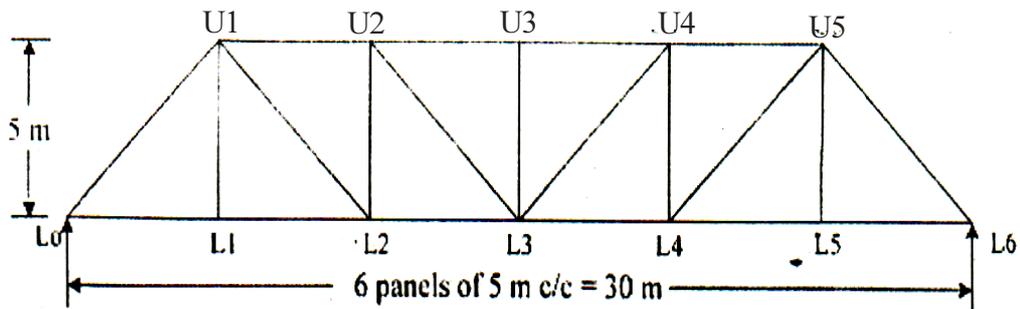


Fig. 3 b

**SECTION - II**

- Q4) a) Explain in details design consideration for the design horizontal truss bracing and cross frame for plate girder highway bridge. [10]
- b) The effective span of a deck type plate girder two lane highway bridge is 24m. The reinforced concrete slab is 250 mm thick inclusive of the wearing coat. The foot paths are provided on either side of the carriage way. Design the maximum section of plate girder, if the bridge is to carry IRC class A loading as shown in Fig. 4 b. [15]

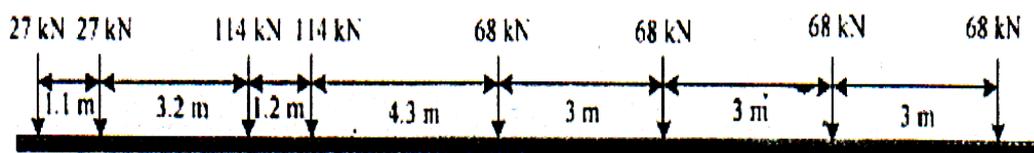


Fig. 4 b. IRC Class A Loading

- Q5) The effective span of through type truss girder highway two lane bridge is 24m. The reinforced concrete slab is 250 mm thick inclusive of the wearing coat. The foot paths are provided on either side of the carriage way. The spacing between centre to centre of truss girder is 12 m. The highway bridge is to carry IRC class A standard loading. Suggest a suitable truss girder for the bridge. Design the central top chord and diagonal members of the central panel. [25]

**Q6) a)** State and explain type of rocker bearing end bearing in steel bridges with sketches. **[10]**

b) The effective span of truss girder through type bridge for a single broad gauge track is 24 m. Reaction due to dead load, live load and impact load is 1200 kN. Vertical reaction due to wind is 180 kN. Tractive force is 900 kN and breaking force is 600 kN. Design the rocker bearing and draw design sketch. **[15]**



Total No. of Questions : 8]

SEAT No. :

**P4587**

**[4760] - 430**

[Total No. of Pages :2

**M.E. (Chemical)**

**ADVANCED THERMODYNAMICS**

**(2008 Course) (Semester - I) (Elective - I) (509104)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Write in brief about probability and microstates. [8]  
b) What are internal energy levels? [8]
- Q2)** a) Give the statistical analog of Helmholtz energy. [10]  
b) Explain with example the use of Stirling's approximation in Thermodynamics. [8]
- Q3)** a) Explain the Fermi-Dirac principles. [8]  
b) State any one application of the physical models. [8]
- Q4)** a) Explain the Maxwell - Boltzmann statistics. [8]  
b) What is partition function? Give the relation between partition function and the Thermodynamic functions of ideal gases. [8]

*P.T.O.*

## SECTION - II

- Q5)** a) How are the translational properties of an ideal gas calculated? [8]  
b) What is the Seebeck effect? [8]
- Q6)** a) Give the Onsager Reciprocal Relation and explain it. [8]  
b) Explain the phenomena of heat transfer in open systems and compare it with closed systems. [8]
- Q7)** a) What is vibrational partition function? Derive the necessary equation. [9]  
b) Describe the Thomson effect. [9]
- Q8)** a) Explain the rigid rotor concept and how it is used. [10]  
b) Describe the statistical Thermodynamic terms like partition function, canonical ensemble, statistical weight factor micro-canonical ensemble with their significance. [6]



Total No. of Questions : 8]

SEAT No. :

**P4021**

**[4760] - 431**

[Total No. of Pages :1

**M.E. (Chemical)**

**COMPUTER AIDED DESIGN**

**(2008 Course) (509104) (Elective - I) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** Explain all the elements of computer system, in detail. **[16]**
- Q2)** What are the methods for properties estimation? Explain. **[16]**
- Q3)** Explain in detail, with flow chart, algorithm and computer aided design of distillation column. **[18]**
- Q4)** Write notes on: **[16]**
- a) Gibbs reactor.
  - b) Antonie equation.

**SECTION - II**

- Q5)** Explain spread sheets, and describe its role in process calculation with example. **[16]**
- Q6)** Explain dynamic simulation of CSTR with heating. **[18]**
- Q7)** Explain orthogonal collocation method with a example. **[16]**
- Q8)** Write short notes on: **[16]**
- a) ChemCad
  - b) Design flow chart for Adsorber.



Total No. of Questions : 8]

SEAT No. :

**P4707**

**[4760] - 432**

[Total No. of Pages :3

**M.E. (Chemical)**

**INDUSTRIAL POLLUTION CONTROL**

**(2008 Course) (509105) (Elective - II) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any THREE questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain the limitations of Gaussian plume model. **[6]**
- b) A 1000 MW power plant burns 10,000 metric tons of 1.5% sulphur coal per day. The flue gases are emitted into the atmosphere through a stack whose height is 200m. The diameter of the stack is 5 m. The velocity and the temperature of the plume at the exit are 10 m/s and 120°C respectively. What is the downwind SO<sub>2</sub> concentration in the plume centreline on the ground at a distance of 5 km on a thin over cast night when the environmental lapse rate is equal to zero? Assume that the ambient air temperature is 15°C and the wind speed at the stack altitude is 6 m/s. Atmosphere pressure = 1000 mb,  $\alpha = 0.28$ , A = 0.098, B = 0.373, P = 0.587. **[10]**
- Q2)** a) With neat sketches explain the mechanism of inertial impaction, direct interception and diffusion. **[8]**
- b) For a cyclone separator derive an equation for finding radial velocity of the gas at radius r. **[8]**

**P.T.O.**

- Q3) a)** Stack gas flows through an electrostatic precipitator at a rate of  $12\text{m}^3/\text{s}$ . The plate area is  $250\text{ m}^2$  and the drift velocity for the system has been found to be **[10]**

$$W = 2.8 \times 10^5 \text{ dp.}$$

Draw a size-efficiency curve for particles ranging in size from  $0.1$  to  $10\mu\text{m}$ .

- b)** Explain the various factors considered for selection of treatment process flow diagram. **[8]**

- Q4)** Explain in brief the pollution caused due to pulp and paper industry and discuss the various methods and equipments which can be used for controlling the same. **[16]**

### SECTION - II

- Q5) a)** Derive an expression for finding the concentration of microorganisms in the effluent in a complete mix reactor without recycle. **[9]**

- b)** A secondary clarifier is to be designed to produce and under flow concentration of  $35000\text{ mg/L}$  from influent with mixed liquor solids content of  $5000\text{ mg/L}$ . The wastewater flow rate is  $0.08\text{ m}^3/\text{s}$ . Calculate the required clarifier area. The following data are obtained from a settling test in a  $100\text{ cm}$  cylinder. **[9]**

|                      |     |    |    |    |    |    |    |    |    |    |    |
|----------------------|-----|----|----|----|----|----|----|----|----|----|----|
| Time, min            | 0   | 2  | 4  | 6  | 8  | 10 | 14 | 18 | 22 | 26 | 30 |
| Interface height, cm | 100 | 88 | 76 | 64 | 54 | 47 | 37 | 30 | 26 | 24 | 20 |

- Q6)** A completely mixed activated sludge plant is to treat  $10000\text{ m}^3/\text{day}$  of industrial Wastewater. The wastewater has a BOD of  $1200\text{ mg/L}$  that must be reduced to  $200\text{ mg/L}$  prior to discharge to a Municipal sewer. Pilot plant analysis indicates that a mean cell residence time of 5 days maintaining MLSS concentration of  $5000\text{ mg/L}$  produces the desired result. The value for  $Y$  is determined to be  $0.7\text{ kg/kg}$  and the value of  $k_d$  is found to be  $0.03\text{ d}^{-1}$ . **[16]**  
Determine:

- Volume of the reactor.
- The mass and volume of solids wasted each day.
- The sludge recycle ratio.

- Q7)** a) Explain various processing techniques used in solid waste management. **[8]**  
b) Discuss nuclear waste disposal. **[8]**
- Q8)** a) Explain in detail the methods of collection and transport of solid waste. **[8]**  
b) Write a note on gases and leaches in the land fill. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P4022**

[Total No. of Pages : 2

[4760] - 433

**M.E. (Chemical)**

**PROCESS OPTIMIZATION**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Solve any three questions from each section.*
- 2) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Minimize  $f(x) = 2x^3 + 3x^2 + x + (9/x^2)$ . Use (a) Newton Raphson Method. Write complete algorithm for the method and demonstrate at least 3 steps towards finding optimized solution for the above function. Do not try to solve it completely. **[17]**

**Q2)** Write stepwise procedure to formulate a maximization problem for the following reaction in a continuous reactor.

In the reaction of chlorination of benzene typical products formed are chlorine derivatives of benzene, eg. Monochlorobenzene (para, ortho, meta), dichlorobenzenes etc. In a reactor process conditions are to be optimized to produce meta chlorobenzene. **[17]**

**Q3)** Maximize  $f(x) = 25x + 2/x$  in the interval  $[-2, 3]$ . Use (a) Internal halving Method. Write complete algorithm for these methods and demonstrate at least 3 steps towards finding optimized solution for the above function. Do not try to solve it completely. **[17]**

**Q4)** Write short notes on (Any Three) **[16]**

- a) Parametric optimization
- b) Quadratic programming
- c) Multivariable Optimization
- d) Cubic Search Method

**P.T.O.**

## SECTION - II

**Q5)** Minimize  $f(x) = \frac{(x_1 - 3)^2}{4} + \frac{(x_2 - 4)^2}{9} - 4$  [17]

Subject to linear constraints  $x_1 \geq 0$ ,  $x_2 \geq 0$ ,  $8 - 2x_1 - 3x_2 \geq 0$ ,  $-3 + 4x_1 - 2x_2 \leq 0$

**Q6)** State various conditions of definiteness of a function using Hessian matrix and discuss. Find whether the following function is strictly convex/strictly concave.  $f(x) = 3x_1^2 + 4x_1x_2 + 13x_1 - 14x_2 - 60x_2^2 + 121$  [17]

**Q7)** Explain the Simplex Search Method and demonstrate for minimization of  $f(x) = 9x_1^2 + 6x_2^2 - 2$  starting at  $(x^0)^T = [2 \ 6]$  in the direction  $s^0 = [-1 \ -6]^T$ . Perform 4 steps. [17]

**Q8)** Write short notes (any three) [16]

- a) Sensitivity Analysis
- b) Optimization parameters
- c) Convexity of a function
- d) Constraints on objective function.



Total No. of Questions : 8]

SEAT No. :

**P4023**

**[4760] - 435**

[Total No. of Pages : 2

**M.E. (Chemical) (Semester - I)**  
**FLUIDIZATION ENGINEERING**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*

**SECTION - I**

- Q1)** a) Define fluidized state and regimization of fluidized state. Discuss the same. [8]
- b) What are the applications of fluidization system? [8]
- Q2)** a) Discuss Hydrodynamics of fluidization systems. [10]
- b) Discuss the operating model for fluidization system. [8]
- Q3)** Explain the following in details :
- a) Incipient fluidization. [8]
- b) Pressure fluidization. [8]
- Q4)** What are the different flow models? Discuss the generalized wake model and Davidson model. [16]

***P.T.O.***

## SECTION - II

**Q5)** Discuss the following in details and write all necessary equations :

- a) 2 phase & 3 phase inverse fluidized bed. [9]
- b) Immersed horizontal cylinder-to-bed heat transfer. [9]

**Q6)** Derive the kinetic model for conversion of shrinking and growing particle in fluidization. [16]

**Q7)** Write short notes on :

- a) Modeling by bed collapsing. [8]
- b) Geldart's classification for power assessment. [8]

**Q8)** Discuss the following in details and write all necessary equations :

- a) Liquid-solid mass transfer in fluidization. [8]
- b) Immersed vertical cylinder-to-bed heat transfer. [8]



Total No. of Questions : 8]

SEAT No. :

**P4024**

[Total No. of Pages : 2

[4760] - 436

M.E. (Chemical)

**PROCESS MODELING & SIMULATION**

**(2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

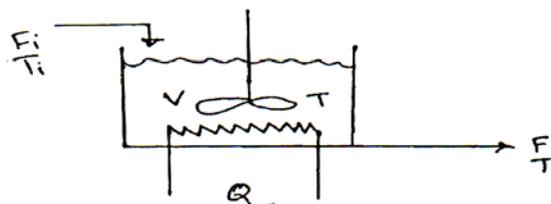
- 1) Answers to the two sections should be written in separate books.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Your answers will be valued as a whole.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed
- 6) Assume suitable data, if necessary.
- 7) Answer any Three Questions.

**SECTION - I**

**Q1) a)** Attempt the following: **[8]**

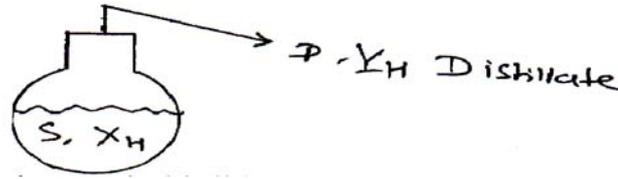
- i) What is process model?
  - ii) Why develop a process model?
  - iii) How to determine the form of a model, give the typical form of models?
  - iv) What is the difference between lumped parameter and distributed parameter systems, give examples of each.
- b) Assume that two chemical species A and B are in a solvent feed stream entering a liquid phase chemical reactor that is maintained at a constant pressure. The two species react irreversibly to form a third species, P. Develop a model to find out the reactor concentration of each species as a function of time. **[8]**

**Q2)** Consider a perfectly mixed stirred tank heater, with a single feed stream and a single product stream as shown below. Assuming that the flow rate and temperature of the inlet stream can vary, that the tank is perfectly insulated, and the rate of heat added per unit time ( $Q$ ) can vary, develop a model to find out the tank temperature as a function of time. State your assumptions. **[16]**



**P.T.O.**

- Q3)** The batch still shown in figure initially contains 25 moles of n-octane and moles of n heptane. If the still is operated at a constant pressure of 1 atmosphere, compute using Euler's method, the final mole fraction of n-heptane  $X_H'$  if the remaining solution in the still,  $S_f$  total 10 moles. [16]



Data : At 1 atmosphere pressure the relationship between  $X_H$  and the mole

$$Y_H = \frac{2.16X_H}{1 + 1.16X_H}$$

fraction of n-heptane in the vapour phase,  $Y_H$  is

- Q4)** The reaction  $3A \rightarrow 2B + C$  is carried out in an isothermal semibatch reactor. Product B is the derived product. Product C is very volatile by product that must be vented off to prevent a pressure buildup in a reactor. Gaseous C is vented off through a condenser to prevent any A & B to go out with C. Assume that from condenser only pure C is vented off. The reaction is first order. The relative volatilities of A and C to B are  $\alpha_{AB}$  and  $\alpha_{CB}$ . Assume perfect gases and constant pressure system. Write the equations describing the system. List all assumptions. [18]

### SECTION - II

- Q5)** What is Optimization? Explain the types of it with suitable examples. [16]
- Q6)** Develop the equations describing a batch distillation column during the startup period when no product is withdrawn and the column is coming to equilibrium conditions. Reflux drum and tray holdups are not negligible but can be assumed constant. [16]
- Q7)** a) State the law of mass action.  
 b) Give different uses of mathematical model.  
 c) What are limitations of mathematical models. Give examples. [16]
- Q8)** What is Process Simulation? Explain any one simulator with example. [18]



Total No. of Questions : 8]

SEAT No. :

**P4025**

[Total No. of Pages : 2

[4760] - 437

**M.E. (Chemical Engg)**

**ADVANCED TRANSPORT PHENOMENA**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from Section - I and three questions from Section - II.*
- 2) *Figures to the right indicate full marks.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of logarithmic tables slide rule, mollier charts, and electronic pocket calculator and steam tables is allowed.*

**SECTION - I**

- Q1)** a) Derive expression of momentum flux, velocity and discharge for flow of Newtonian fluid through the vertical cylinder. [10]  
b) Derive the equation of energy (spherical coordinates) [6]
- Q2)** a) Explain Newton's Law of Viscosity, Newtonian & Non-Newtonian fluids and Theory of Gases & Liquids. [8]  
b) Verify the relation:  $[\mathbf{u} \times [\mathbf{v} \times \mathbf{w}]] = \mathbf{V}(\mathbf{u} \cdot \mathbf{w}) - \mathbf{W}(\mathbf{u} \cdot \mathbf{v})$  [8]
- Q3)** a) Explain the term of the partial time derivatives, total time derivative and substantial time derivative? Express the equation of continuity, equation of motion and equation of mechanical energy in terms of substantial time derivative. [12]  
b) Write short note on the substantial time derivative. [6]
- Q4)** a) A semi-infinite body of liquid with constant density and viscosity is bounded by a horizontal surface (the xz—plane). Initially the fluid and the solid are at rest. Then at time  $t = 0$ , the solid surface is set in motion in the positive x direction with velocity  $v_0$ . Find the velocity  $v$  as function of  $y$  and  $t$ . There is no pressure gradient or gravity force in the x direction and the flow is presumed to a laminar. [12]  
b) Write short note on the time smooth temperature in turbulent flow with neat sketch [6]

**P.T.O.**

## SECTION - II

- Q5)** a) Compare turbulent thermal conductivity and turbulent viscosity as to definition, order of magnitude, and dependence on physical properties of nature of flow. [8]  
b) What are the semi-empirical expressions for the turbulent energy flux?[8]
- Q6)** a) Describe Ficks first and second laws? Explain under what circumstances they are applicable? [8]  
b) Discuss the equation of energy and equation of continuity for turbulent flow? [8]
- Q7)** a) Derive an expression for temperature distribution with more than one independent variables. [10]  
b) Discuss stream function and potential flow along with its significance?[6]
- Q8)** Write a note on (Any Three) [3 × 6 = 18]  
a) Momentum, heat and mass transfer analogies.  
b) Significance of Reynolds analogy  
c) Boundary layer theory  
d) Time smoothened equations



Total No. of Questions : 8]

SEAT No. :

**P4026**

**[4760] - 438**

[Total No. of Pages :2

**M.E. (Chemical)**

**ADVANCED PROCESS CONTROL  
(2008 Course) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question Nos. 04 and 08 are compulsory. Out of the remaining attempt two questions from Section I and two questions from Section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Draw block diagram of feedback control system and explain the procedure for control of the controlled variable at the set-point. [8]
- b) State the servo and regulator response transfer functions of a feedback control system. Derive the servo response of a first-order process with p-controller, (Assume  $G_m = G_f = 1$ ). [8]
- Q2)** a) Sketch feedback control strategy for controlling temperature inside the CSTR by manipulating flow of jacket fluid. [8]
- b) Sketch cascade control strategy for controlling temperature inside the CSTR using jacket fluid temperature as the secondary variable. [8]
- Q3)** a) Derive the input-output model of a  $2 \times 2$  MIMO system having inputs  $u_1(t)$ ,  $u_2(t)$  and outputs  $y_1(t)$ ,  $y_2(t)$ . [8]
- b) If the outputs  $y_1$ ,  $y_2$  of a  $2 \times 2$  MIMO system are controlled using two controllers having transfer functions  $G_{c1}$ ,  $G_{c2}$ , derive the servo response transfer functions for both the loops and explain interaction between the loops. [8]

**P.T.O.**

**Q4)** Write short notes on the following. **[18]**

- a) Ratio control
- b) Split range control
- c) Selective control systems

**SECTION - II**

**Q5) a)** A Stirred tank heater is used to heat liquid flowing through it using a steam coil. The tank is equipped with two control loops - one for controlling liquid level by manipulating the exit flow rate, and the other for controlling temperature of liquid in the tank by manipulating steam flow rate. Sketch the control system and explain the interaction between the loops. **[8]**

b) Explain the concept of RGA and its use for selection of loops formed by pairing input & output variables. **[8]**

**Q6) a)** What are model-based controllers? What are their advantages over classical feedback control system. **[8]**

b) Explain the direct synthesis approach for control. Derive the controller  $G_c$  for a plant  $G$ , such that the closed-loop response follows a first-order trajectory. **[8]**

**Q7) a)** Derive a DS-controller for a first-order process so that the closed-loop response will follow a first-order trajectory. **[8]**

b) Explain internal model control (IMC) system. Compare the performance of feedback control system & IMC. **[8]**

**Q8)** Write short notes on the following. **[18]**

- a) Model-predictive control system.
- b) Plantwide control systems
- c) ANN control systems.



Total No. of Questions : 8]

SEAT No. :

**P4027**

**[4760]- 439**

[Total No. of Pages :2

**M.E. (Chemical)**

**CATALYSIS AND SURFACE PHENOMENA**  
**( 2008 Course) (Elective-III) (509111) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer sheets.*
- 3) *Neat Diagrams should be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

**Q1)** Discuss the following reactions including their reactions and surface mechanisms on catalysts **[16]**

- a) Methanol synthesis
- b) Ammonia synthesis

**Q2)** Give the classification of catalysts and explain the preparation of catalysts using laboratory techniques and industrial methods. **[16]**

**Q3)** Describe the following methods of catalyst characterization. State the principles involved. **[18]**

- a) ESR
- b) UPS
- c) NMR

**Q4) a)** Explain different types of hysteresis loops. **[10]**

- b) What are the factors which should be considered while selection of support material for a catalyst? **[6]**

**P.T.O.**

## SECTION-II

- Q5)** Explain the difference between Eiley-Rideal and L-H models? What is the ideal occupancy theory? Derive an expression for rate of reaction  $A+B \leftrightarrow C+D$ , assuming surface reaction controls the rate of reaction. [16]
- Q6)** a) Derive an expression for the effectiveness factor of a cylindrical catalyst pellet sealed at both the ends in which first order reaction occurs. [12]  
b) Give the significance of Thiele modulus. [6]
- Q7)** a) What is the dynamic model for deactivation? Find the equation for the rate at which the core radius decreases. [12]  
b) Explain catalytic reforming. [4]
- Q8)** a) Explain the steady state deactivation model. [10]  
b) Write a note on dual function catalysts. [6]



Total No. of Questions : 6]

SEAT No. :

**P3756**

[Total No. of Pages : 2

[4760] - 44

**M.E. (Civil - Structures)**

**PLASTIC ANALYSIS & DESIGN OF STEEL STRUCTURES**

**(2008 Pattern) (Elective - II) (Semester - I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answer to the TWO Sections should be written in separate Answer books.*
- 3) *Neat sketches must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non-programmable calculator, IS: 800 - 2007 and steel table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Explain elasto-plastic behaviour of a beam in flexure and find expression for moment of resistance. **[10]**

b) Explain step by step how-plastic hinge in beam develops under progressive loading. Draw various stages with stress diagrams. Taking angle section for above illustration finds its shape factor. Flange  $100 \times 10$  mm, vertical leg  $100 \times 10$  mm, Total depth 120 mm,  $I_{zz} = 24.425 \times 10^5 \text{mm}^4$ . **[15]**

**Q2) a)** A Rectangular Portal frame ABCD is fixed at A & D. Columns AB & DC are 5m in height & beam BC is 6m long.  $M_p$  for beam is twice that for columns. It is subjected to factored udl of 30kN/m over BC & horizontal factored concentrated load of 50 kN at B in the direction BC. Sketch all possible mechanisms & obtain design moment  $M_p$ . Draw statically admissible bending moment diagram. **[13]**

b) Find value of W at collapse for the continuous beam shown in Fig. 2 (b) & Draw bending moment diagram. **[12]**

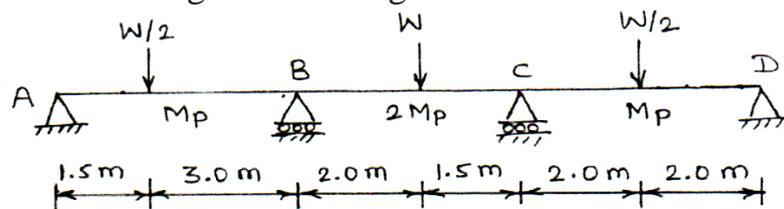


Fig. 2 (b)

**P.T.O.**

- Q3)** A symmetrical gable portal frame ABCDE has bases A & E fixed 16 m apart. Vertical columns AB & ED each equal to 5 m & apex C is 10 m above base. It is subjected to horizontal load 20 kN at B & concentrated load of 80 kN each at centre of each gable beam.  $M_p$  is uniform. [25]
- Draw all basic mechanisms and obtain  $M_p$  in each case.
  - Draw (sway + Gable) mechanism & obtain  $M_p$
  - Draw free body diagram of beam & column.

### SECTION - II

- Q4)** a) Classify symmetrical 'I' section having width of flange 400 mm & overall depth 500 mm. Thickness of section is 20 mm uniform.  $F_y = 280$  MPa. If this section is used as a beam, find moment of resistance as per IS: 800 - 2007 codal provisions. [12]
- b) A simply supported beam has a span 6 m. If section used is ISLB 350. Find moment of resistance of the section in following two cases. [13]
- Compression flange is laterally supported fully.
  - Compression flange is laterally restrained at both the ends and at Mid span only. Use  $F_y = 250$  MPa.

- Q5)** A column between floor of a multi storey building frame is subjected to load and moment as mentioned below, [25]
- Ultimate axial compression = 1200 kN  
 Ultimate moments about major axis:  
 At Top = 160 kN.m  
 At Bottom = 80 kN.m  
 The effective length of column is 5.0 m.  
 It is braced at its mid-height to provide local lateral restraint for buckling about y-y axis.  
 Design the section & use specifications for interaction between moment & axial compression.

- Q6)** In a rectangular portal frame, a corner connection is to be designed. Bending moment at knee is 220 kN.m. If designed section for beam & column both is ISMB 400. Design & Draw details at knee portion  $F_y = 280$  MPa. Apply all checks & provide diagonal stiffener if required any. [25]



Total No. of Questions : 8]

SEAT No. :

**P4588**

**[4760] - 440**

[Total No. of Pages :3

**M.E. (Chemical Engineering)**

**ADVANCED REACTION ENGINEERING**

**(2008 Pattern) (Semester - II) (Elective - III) (509111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any three questions from each section.*
- 2) *Figures to the right indicates full marks.*

**SECTION - I**

**Q1)** What is a rate limiting step? What is a diffusion controlled phenomenon? Give proper example with model equations involved? **[16]**

**Q2)** Find out the mechanism for oxidation of CO over a catalyst. **[16]**



All the rates are initial rates

|   |     |     |     |     |     |     |     |     |     |     |     |     |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $-\text{r}_{\text{CO}_2}$<br>(mol/dm <sup>3</sup> .sec) | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.8 | 1.9 | 3.4 | 4.1 | 5.1 | 3.1 |
|   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 0   | 1   | 2   |
| $C_{\text{CO}}$ (mol/dm <sup>3</sup> )                  | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.3 | 0.4 | 3.0 | 4.0 | 8   | 10  | 20  |
|   | 2   | 3   | 3   | 3   |     |     |     |     |     |     |     |     |
| $C_{\text{O}_2}$ (mol/dm <sup>3</sup> )                 | 0.5 | 2.5 | 4.5 | 7.5 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |

**Q3)** Give types of catalyst deactivation. Explain mechanism governing each type. For general gas phase catalytic reaction.

A  $\xrightarrow{k_1}$  B which is carried out isothermally in a batch reactor, the catalyst

**P.T.O.**

deactivation follows a first order decay law and is independent of the concentrations of both A & B.

Given:  $C_{Ao} = 1.5 \text{ mol/dm}^3$ ,  $V_o = 1.9 \text{ dm}^3$ ,  $W = 1.6 \text{ kg}$ ,  $k_d = 0.15 \text{ min}^{-1}$  at 270K ( $E_d/R = 2,500 \text{ K}$ ),  $k_1 = 0.25 \text{ dm}^3/(\text{kg cat. min})$  at 270 K ( $E_d/R = 700\text{K}$ ).

Write general equation for catalyst activity as a function of time. [16]

**Q4)** Write short note on any THREE. [18]

- a) Surface Reaction Rate
- b) Nonidealities in a tubular reactor
- c) Catalyst properties
- d) Dual site mechanism

### SECTION - II

**Q5)** What is RTD? Define function  $E(t)$ . Discuss use of  $E(t)$  in determining non idealities with proper example. [16]

**Q6)** Write segregation model for determining non idealities in a CSTR. The second order reaction.

$3A \rightarrow B+C$  occurs in the liquid phase. The RTD function for the reactor in which it is to be carried out is given by

- a)  $E(t) = 0$  for  $0 < t < 5$ ,
- b)  $E(t) = 0.01 * (t-5)$  for  $5 < t < 10$ ,
- c)  $E(t) = 0.01 * (20-t)$  for  $10 < t < 20$ ,
- d)  $E(t) = 0$  for  $t > 20$

The entering concentration is 5 molar and the specific reaction rate is  $0.08 \text{ dm}^3/\text{mol. sec}$ . What is the conversion after 20 sec in a batch reactor? [16]

**Q7)** From the first principle derive the equation in dimensionless form for the diffusion of reactant molecules through porous catalyst and surface catalytic reaction. **[16]**

**Q8)** Write short notes. (any three). **[18]**

- a) Weisz Prater factor
- b) Sintering Kinetics
- c) Effectiveness factor
- d) Thiele Modulus



Total No. of Questions : 8]

SEAT No. :

**P4028**

**[4760]-441**

[Total No. of Pages : 3

**M.E. (Chemical)**

**MATHEMATICAL METHODS IN CHEMICAL ENGINEERING**

**(2008 Course) (Semester-II) (Elective-III) (Theory) (509111)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** a) Prove the following expressions

$$(\boldsymbol{\tau} : \nabla) = (\nabla \cdot [\boldsymbol{\tau} \cdot \boldsymbol{v}]) - (\boldsymbol{v} \cdot [\nabla \cdot \boldsymbol{\tau}]). \quad [6]$$

b) Derive the expression for  $(\nabla \cdot \boldsymbol{v})$  and  $\nabla_{\boldsymbol{v}}$  in cylindrical coordinates. [12]

**Q2)** a) Use multiple equation Newton Raphson method to determine roots of following equations

$$x = y + x^2 - 0.5$$

$$y = x^2 - 5xy \quad [8]$$

b) Determine the solution of following nonlinear equations using fixed point iteration methods

$$x^2 + xy - 10 = 0$$

$$y + 3xy^2 - 57 = 0 \quad [8]$$

**P.T.O.**

**Q3) a)** Express the Laplace equation in polar, cylindrical and spherical coordinates. Write the significance of each term. [8]

b) Explain the significance of boundary conditions for solving partial differential equation and what are types of boundary conditions used for solving partial differential equations? [8]

**Q4) a)** Write short note on: [8]

i) Phase Portraits of multi-dimensional Linear Systems.

ii) Elementary Stability and Bifurcation Analysis.

b) Find the eigen values and eigen functions of

$$\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial x} + \lambda u = 0 \quad 0 < x < 1$$

subject to  $u(0) = u(1) = 0$ . [8]

### SECTION-II

**Q5) a)** Use the explicit method to solve for the temperature distribution of long, thin rod with a length of 10 cm based on the following data

$K = 0.835 \text{ cm}^2/\text{s}$ ,  $\Delta x = 2 \text{ cm}$ ,  $\lambda = 0.020875$  and  $\Delta t = 0.1 \text{ s}$ .

At  $t = 0$  the temperature of the rod is zero and boundary conditions are fixed for all times at  $T(0) = 100^\circ\text{C}$  and  $T(10) = 50^\circ\text{C}$ . Solve for three iterations. [12]

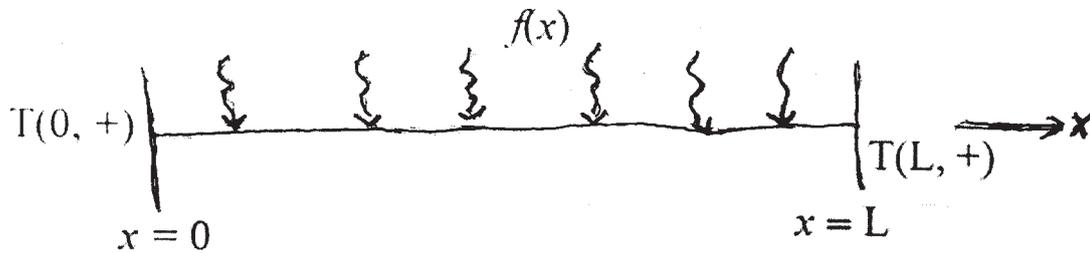
b) Derive formula for explicit method of finite differences using Laplace equation. [6]

**Q6) a)** Differentiate between regular and singular perturbation. [6]

b) Explain the multiple scale and homogenization methods for perturbations. [6]

c) Write short note on Lattice method for perturbations. [4]

**Q7)** Use direct approach finite element method to generate matrix equation that describe the behavior of rod shown in following figure. The rod is made of 10 cm length with boundary conditions of  $T(0, +) = 40$  and  $T(L, +) = 200$  and uniform heat source of  $f(x) = 10$ . The equation for the same is  $d^2T/dx^2 = -10$ . [16]



**Q8) a)** Write note on grid formation in finite element method. [8]

b) Write note on FEMLAB. [8]



Total No. of Questions : 12]

SEAT No. :

**P4029**

**[4760] - 442**

[Total No. of Pages :3

**M.E.(Chemical)**

**BIOPROCESS ENGINEERING**

**( 2008 Course) (Elective - III) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Answers to the two sections should be written in separate Answer books.*

**SECTION - I**

- Q1)** a) Explain the effect of pH and temperature on the enzyme activity? [8]
- b) Discuss the model used for insoluble substrate and immobilized enzyme systems? [8]

OR

- Q2)** Derive the equation for diffusional mechanisms and mention the limitations in immobilized enzyme systems? [16]

- Q3)** a) Explain the concept of the central dogma for the flow of genetic information within a biological system? [8]
- b) State and explain in detail about the process of Transcription? [8]

OR

- Q4)** a) Write down the mechanisms to transport small molecules across cellular membranes? [8]
- b) State and explain the translation and posttranslational processing? [8]

***P.T.O.***

- Q5) a)** What is the Pasteur effect? Explain in terms of regulation of metabolic flow into a pathway? [9]
- b) Explain the details of Glucose Metabolism in terms of Glycolysis and the TCA Cycle? [9]

OR

- Q6) a)** Discuss the autotrophic metabolism for the case of photoautotrophic growth? [9]
- b) What are the major steps in aerobic metabolism of hydrocarbons? What are the end products? [9]

### SECTION - II

- Q7) a)** What are the scale-up challenges for solid state fermentation Bioreactors? [8]
- b) Explain in detail about Chemostat Cascade and Chemostat with recycle? [8]

OR

- Q8) a)** Discuss the concept of Fed-batch operation in bioreactors? [8]
- b) Write down the different methods used for passive immobilization of cells? [8]

- Q9) a)** A plasmid-containing strain of *E. coli* is used to produce recombinant protein in a 250 litre fermenter. The probability of plasmid loss per generation is 0.005. The specific growth rate of plasmid-free cells is  $1.4 \text{ h}^{-1}$ ; the specific growth-rate of plasmid-bearing cells is  $1.2 \text{ h}^{-1}$ . Estimate the fraction of plasmid-bearing cells after 18 h growth if the inoculum contains only cells with plasmid. [8]
- b) Explain in detail about diffusion and reaction in waste treatment lagoon? [8]

OR

- Q10) a)** *Serratia marcescens* is cultured in minimal medium in a small stirred fermenter. Oxygen consumption is measured at a cell concentration of 22.7 g/lit dry weight.

| Time<br>(min) | Oxygen conc.<br>(m mol/lit) |
|---------------|-----------------------------|
| 0             | 0.25                        |
| 2             | 0.23                        |
| 5             | 0.21                        |
| 8             | 0.20                        |
| 10            | 0.18                        |
| 12            | 0.16                        |
| 15            | 0.15                        |

- i) Determine the rate constant for oxygen uptake.
- ii) If the cell concentration is reduced to 12 g/lit, what is the value of the rate constant? [8]
- b) A bacterial fermentation was carried out in a reactor containing broth with average density  $1200 \text{ kg/m}^3$  and viscosity  $0.02 \text{ Ns/m}^2$ . The broth was agitated at 90 rpm and air was introduced through the sparger at a flow rate of 0.4 vvm. The fermenter was equipped with two sets of flat blade turbine impellers and four baffles. The dimensions of vessel, impellers and baffle width were:  
 tank diameter,  $D_t=4\text{m}$ ; impeller diameter,  $D_i=2\text{m}$ ; baffle width  $W_b=0.4\text{m}$ ; also the liquid depth was  $H=6.5\text{m}$ . Determine: (i) ungasged power,  $P$ ; (ii) gassed power,  $P_g$ ; (iii)  $K_L a$ ; (iv) gas hold-up. [8]

- Q11)** a) Explain the steps and procedure involved in design and modeling of activated sludge process? [9]
- b) Derive the equation for volume calculation of the sludge tank in activated sludge process? [9]

OR

- Q12)** Write short notes on [18]
- Modeling of anaerobic digester
  - Phosphate removal bioprocess
  - Microbial participation in natural cycle of matter
  - Anaerobic denitrification



Total No. of Questions : 8]

SEAT No. :

P4030

[Total No. of Pages : 2

[4760] - 443

**M.E. (Chemical Engineering)**

**OPEN ELECTIVE - CATALYSIS AND SURFACE PHENOMENA**

**(2008 Pattern) (Semester - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from section I and any three questions from section II.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with example catalyst activation. [6]  
b) Write about importance of pore size distribution in catalyst. [6]  
c) What is the role of promoter and inhibitor in a catalytic process?  
Give examples. [6]
- Q2)** a) Give a method of preparation of catalyst on an industrial scale. [8]  
b) Explain LHHW model.. [8]
- Q3)** a) Explain in detail how a rate determining step found. [8]  
b) Explain random pore model. [8]
- Q4)** a) Describe a method for determining the surface area of a catalyst. [8]  
b) Describe any two methods of catalyst characterization. [8]

**P.T.O.**

## SECTION - II

- Q5)** a) Derive the effectiveness factor for a cylindrical catalyst pellet. [10]  
b) Explain in detail the difference between catalyst poisoning and deactivation. [8]
- Q6)** a) Explain any one model for catalyst deactivation in detail. [8]  
b) How is catalyst regeneration carried out? [8]
- Q7)** a) What are spinels? Write about their catalytic activity in detail. [8]  
b) Explain the ammonia synthesis process in detail. [8]
- Q8)** a) Explain the effect of internal transport on catalyst selectivity. [8]  
b) Explain the phenomenon of catalyst sintering. [8]

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4589**

**[4760] - 444**

[Total No. of Pages :2

**M.E. (Chemical)**

**PROCESS OPTIMIZATION**

**(2008 Pattern) (Semester - II) (Open Elective - IV) (Theory) (509112)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Minimize  $f(x) = x^2 + (3/(1+x))$ . Use Newton Raphson Method. Write complete algorithm for this method and demonstrate at least 3 steps towards finding optimized solution for the above function. Do not try to solve it completely. **[17]**

**Q2)** Minimize  $f(x) = x^2 + (2/x) + (1/x^3)$ . Use **[17]**  
a) Fibonacci Search Method,  
b) Secant Method.

Write complete algorithm for these methods and demonstrate at least 3 steps towards finding optimized solution for the above function. Do not try to solve it completely.

**Q3)** A typical plug flow reactor is an example of a set of ordinary and partial differential equations. The typical constraints on such a problem are of physical type based on dimensions of units, of system type based on the physicochemical considerations. Considering above, construct a problem around a plug flow reactor and identify the objective function, constraints. Also discuss the strategy to get optimized solution out of it. **[16]**

**P.T.O.**

**Q4)** Write short notes (Any three). **[16]**

- a) Constrained optimization
- b) Linear constraints
- c) Fundamentals in Gradient based methods
- d) Concave function

**SECTION - II**

**Q5)** Minimize  $f(x) = (x_1 - 2)^2 + x_2^2$

Subject to linear constraint s

$$x_1 \geq 0, x_2 \geq (-10), 7 - 2x_1 - x_2 \geq 0, 24 - 3x_1 - 2x_2 \leq 0. \quad [17]$$

**Q6)** Explain the Simplex Search Method and demonstrate for minimization of

$$f(x) = 2x_1^2 + 5x_2^2 - 9 \text{ starting at } (x^0)^T = [4 \ 3] \text{ in the direction } s^0 = [-1 \ -3]^T.$$

Perform 4 steps. **[17]**

**Q7)** State various conditions of definiteness of a function using Hessian matrix. Find whether the following function is strictly convex/strictly concave.

$$f(x) = 2x_1^2 + 5x_1x_2 + 12x_1 + 13x_2 - 4x_2^2 + 9. \quad [16]$$

**Q8)** Write short notes (Any three). **[16]**

- a) Degree of Freedom
- b) Objective function
- c) Langrange's Multipliers
- d) Grad Function



Total No. of Questions : 8]

SEAT No. :

P4031

[Total No. of Pages : 2

[4760]-445

M.E. (Chemical)

FUEL CELL TECHNOLOGY

(2008 Pattern) (Elective)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Solve any three questions from each section.
- 2) Figures to the right indicate full marks.

**SECTION - I**

**Q1)** Derive Tafel equation used to predict current generated in a fuel cell. [17]

**Q2)** For diffusion controlled unidirectional process the current generated in a fuel cell is calculated using Cottrell equation. Using Cottrell equation find out the variation of the current in the external circuit with time for following cell. Given ::  $n = 2$ ,  $D_{AB} = 8.9 \times 10^{-5} \text{ cm}^2/\text{sec}$ ,  $A = \text{Cross Sectional area} = 0.4 \text{ cm}^2$ ,  $\delta = \text{Film thickness} = 20 \mu\text{m}$ . [17]

**Q3)** Compare hydrogen & oxygen based fuel cell and solid oxide fuel cell. Describe the construction and working of any one of them. [17]

**Q4)** Write short notes on any three. [16]

- a) Military Applications of fuel cells.
- b) Ohmic Polarization.
- c) Tafel plot.
- d) Application of Fick's Law in Electrochemistry.

**P.T.O.**

## SECTION - II

- Q5)** Describe improvements in the fuel cell performance of present day solid oxide fuel cell. **[17]**
- Q6)** Explain in detail the principle on which a fuel cell is designed. Give details of general electrode reactions and emf generated in such a cell. **[17]**
- Q7)** What are various applications of fuel cells? Which fuel cells are being used in the transportation industry? **[17]**
- Q8)** Write short notes on any three. **[16]**
- a) Anodic reactions.
  - b) Half Cell Potential.
  - c) Nernst equations.
  - d) Faraday's Law.

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4032**

[Total No. of Pages : 2

**[4760] - 446**

**M.E. (Environmental Engg.) (Chemical)**

**APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers any 3 questions.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Explain probable error of a correlation coefficient. **[8]**

- b) For a group of 200 items, the mean and standard deviation of scores were found to be 40 and 15 respectively. Later on it was discovered that the scores 43 and 35 were Misread as 34 and 53 respectively.

Find the corrected mean and standard deviation corresponding to corrected figures. **[8]**

**Q2) a)** A random sample of size  $n = 100$  is taken from a population with  $\sigma = 5.1$ . Given that the sample mean is  $\bar{x} = 21.6$ , construct a 95% confidence interval for a population mean  $\mu$ . **[8]**

- b) Comment on factorial experimentation with suitable example. **[8]**

**Q3) a)** Explain convexity of the frequency curve related to kurtosis. **[8]**

- b) Discuss relation between moments about mean in terms of moments about any point. **[8]**

**Q4)** Prove that F distribution is unimodal at the value  $\left(\frac{V_1-2}{V_1}\right)\left(\frac{V_2}{V_2+2}\right)$  if  $V_1 > 2$ . **[18]**

**P.T.O.**

**SECTION - II**

**Q5)** a) Elaborate model equation for latin square design. [8]

b) Explain graphical procedure for sequential sample. [8]

**Q6)** a) State and explain the assumptions in the analysis of variance. [8]

b) What is the analysis of variance in two way classification model. [8]

**Q7)** Write short notes on : [18]

a) Transportation algorithm

b) Optimality test

c) Degeneracy in transportation problem

**Q8)** a) Find the optimal assignment of four jobs and four machines when the cost of assignment is given by the following table. [8]

|    |    |   |   |   |
|----|----|---|---|---|
| M1 | 10 | 9 | 8 | 7 |
| M2 | 3  | 4 | 5 | 6 |
| M3 | 2  | 1 | 1 | 2 |
| M4 | 4  | 3 | 5 | 6 |

b) What are the three basic steps in constructing a linear programming model. [8]



Total No. of Questions : 8]

SEAT No. :

**P4033**

[Total No. of Pages : 2

**[4760] - 447**  
**M.E. (Chemical)**  
**ENVIRONMENTAL GEOSCIENCES**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section .*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Describe the Earth system and Biosphere. **[16]**

**Q2)** Explain energy budget of the earth. **[16]**

**Q3)** Explain concept of radiation balance & energy balance in atmosphere. **[16]**

**Q4)** Write short notes on : **[18]**

- a) Catastrophic Geological Hazards.
- b) EL-Nino effect.

**SECTION - II**

**Q5)** What is remote sensing? Explain the principles of remote sensing. **[16]**

**Q6)** Explain chemistry of Acid mine Drainage & effects. **[16]**

**P.T.O.**

- Q7)** a) Discuss the classification of trace element? [16]  
b) What are the effects of trace elements? [16]
- Q8)** Write Notes on : [18]  
a) Geochemical cycle.  
b) Application of GIS in Environmental Management.

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Total No. of Questions : 8]

SEAT No. :

**P4044**

**[4760] - 448**

[Total No. of Pages :2

**M.E. (Chemical)**

**ENVIRONMENTAL CHEMISTRY**

**(2008 Pattern) (Semester - I) (509133)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) What is Environmental chemistry?

b) Discuss the importance of it.

**[16]**

**Q2)** a) What are the unusual physical properties of water?

b) Write in short about biosynthesis of DNA & RNA.

**[18]**

**Q3)** Describe the constituents and properties of soils in detail.

**[16]**

**Q4)** a) Give the classification of pesticides.

b) What are the environmental effects of Pesticides.

**[16]**

**P.T.O.**

## SECTION - II

**Q5)** Draw a neat sketch and explain the construction, principle and working of Atomic Absorption spectroscopy. **[16]**

**Q6)** Define following explain the procedure to determine it. **[18]**

- a) TDS
- b) COD
- c) TOC
- d) pH

**Q7)** Give the estimation procedure of heavy metal-copper from industrial waste water. **[16]**

**Q8)** Write short notes on: **[16]**

- a) Polarography
- b) Ion Exchange Chromatography.



Total No. of Questions : 8]

SEAT No. :

**P4364**

**[4760] - 449**

[Total No. of Pages :2

**M.E. (Environmental Engineering)**  
**MODELING OF ENVIRONMENTAL SYSTEMS**  
**(2008 Course) (Semester - I) (Elective - I) (509134)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Explain models of Environmental systems with suitable examples. **[16]**

**Q2)** a) What is sensitivity analysis. **[8]**

b) Explain how numerical methods are useful in modeling of environmental systems. **[8]**

**Q3)** a) What is air pollution metrology. **[8]**

b) Explain atmospheric turbulence. **[8]**

**Q4)** a) Explain Gaussian Plume model. **[9]**

b) Explain types of reactions and order of reactions. **[9]**

**P.T.O.**

## SECTION -II

- Q5)** a) How air quality models are useful in Environmental systems. [8]  
b) Explain how models are helpful in relation to climate change. [8]

**Q6)** Explain in detail the assumption or facts which are considered for modeling of river as a Environmental system. [16]

- Q7)** a) Explain Dissolved Oxygen models. [8]  
b) Explain temperature models. [8]

- Q8)** Write short note on. [18]  
a) Estuarine  
b) Prediction of fate organism and toxic substances  
c) Models for management applications.



Total No. of Questions : 6]

SEAT No. :

**P4556**

**[4760] - 45**

[Total No. of Pages :2

**M.E. (Civil - Structure)**

**DESIGN OF INDUSTRIAL STEEL STRUCTURES**

**(2008 Course) (Semester - I) (Elective - II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any two questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of cell phone is prohibited in the examination hall.*
- 7) *Use of electronic pocket calculator, latest IS codes and steel table is allowed.*

**SECTION - I**

**Q1)** The span of knee braced roof trusses over an industrial building 28 m long is 18 m. The spacing of roof trusses is 4 m. The pitch of roof truss is 1 in 4. The galvanized corrugated iron sheet is used for roof covering. The basic wind pressure is 1.5 kN/m<sup>2</sup> and there is no snow fall. The height of eaves above ground level is 8.0 m. Propose a suitable type of roof truss. Determine the load at the various panel points due to dead load, live load and wind load. Also determine the reactions. **[25]**

**Q2)** Analysis the columns of an industrial building given in Question No. 1 for following conditions and find maximum bending moment. **[25]**

- a) Columns hinged at the base.
- b) Columns fixed at the base.
- c) Columns partially fixed at the base.

**Q3) a)** Explain in details design of bracket supporting gantry loads. **[10]**

- b) Explain in details analysis and design of gable portal frame with and without gantry loads with usual notation. **[15]**

**P.T.O.**

## SECTION - II

- Q4)** a) State and explain design steps of machine foundation with suitable expression. **[10]**
- b) Design an open web or castellated beam for a span of 14 m. The dead load coming on roof is 4.0 kN/m and live load is 5.0 kN/m. Cut the selected I - section at 45° and adjust section such that overall depth of section should not exceed 900 mm. Assume  $f_y = 250 \text{ N/mm}^2$ . **[15]**
- Q5)** a) Explain in brief the forces acting on mobile gantry girder with suitable sketch. **[10]**
- b) Explain design procedure bracing systems in an industrial shed structure in transverse and longitudinal plane. **[15]**
- Q6)** a) State the functional aspect of various bracing systems in an industrial shed structure. **[5]**
- b) Design a trussed purlin to carry a uniformly distributed load 20 kN/m over a simply supported span of 15 m. Use double angles for chord and single angle for web members. Select suitable geometry for truss purlin and draw its cross section of the members. **[20]**



Total No. of Questions : 8]

SEAT No. :

**P4365**

**[4760] - 450**

[Total No. of Pages :3

**M.E. (Chemical) (Environmental Engg.)**

**GROUND WATER CONTAMINATION & POLLUTION TRANSPORT**

**(2008 Course) (Semester - I) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

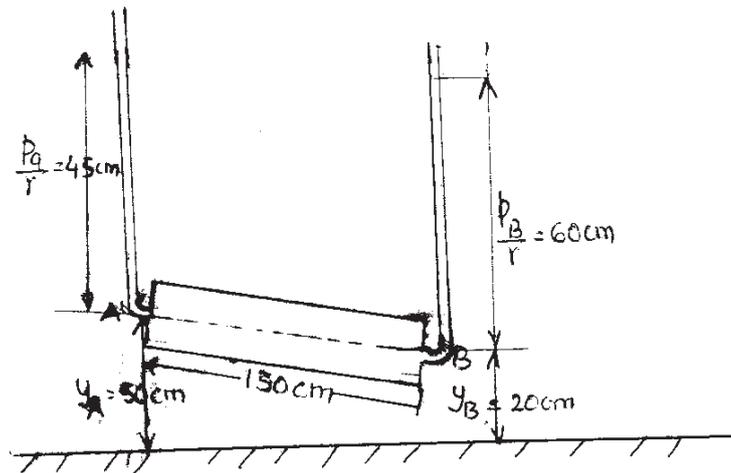
*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain Mechanism of Groundwater contamination & what are the factor affecting groundwater contamination. [6]
- b) Surface water sources are more prone to contamination than groundwater, explain. [6]
- c) What is hydrologic cycle & explain formation of groundwater from hydrologic cycle. [6]
- Q2)** a) Explain the relation between groundwater quality and its movement through soil & rock leading to different types of pollution. [8]
- b) Define steady & transient flow condition with example and what are the factor that affect hydraulic conductivity of soil. [4]
- c) Flow-occurs from A to B as shown in fig.1. A dye injected at A moves along AB. If the strate had an average hydraulic conductivity of  $8.64 \times 10^2$  m/d, find the hydraulic gradient between A & B, & also the time taken by dye to move from A to B. [4]

**P.T.O.**



- Q3)** a) Explain the effect of compressibility on soil consolidation & movement of groundwater & contaminants. [6]
- b) What is storage coefficient, specific yield & their utility in groundwater analysis. [6]
- c) Develop the relation between Permeability & transmissivity. [4]
- Q4)** a) What are aquifer parameters & explain the necessity of aquifer test to determine aquifer parameter. What are the different methods of aquifer test? [8]
- b) Explain any 2 of the following. [8]
- i) Construction of flow net & its utility & any one method of construction of flownet.
  - ii) Radionuclides in ground water.
  - iii) Regional groundwater & its advantages

### SECTION -II

- Q5)** a) What is advection & its role in solute transport? With neat diagram of plume of contamination, explain the movement of contaminant through aquifer. [8]
- b) What are environmental isotopes & commonly occurring environmental isotopes? Explain the utility of radio isotope in groundwater contamination study. [6]
- c) Discuss the phenomenon of dispersion in fractured rock. [4]

- Q6)** a) What is leaching? Explain leaching efficiency, leaching requirement, & leaching fraction. [8]
- b) Explain the development of “interface” with the help of Ghyben-Herzberg curve. What are limiting condition for sea-water intrusion. [8]
- Q7)** a) What is the necessity of model studies in Groundwater pollution studies? Explain finite difference method for study of pollution migration. [8]
- b) Explain solute transport phenomenon in homogeneous & heterogenous flow medium. [8]
- Q8)** a) What are the different methods of land disposal of solid & explain any one method in detail. [8]
- b) Answer any two of the following. [8]
- i) Artificial Recharge by shaft & Recharge pit
  - ii) Geochemical cycle of groundwater
  - iii) Advantages & practical disadvantage of model studies.



Total No. of Questions : 8]

SEAT No. :

**P4045**

**[4760]-452**

[Total No. of Pages : 2

**M.E.(Chemical) (Environmental)  
AIR AND NOISE POLLUTION CONTROL  
(509134) (2008 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary*

**SECTION-I**

**Q1)** Discuss the Gaussian dispersion model for pollutants. Explain assumptions & limitations of this model. write the formula for estimation of ground level concentration **[18]**

**Q2)** a) Explain the effects of air pollution on vegetation. Discuss the mechanism of there effects. Write the natural factors which aggravate these effects.  
b) Discuss the sampling and monitoring techniques of air pollution. Gives the effects of air pollution. **[16]**

**Q3)** Explain the principle, working and design of the fabric filter with neat figure. **[16]**

**Q4)** Write short notes on: **[16]**  
a) Control of NO<sub>x</sub>.  
b) Photochemical smog formation.

**P.T.O.**

## SECTION-II

- Q5)** a) Explain the estimation of plume rise considering buoyancy & momentum components.  
b) With a neat sketch, explain importance of isokinetic sampling.

**[16]**

- Q6)** a) What is the difference between sound pressure and sound level?  
b) The sound power from a voice shouting is 0.001 W. What is the sound Power level? What are the sound intensity, the sound intensity level, the sound pressure and the sound pressure level at a distance 6m from the source.

**[18]**

- Q7)** a) What is air quality Assessment?  
b) With respect to vehicular pollution, explain, types of pollutants generated, Air/Fuel ratio and control measures.

**[16]**

- Q8)** Write notes on: **[16]**  
a) Air pollution laws.  
b) Air pollution status in India.



Total No. of Questions : 8]

SEAT No. :

**P4046**

[Total No. of Pages : 2

**[4760] - 453**

**M.E. (Chemical) (Environmental Engg.)**

**MEMBRANE TECHNOLOGY IN ENVIRONMENTAL ENGG.**

**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) Answer any three questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain conventional filtration and membrane filtration process. How Membrane separation processes are classified? [6]
- b) Explain Industrial applications of membrane processes. [6]
- c) Discuss essential features of membrane process. [6]
- Q2)** a) Explain controlling factors for the selection of polymers for the membrane preparation. [8]
- b) Explain phase inversion process on a ternary diagram. [8]
- Q3)** a) Explain how performance of a membrane is determined? [8]
- b) Explain classification of separation processes with suitable examples. [4]
- c) Explain the use of non porous membranes. [4]

***P.T.O.***

**Q4)** Write short notes on the following : **[16]**

- a) Surface properties of membranes.
- b) Necessity of modules.
- c) Charged membranes.
- d) Polymer coating process.

**SECTION - II**

**Q5)** a) Explain Symmetric and Asymmetric membranes. How interfacial polymerization is used for the preparation of composite membrane? **[6]**

- b) Explain Sol-Gel Process for inorganic composite membrane. **[6]**
- c) Explain dead-end operation and cross flow operation. What is a 'tapered design' of modules in system? **[6]**

**Q6)** a) Explain how demixing time controls the membrane morphology. **[6]**

- b) Define a phase and explain the preparation of glass membrane by phase separation. **[5]**
- c) Various methods used for membrane preparation. **[5]**

**Q7)** a) Explain the crystallization, gelation and vitrification process for the polymer membranes. **[8]**

- b) Which are the driving forces are used in membrane processes? Explain with suitable Examples. **[8]**

**Q8)** Write short notes on the following : **[16]**

- a) Osmosis and reverse osmosis.
- b) Membrane reactors.
- c) Liquid membranes.
- d) Purification of Sea water.



Total No. of Questions : 8]

SEAT No. :

**P4047**

[Total No. of Pages : 2

**[4760] - 454**

**M.E. (Environmental Engg.)**

**ENVIRONMENTAL AUDITING AND EMS (Elective - II)**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Discuss the aspects of effective auditing in detail and what are the outcomes of Environmental auditing with respect to Environmental Management. [16]

**Q2)** a) What are the different types of Environmental audit? [8]

b) Explain Data Sampling inspections. [8]

**Q3)** a) What is Life Cycle approach in auditing. [8]

b) State and explain the benefits of environmental management system. [8]

**Q4)** Write short notes on [18]

a) Pre -visit data collection

b) ISO Principle for Environmental audit

c) Audit Protocol

**P.T.O.**

## SECTION - II

- Q5)** a) What are the elements of successful Environmental management. [8]  
b) Explain the contents of audit report and favourable action plan for environmental auditing. [8]
- Q6)** Explain in detail the process of implementation of environmental management system. [16]
- Q7)** a) Discuss measurement and evaluations required for environmental management system. [8]  
b) Discuss various legal and regulatory concerns of environmental auditing. [8]
- Q8)** Write short note on [18]  
a) Integrating ISO 9000 and ISO 14000  
b) Onsite audit  
c) Objectives of audit



Total No. of Questions : 8]

SEAT No. :

**P4048**

[Total No. of Pages : 2

[4760] - 455

**M.E. (Environmental Engg.-Chemical Engg.) (Semester - I)**  
**AGRICULTURAL POLLUTION AND CONTROL (Elective - II)**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Figures to the right indicate full marks.*
- 2) *Use of programmable calculator is not allowed.*
- 3) *Draw a neat sketch wherever necessary.*
- 4) *Make necessary assumptions where required.*
- 5) *Answer any three questions from section - I and any three questions from section -II.*

**SECTION - I**

**Q1)** Explain in details from the following : **[16]**

- a) Conservation of fertilizers
- b) Recycle and Reuse of Agricultural Waste

**Q2)** a) Explain with neat sketch the biotrickling filter for air pollution control. **[8]**

- b) Bioremediation is a better mode of treatment for agricultural pollution. Comment on this statement. **[8]**

**Q3)** a) Explain the mechanism, advantages and disadvantages of root zone treatment with a neat sketch. **[9]**

- b) What is the procedure, advantages and disadvantages of bioremediation of soil? **[9]**

**Q4)** a) Write notes on Agro meteorology **[9]**

- b) Explain various soil conservation techniques. **[9]**

**P.T.O.**

## SECTION - II

- Q5)** a) Comment on appropriate management plan for curbing agricultural pollution with reference to North Maharashtra. [9]
- b) What are the remedial measures to rejuvenate water logged area? [9]
- Q6)** a) Give in tabular form water requirements and favorable climatological conditions for any 8 crops. [9]
- b) Draw and explain treatment flow sheet for dairy waste. [9]
- Q7)** a) Explain how crop rotation and fertilizer requirement are interlinked. [8]
- b) Understanding virtual water will help of understand crop suitability in an area. Explain in detail. [8]
- Q8)** a) Explain in detail anaerobic digestion. Explain its importance to agricultural area. [8]
- b) Explain suitability of vermin-composting for agricultural area. [8]



Total No. of Questions : 8]

SEAT No. :

**P4367**

[Total No. of Pages :2

**[4760]-457**

**M.E. (Chemical) (Environmental Engineering  
WASTEWATER TREATMENT AND DESIGN  
(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Illustrate your answers with suitable examples and diagrams, wherever necessary.*
- 6) *Assume suitable data, if necessary.*
- 7) *Write correct question number before writing the answer.*

**SECTION - I**

- Q1)** a) What are the ideal and non-ideal reactors? Explain the significance of residence time distribution for differentiating the reactors. [8]  
b) Explain the two film theory of mass transfer. [8]
- Q2)** a) What are the colloidal suspensions? Explain the mechanism of coagulation for suspension destabilization. [8]  
b) Brief the purpose of mixing in wastewater treatment. [8]
- Q3)** a) What is the significance of slow and rapid mixer in wastewater treatment? Differentiate between slow and rapid mixing in wastewater treatment.[9]  
b) Explain the different types of settling of particles. [9]
- Q4)** Write short notes on:  
a) Flocculation. [4]  
b) Settling velocity. [4]  
c) Dual media filters. [4]  
d) High rate clarification. [4]

***P.T.O.***

**SECTION - II**

- Q5)** a) Explain the development of mass transfer zone in the adsorption column. [8]  
b) Describe the different criteria for the selection of adsorbents. [8]
- Q6)** a) Which are the different biological treatment technologies used for wastewater treatment? Explain the conventional activated sludge process for wastewater treatment. [10]  
b) Describe the functioning of up flow anaerobic sludge blanket reactor for wastewater treatment. [8]
- Q7)** a) Differentiate between suspended and attached growth biological process for wastewater treatment. [8]  
b) What are the characteristics of an ideal disinfectant? [8]
- Q8)** Write short notes on:
- a) Adsorption isotherms. [4]  
b) Membrane Bioreactor. [4]  
c) Disinfection [4]  
d) Ion exchange softener. [4]



Total No. of Questions : 8]

SEAT No. :

P4711

[Total No. of Pages : 2

[4760] - 458

M.E. (Chemical) (Environmental Engineering)

SOLID WASTE MANAGEMENT

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 100

*Instructions to the candidates:*

- 1) *Attempt any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) What are the objectives of solid waste management and discuss the Environmental impact of solid waste mismanagement. [8]

b) Explain the hierarchy of integrated solid waste management. [8]

**Q2)** a) What are the means and methods for transportation of solid waste? [8]

b) Discuss the Economic Analysis of Solid waste. [8]

**Q3)** Discuss the following in details : [18]

a) Recovery of metals from solid waste.

b) Guidelines for sorting of material and recovery.

**Q4)** Explain the principle, construction and design details of the following with neat diagrams; [16]

a) Vermicomposting.

b) Energy recovery from solid waste.

**SECTION - II**

**Q5)** a) Define landfill. What are the types of landfills? Explain the Site selection and essential Components of landfilling. [10]

b) Discuss the modified landfill design for sustainable waste management.[6]

**P.T.O.**

**Q6)** What are the various elements of financial management plan for solid waste system. **[16]**

**Q7) a)** For solid waste disposal site, the avg. - speed data obtained is;

|                            |      |     |      |      |      |      |
|----------------------------|------|-----|------|------|------|------|
| Distance<br>X,km/trip      | 9    | 12  | 15   | 18   | 21   | 24   |
| Avg.Haul speed,<br>Y,km/hr | 12   | 16  | 20   | 24   | 28   | 32   |
| Total Time, hr.            | 0.75 | 0.8 | 0.83 | 0.85 | 0.87 | 0.89 |

Find the haul speed constants “a” and “b” and the total time for site located at 15 km away. **[12]**

b) Give the expression for the Hauled Container System. **[6]**

**Q8)** Write notes on : **[16]**

- a) Measures to improve system for different functional elements of solid waste management.
- b) Fluidized bed combustion.



Total No. of Questions : 8]

SEAT No. :

**P4049**

**[4760] - 459**

[Total No. of Pages :2

**M.E. (Chemical) (Environmental Engineering)**  
**INDUSTRIAL WASTE TREATMENT**  
**(2008 Course) (Semester - II) (509140)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Explain the treatment techniques for removal of the following pollutants from Industrial waste:

- a) Organic pollutants. [6]
- b) Oil & Grease [6]
- c) Phosphate [6]

**Q2)** a) Write short notes Trickling Filters. [8]

- b) Explain Tertiary treatments for industrial Wastewater. [8]

**Q3)** What are clean up and cleaner technologies? Explain with proper examples. [16]

**Q4)** Explain the treatment techniques for the removal of Heavy Metals from industrial wastewater with neat flow diagram. [16]

**P.T.O.**

## SECTION - II

**Q5)** Draw the flow sheet for treatment of sugar waste and focus on its cost benefit analysis with all details. **[18]**

**Q6)** Define BOD. Explain the procedure to determine BOD. What are the limitations of BOD TEST.? **[16]**

**Q7)** Explain the concept, objective, design and cost-benefit analysis of common ETP plant. **[16]**

**Q8)** Write notes on:

a) Flow chart for sludge treatment & disposal. **[8]**

b) Oxidation Pond. **[8]**



Total No. of Questions : 6]

SEAT No. :

P3757

[Total No. of Pages : 2

[4760]-46

M.E. (Civil/Structures)

**THEORY OF PLATES AND SHELLS**

**(2008 Pattern) (Semester - II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Attempt any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non programmable electronic calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) For a thin plate subjected to bending, derive the governing differential equation. Find expressions for moments, shears using various boundary conditions. **[13]**
- b) Differentiate between thin plate theories for small and large deflections. Sketch the free body diagram of a plate element representing lateral loads, moments and shears. State the assumptions in the small deflection theory of thin plate. **[12]**
- Q2)** a) Derive Levy's solution for a rectangular plate with two opposite edges simply supported and the other two edges clamped; under uniform intensity of loading  $q$ . **[18]**
- b) State the advantages of Levy's method over Navier's method. **[7]**
- Q3)** A circular plate of radius 'a' is having simply supported edges. Find the maximum values of radial and tangential moments when the plate is subjected to central circular patch load over a area of radius  $a/4$  with intensity  $P_0$  per unit area. **[25]**

**P.T.O.**

## SECTION - II

- Q4)** a) A thin spherical tank is supported on cylindrical rim along a parallel circle. The tank is completely filled with liquid of density  $w$ . Derive the expression for the membrane stresses  $N_\theta$  and  $N_\phi$ . [18]
- b) State the advantages and disadvantages of shell structures compared to plates. With neat sketches classify shell surfaces based on Gaussian curvature. [7]
- Q5)** a) For a cantilever cylindrical open shell of length  $L$ , radius  $a$ , and half angle  $\phi_0$  subjected to self weight, obtain the expression membrane stresses  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$ . [15]
- b) Differentiate between membrane theory and bending theory for analysis of shells. Explain how membrane theory fails at the supports. [10]
- Q6)** a) Explain Beam theory of cylindrical shells. Discuss the advantages and limitations of the theory. [7]
- b) Derive the equilibrium equation and hence the equation for deflection using general cylindrical shell theory (considering the bending action) for axisymmetric case. [18]



Total No. of Questions : 8]

SEAT No. :

**P4368**

**[4760] - 460**

[Total No. of Pages :2

**M.E. (Environmental Engineering) (Chemical)**  
**ECOLOGY & RISK ASSESSMENT**  
**(2008 Pattern) (Semester - II) (Elective-III) (509141)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt Any Six questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Illustrate your answers with suitable examples and diagrams, wherever necessary.*
- 4) *Write relevant question number before writing the answer.*

**Q1) a)** What are components of ecosystem? **[8]**

b) How energy flows through eco-system in a food chain? **[8]**

**Q2) a)** Give a brief account on biogeochemical cycles. **[8]**

b) Describe in detail hydrological cycle. **[8]**

**Q3) a)** What is importance of study of species in ecology? **[10]**

b) Describe evolution and devolution of eco-system. **[8]**

**Q4) a)** What is terrestrial ecology? **[8]**

b) How the physico-chemical environment varies as one moves along an estuary from river to sea? **[8]**

**Q5) a)** What is habitat? State examples. **[8]**

b) How species respond to change in habitat? **[10]**

**P.T.O.**

- Q6)** a) Explain the concept of sustainable development. [8]  
b) What is biodiversity? [8]
- Q7)** a) How damage assessment can be done? [8]  
b) What are benefits of risk assessment studies? [8]
- Q8)** a) What is predictive risk assessment? [8]  
b) Explain effect of oil spill on marine eco-system. [8]



Total No. of Questions : 8]

SEAT No. :

**P4050**

**[4760]-461**

[Total No. of Pages : 2

**M.E. (Chemical) (Environmental)**

**WATER QUALITY MODELING**

**(2008 Course) (Semester-II) (Elective-III) (509141)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** a) What do you mean by water quality

b) What is water quality modeling?

c) What are the types of models?

**[18]**

**Q2)** What are the sources of water pollutants? Explain with example.

**[16]**

**Q3)** What are the point and nonpoint sources of pollution? Explain with example.

**[16]**

**Q4)** Write notes on:

**[16]**

a) Bacterial Decay.

b) Nitrification.

**P.T.O.**

## SECTION-II

*Q5)* Develop a model for batch reactor. [16]

*Q6)* Develop a model for plug flow reactor. [18]

*Q7)* What is model calibration? How to do it? [16]

*Q8)* Write short notes on: [16]

- a) Water Quality Management.
- b) Ocean outfalls.



Total No. of Questions : 8]

SEAT No. :

**P4051**

**[4760]- 463**

[Total No. of Pages :2

**M.E. (Environmental Engineering-Chemical Engineering )**

**ENVIRONMENTAL BIOTECHNOLOGY**

**( 2008 Course) (Semester- II)(509141)(Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Figures to the right indicate full marks.*
- 2) Use of programmable calculator is not allowed.*
- 3) Draw a neat sketch wherever necessary.*
- 4) Make necessary assumptions where required.*
- 5) Answers any three questions from section I and any three questions from Section-II.*

**SECTION-I**

**Q1)** Discuss in details from the following: **[16]**

- a) Environment is both physical and biological
- b) The characteristics of living things

**Q2)** a) Define the terms:Metabolism, responsiveness,growth,ecology,evolution **[8]**

- b) Explain the various types of environment which influence the personality of an individual. **[8]**

**Q3)** a) Differentiate between aerobes and anaerobes. **[8]**

- b) Write a note on growth requirements of microorganisms. **[8]**

**Q4)** What are the different types of bioremediations? Explain in details any three.**[18]**

**P.T.O.**

## SECTION-II

**Q5)** Comment in details on : **[16]**

- a) Fermentations and Biotechnology
- b) Agar is particularly suited as a solidifying agent

**Q6)** a) Explain anyone processes of anaerobic digestion in detail. **[8]**

- b) Discuss about bioremediation is a better mode of treatment for pesticides and herbicides pollution. **[8]**

**Q7)** Write short note on: **[16]**

- a) Biotrickling filters and their applications
- b) Root zone treatment

**Q8)** a) Draw and explain treatment flow sheet for tannery and distillery. **[9]**

- b) Discuss about any one Novel methods of pollution control in details.**[9]**



Total No. of Questions : 8]

SEAT No. :

**P4590**

**[4760] - 464**

[Total No. of Pages :4

**M.E. (Chemical) (Environmental Engineering)**  
**GROUNDWATER CONTAMINATION & POLLUTION TRANSPORT**  
**(2008 Pattern) (Semester - II) (Open Elective - IV) (509142)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** Groundwater contamination is a potential threat to country's water Resources-Discuss. What are the potential problems that arise from such contamination. **[6]**
- b) What are major soil characteristics or properties that aid groundwater contamination? Discuss the geological formation which are favourable for groundwater movement. **[6]**
- c) During an aquifer test, the data pertaining to aquifer characteristics was taken as below. **[6]**
- i) Effective size of particles forming aquifer = 0.20mm
  - ii) Hydraulic gradient 1 in 100
  - iii) Viscosity coefficient at 10°C = 1.0
- Find
- 1) The discharge through aquifer having 150m width & 20m deep &
  - 2) Velocity of flow through aquifer

Use sliticher formula & take sliticher constant = 400 & Hazen constant = 1000.

***P.T.O.***

- Q2)** a) Explain the role of permeability in groundwater contaminant movement & Derive Darcy's law as applied to groundwater flow. State its validity & limitations. [6]
- b) Clearly distinguish between any two of the following. [4]
- i) Radius of influence & well interference
  - ii) Isotropic & anisotropic formation
  - iii) Source & sink
- c) Explain specific yield & factors affecting specific yield. [6]
- Q3)** a) What is steady state & transient state of flow & explain the conditions for occurrence of these flows. [6]
- b) Derive the Laplace conditions to be satisfied by flow through homogeneous, isotropic medium under steady condition. [4]
- c) Pumping test was conducted on a 4.8m diameter well penetrating 25m below static water level. After pumping for 24 hours, 4500 lpm of water was discharged, the water level in the observation well at a distance of 60m is lowered by 55cm & in a well 30m away is lowered by 1.0m. Find [6]
- i) Transmissivity of aquifer
  - ii) Drawdown in pumping well
- Q4)** a) Explain the methods for determining groundwater flow direction with necessary example. [6]
- b) Explain the finite difference method for solving 1-D groundwater flow equation considering explicit & implicit approximation. [6]
- c) What is flow net & its application in groundwater contamination studies? Discuss the necessary conditions for constructing flow nets. [4]

## SECTION - II

- Q5)** a) Explain the underground travel phenomenon of groundwater contaminants. [6]
- b) Explain geochemical cycle of surface & groundwater with required sketch. [8]
- c) Explain Leaching & leaching requirement. [4]
- 
- Q6)** a) What is artificial groundwater recharge? What are the different types of artificial recharge & explain any 2 methods with necessary sketch. [8]
- b) What do you understand by groundwater pollution control? Explain Vyredox method for insitu chemical treatment for groundwater contamination control. [8]
- 
- Q7)** a) Explain. [8]
- i) Collin bar chart
- ii) Piper trilinear diagram
- iii) Stiff's polygon of
- Explain water quality plots & maps.
- b) Explain the importance of model study in groundwater pollution transport phenomenon. What are the practical disadvantages. [4]
- c) Explain mechanism of which help in salt water intrusion into aquifer & discuss any one method for controlling salt water intrusion into aquifer. [4]

**Q8) a)** Write short note on any four of the following. **[12]**

- i) Mechanism of solute transport in vadose zone
- ii) Dipole pumping test model
- iii) Gaussian plume model for groundwater contamination
- iv) Groundwater pollution control by sheet piling
- v) Ground water pollution cycle between water & bound

**b)** What are karstic land form & how they are developed? **[4]**



Total No. of Questions : 10]

SEAT No. :

**P4369**

[4760] - 465

[Total No. of Pages : 3

**M.E. (Petroleum)**

**NUMERICAL METHODS AND SIMULATION IN  
PETROLEUM ENGINEERING  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answer any 3 questions from Section I and any 3 questions of Section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Using Gauss Elimination Method solve following set of simultaneous equations: **[10]**

$$x_1 - x_2 + 2x_3 = -8$$

$$2x_1 - 2x_2 + 3x_3 = -20$$

$$x_1 + x_2 + x_3 = -2$$

b) How can nonlinear algebraic equations can be solved write a general procedure of any method in details. **[8]**

**Q2) a)** Provide a stepwise procedure of Bisection method. Provide neat diagram. Discuss its advantages and disadvantages. **[10]**

b) Can the following set of equations be solved, comment on it: **[6]**

$$2.1x_1 + 3.7x_2 = 19.5$$

$$8.4x_1 + 14.8x_2 = 78$$

**P.T.O.**

**Q3) a)** Solve using Newton - Raphson technique: [10]

$$F(x) = x - \frac{1}{3}e^x$$

b) Petroleum reservoir models are inherently nonlinear in nature justify the statement with help of suitable example. [6]

**Q4) a)** Derive the Euler method based on Taylor series expansion. Compare between Euler Technique and Runge Kutta Methods. [8]

b) Name various methods used for solving partial differential equations. Discuss any of the method with help of mathematical expressions. [8]

**Q5) a)** Use Runge- Kutta method to solve following system at  $t = 1.5$ . [10]

$$\begin{bmatrix} y_1' \\ y_2' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -5 & -2 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$$

Given that at  $t = 0$ ,  $y_1(0) = 2$  and  $y_2(0) = -4$ .

b) Show that velocity distribution inside a circular pipe can be represented by: [6]

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Where symbols have their usual significances. The ratio of  $\delta/\delta^* = 3$ .

### **SECTION - II**

**Q6) a)** Write a detailed note on the various parameters / data which are very much essential for reservoir simulation - elaborate on their availability.[8]

b) What are black oil models? How do they differ from compositional models? [8]

- Q7) a)** Name four commercial reservoir simulators and discuss their advantages. [8]
- b) Solve the following reservoir equation: [10]

$$\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$$

subject to the conditions

$$u(0, t) = 0$$

$$u(4, t) = 0$$

$$u(x, 0) = x(4 - x)$$

$$\frac{\partial u}{\partial t} = 0 \text{ at } t = 0$$

Taking  $h = \Delta x = 1$  and  $k = \Delta t = 0.5$

Find the values of  $u$  upto  $t = 1.5$

- Q8) a)** What are the key features of sophisticated numerical simulators? Discuss and elaborate how various challenges on computation front can be handled and bridged well with field data for actual petroleum field applications by modern day simulators. [8]
- b) Develop Mass Balance and Momentum Balance equations for one dimensional flow through porous media. [8]
- Q9) a)** With help of neat diagram explain how advanced simulation techniques can be applied for Geothermal Reservoirs. [8]
- b) Write a detailed note on History Matching Technique. In this context also highlight Regression Analysis. [8]
- Q10) a)** With help of some case study explain how numerical simulation based methodologies actually help hydrocarbon recovery. [8]
- b) Differentiate between the development of model and its simulation. What are the advantages of numerical simulation techniques? [8]



Total No. of Questions : 8]

SEAT No. :

**P4052**

[Total No. of Pages : 4

[4760] - 466

**M.E. (Petroleum Engg.)**

**PETROLEUM RESERVOIR MANAGEMENT**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Use of graph paper is allowed.*
- 3) *Figures to the right indicate marks.*
- 4) *Assume additional data, if necessary.*

**SECTION - I**

- Q1)** a) Why do rock properties vary from one location to another within the reservoir? To what degree are the variations in rock properties usually known or estimated? Based on what has been learned, what rock property may be varying spatially and having the greatest influence on reservoir performance? **[15]**
- b) Define formation compressibility. The formation compressibility is given as  $5.8 \times 10^{-6} \text{ psi}^{-1}$  and  $5.8 \times 10^{-5} \text{ psi}^{-1}$ , respectively. Which formation is more compressible? Why? **[10]**

OR

- Q2)** a) Why are relative permeability, wettability, capillary pressure, and certain other properties of rock referred to as dynamic properties? **[15]**
- b) Define formation transmissibility and storativity. Qualitatively compare the performance of the following layers in a reservoir : **[10]**
- Lower layer: very high transmissibility and low storativity
- Upper layer : relatively low transmissibility and high storativity
- i) Which layer is likely to be responsible for early water breakthrough? What remedial action can be taken?
  - ii) Should any difference be anticipated in reservoir performance if good vertical communication exists between the two layers?

**P.T.O**

- Q3)** a) Why is knowledge of the dew point, gas/oil ratio, and gas condensate formation volume factor necessary to effectively develop and produce a gas condensate reservoir? [15]
- b) Write notes on any two of the following : [10]
- i) poroperm relationship.
  - ii) Estimation of porosity/lithology from well logs
  - iii) Relative permeability curves
  - iv) Borehole environment

OR

- Q4)** a) A low permeability gas reservoir is discovered at a depth of 9,250 ft. (TVD). The specific gravity of the natural gas is found to be 0.669. Based on this information alone, can the reserve be calculated in MMscf per acre-ft.? If so, perform the calculation, showing all the steps. If not, clearly state any other assumptions necessary in the estimation of the reserves. In case of an overpressure formation, will the estimate change? [10]
- b) The table given below shows porosity and permeability values as per increasing depth in a vertical well. [15]

| S.No. | Depth, m | Porosity, $\phi$ , (%) | Permeability, md |
|-------|----------|------------------------|------------------|
| 1     | 2040     | 9.35                   | 48               |
| 2     | 2041     | 10.2                   | 65               |
| 3     | 2042     | 7.30                   | 33               |
| 4     | 2043     | 6                      | 28               |
| 5     | 2044     | 6.50                   | 32               |
| 6     | 2045     | 5.8                    | 17               |
| 7     | 2046     | 6.25                   | 24               |

Generate the separate Semivariogram for porosity and permeability as a function of lag distance. Interpret the graphs using behavior of different parameters like sill, range, nugget value etc. What statistical correlation would you derive between porosity and permeability in this case?

## SECTION - II

- Q5)** a) Discuss the conceptual reservoir model or models used in traditional interpretation when the test is performed in a newly discovered reservoir. [15]
- b) Describe the distinct flow regimes that might develop during the transient testing of horizontal wells. [10]

OR

- Q6)** a) What is the principal tool one would plan to use in identifying any geologic heterogeneity from the test designed? Explain how the existence of the following would be recognized : [15]

Natural fractures, Pinch out boundary, Sealing fault.

- b) As part of a waterflood project, several producers are being converted to injectors in a reservoir. Would the permeability values obtained by well testing before and after the conversion of a producer be expected to remain the same? Explain. [10]
- Q7)** a) What are the field challenges for the development of reservoir management plan for mature field. [15]
- b) Consider three reservoirs at various depths and locations having following rock and fluid properties. With limited resources which of the three reservoirs should be water flooded first, all other factors being the same? Explain why? [10]
- i) Depth 1500 m. Permeability; 20–30 md. Oil gravity: 230 API. Onshore location.
  - ii) Depth 2500 m. Permeability; 14–18 md. Oil gravity: 280 API. Onshore location.
  - iii) Depth 3500 m. Permeability; 10–500 md. Oil gravity: 310 API. Offshore location

List all other factors that should be gathered before making final decision.

OR

- Q8)** a) What is the basis for Fetkovich type curve analysis for improving the decline curve analysis technique? [10]

- b) An international contractor signs a block in a low risk area. During the first two years the contractor conducts exploration activities for \$ 80MM each in first two years. If a commercial oil field is encountered, it will take another three years to develop the field at a cost of \$ 100 MM every year for the next three years. [15]

Production from the field starts after the development phase at 8000 BOPD declining at a rate of 15% each year. Annual Operating expenditure is \$ 4/ barrel. Oil price is assumed to be \$ 80/barrel.

Government earns royalty of 10%, 60% production share and 30% income tax.

Prepare a detailed spreadsheet for the same. Calculate the net cash flow for the contractor and the host government for next ten years.

If cost recovery is estimated up to 80% from the first year of commercial production and 20% is the profit petroleum then how much time the contractor will require to recover the exploration and development cost?

Prepare a detailed spreadsheet inclusive of gross revenue, royalty, net revenue, exploration and development cost, production cost, accumulation, cost recovered, cost to be recovered, profit petroleum, government share, contractor share, tax and profit for contractor.

How is the distribution of \$ 80/ barrel between contractor and government?



Total No. of Questions : 6]

SEAT No. :

**P4591**

**[4760]-467**

[Total No. of Pages : 2

**M.E. (Petroleum Engineering)**

**HORIZONTAL, MULTILATERAL AND INTELLIGENT WELLS**

**(2008 Course) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section-I and any three questions from section-II.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

- Q1)** a) Explain different parameters considered while making Geo technical order. **[8]**
- b) Commonly encountered drilling problems are mentioned below. Write in brief the symptoms, causes and indications: **[10]**
- i) Bit balling.
  - ii) Chemically reactive shale.
  - iii) Gas Influx.
  - iv) Ballooning effect.
  - v) Mudloss.
- Q2)** a) What is leak off test? Explain with suitable example. **[8]**
- b) During pressure test calculate net burst load at casing shoe. Data given as 9-5/8" casing seat at 9,755 ft, Mud weight 11.7 ppg, top of cement 2000 ft, previous casing shoe at 1,500ft, pressure test carried at 3000 psi. **[4]**
- c) Discuss casing design consideration in details. **[4]**

**P.T.O.**

- Q3)** a) Discuss volumetric method of well control in detail with suitable example. [8]
- b) Discuss primary cementation in details. [8]

### **SECTION-II**

- Q4)** a) Draw BOP Stack and describe various ram preventers. [8]
- b) Discuss different types of horizontal wells. [8]

- Q5)** a) Discuss different components of drill string and effect of each component on design.
- b) Write short note on:
- i) LWD Tool.
  - ii) Well completions.

[16]

- Q6)** a) What is hydraulics? Discuss optimization of hydraulics in multilateral wells. [9]
- b) Discuss economics of complex wells in brief. [9]



Total No. of Questions : 6]

SEAT No. :

P4557

[Total No. of Pages : 2

[4760] - 47

M.E. Civil (Structures)

FINITE ELEMENT METHOD

(2008 Pattern) (Semester - II)

Time : 4 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any two questions from each section.
- 2) Answer to the two sections should be written in separate books.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Use of non programmable calculator is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

Q1) a) Using potential energy approach derive stiffness matrix for a beam element. [9]

b) Explain with examples different types of co-ordinates used in finite element method to define location of points in element. Hence obtain relation for natural co-ordinates for two noded element when range is – 1 to +1. [8]

c) Using finite element approach, show that, stiffness matrix for one-dimensional axially loaded bar element is  $[K] = \frac{AE}{L} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ . [8]

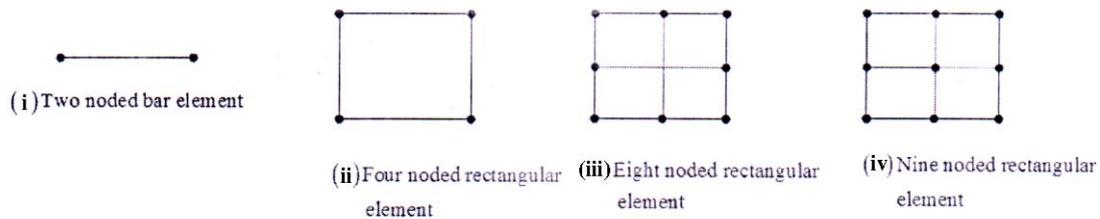
Q2) a) Derive area co-ordinates of three noded constant strain triangular (CST) element. [9]

b) State the convergence criteria for the choice of the displacement function in FEM. [8]

c) Explain standard formulation procedure using variational principle. [8]

P.T.O.

- Q3) a)** State and explain the three basic laws on which isoparametric concept is developed. [7]
- b) Derive shape functions of following isoparametric elements in natural coordinate system  $(\xi, \eta)$ . [18]
- Two noded bar element
  - Four noded rectangular element
  - Eight noded rectangular element
  - Nine noded rectangular element



### SECTION - II

- Q4) a)** Explain strain-displacement and stress-strain relationships for triangular problem. Hence, derive necessary matrices for formulation of stiffness matrix of triangular axisymmetric element. [18]
- b) Explain in brief plane stress, plane strain and axisymmetric problems. [7]
- Q5) a)** Write displacement functions for both ACM and BFS elements. [12]
- b) Write short note on conforming and non-conforming plate bending elements. [6]
- c) What do you understand by  $C^0$ ,  $C^1$  and  $C^2$  continuity? Explain with suitable examples. [7]
- Q6) a)** Explain the concept of degenerated solid elements by suitable examples. Write displacement fields in 4 noded degenerated shell element. [13]
- b) Explain membrane and bending actions in shell elements. How these two states of stresses are considered in formulating  $[K]$  for shell element. [12]



**P4053**  
Total No. of Questions : 10]

SEAT No. :   
[Total No. of Pages : 2

**[4760]-470**  
**M.E. (Petroleum)**  
**OIL AND GAS FIELD DEVELOPMENT**  
**(2008 Course) (Elective-I)(C) (Semester-I)(512104)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from section-I and any three questions from section II.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right side indicate full marks.*
- 5) Use of Calculator is allowed.*
- 6) Assume Suitable data if necessary*

**SECTION-I**

- Q1)** Describe in detail different stages involved in the process of oil field development from the stage of exploration to transportation of hydrocarbons to refinery? **[18]**
- Q2)** Describe different reservoir drive mechanisms and their features along with necessary graph in brief. **[16]**
- Q3)** Write the names of different types of artificial lift techniques and explain any four in brief. **[16]**
- Q4)** a) What is formation damage problem for a wellbore? Discuss any one method to overcome it. **[8]**  
b) What is well planning? Describe well planning objectives and procedure in brief. **[8]**
- Q5)** Draw typical process flow diagram and discuss working of a typical central processing facility in detail. **[16]**

**P.T.O.**

## SECTION-II

- Q6)** Write and explain, steps involved production performance prediction for a reservoir? Discuss role of reservoir simulation and modeling in it? Write advantages and applications of reservoir modeling and simulation technique in field development along with one example? **[18]**
- Q7)** a) What is pressure maintenance? What is the need of it? Discuss in detail water flooding operation. **[8]**  
b) Discuss in brief basic principle and design considerations of polymer flooding. **[8]**
- Q8)** a) Describe the following in brief. **[12]**  
i) Water and gas shut off.  
ii) Steam flooding.  
iii) Offshore field development.  
iv) Miscible drive.  
b) Discuss liquid loading problem of gas wells in brief. **[4]**
- Q9)** What are the different resources of data collection in oil field development? Describe them in detail. **[16]**
- Q10)** Write short notes on, **[16]**  
a) Economics of field development.  
b) Laboratory analysis of core samples.  
c) Reserves in place.  
d) Well completion.



Total No. of Questions : 8]

SEAT No. :

P4370

[Total No. of Pages : 5

[4760] - 474

**M.E. (Petroleum Engineering)**  
**WELL TESTING AND ANALYSIS**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections must be written in separate answer books.*
- 2) *Questions No. 2(two) and 8 (eight) are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Answer 3 questions from Section - I and 3 questions from Section - II.*
- 5) *Neat diagrams should be drawn wherever necessary.*
- 6) *Use of a non-programmable calculator, log-log, and semi-log paper is allowed.*
- 7) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Derive the diffusivity equation for a single phase fluid flowing through a radial porous media. **[6]**
- b) Explain the various flow regimes that are witnessed in a horizontal well test, along with neat diagrams. **[10]**

**Q2)** Following data is given:

$$q = 30 \text{ stb/d}$$

$$h = 140 \text{ ft}$$

$$B = 1.47 \text{ RB / STB}$$

$$k = 0.2 \text{ md}$$

$$c_t = 1.4 \times 10^{-5} \text{ psi}^{-1}$$

$$\mu = 0.72 \text{ cp}$$

$$r_w = 0.5 \text{ ft}$$

$$P_i = 3100 \text{ psi}$$

$$\text{porosity} = 20\%$$

$$r_e = 2800 \text{ ft}$$

Calculate the reservoir pressure at the radius of 1 ft, 5 ft, 10 ft and 50 ft after 3 hours of oil production. **[18]**

**P.T.O.**

- Q3)** a) Explain the concept of Superposition in space, with appropriate figures. [4]
- b) What is the need of doing a well test? Write your answer in detail. [4]
- c) A new oil well produced 400 stb/day for 2± days; then it was shut-in for a pressure buildup test, during which the data in Table below were recorded. The other data were;  $B_o = 1.25 \text{ rb/stb}$ ,  $h = 20 \text{ ft}$ ,  $\phi = 0.20$ ,  $r_w = 0.29 \text{ ft}$ ,  $ct = 19.5 \times 10^{-6}$ , and viscosity = 1.1 cP. From these data, estimate the formation permeability,  $k$ ,  $p_i$  and skin factor  $s$ . Use the Semi-Log graph. [8]

| Shut-in time, $Del-t$ (hr) | $(tp + Del-t)/Del-t$ | $P_{ws}$ (psia) |
|----------------------------|----------------------|-----------------|
| 0                          | -                    | 1165            |
| 2                          | 37.0                 | 1801            |
| 4                          | 19.0                 | 1838            |
| 8                          | 10.0                 | 1865            |
| 16                         | 5.5                  | 1891            |
| 24                         | 4.0                  | 1905            |
| 48                         | 2.5                  | 1925            |

- Q4)** a) Explain with appropriate diagrams, the various pressure gradients in a DST. [6]
- b) Explain the phenomenon of constant and changing wellbore storage, along with appropriate diagrams. [10]

### SECTION - II

- Q5)** a) Explain what do you mean by pseudo pressure. [16]
- b) What is the difference between Isochronal and Modified Isochronal Well test.

**Q6)** What are the different types of empirical decline curves? Explain with sketches. **[16]**

**Q7)** What are the various solutions of the diffusivity equation? What assumptions are used in deriving the line-source solution? What assumptions would be nullified beyond the limit of line-source solution of the diffusivity equation?**[16]**

**Q8)** Define and explain the pressure derivative plot. Draw and explain the diagnostic plot giving five examples. **[18]**

### Formulas for the exam

For E (i) function values, refer to the table given with the examination paper.

$$p = p_i + 70.6 \frac{qB\mu}{kh} \text{Ei} \left( -\frac{948\phi\mu c_i r^2}{kt} \right)$$

$$t_D = \frac{0.000264kt}{\phi\mu_o C_i r_w^2}$$

$$p_{ws} = p_i - \frac{162.6q_o\mu_o\beta_o}{kh} \log \left[ \frac{t_p + \Delta t}{\Delta t} \right]$$

$$p_D = -\frac{1}{2} \text{Ei} \left( -\frac{r_D^2}{4t_D} \right)$$

$$S = 1.151 \left[ \frac{p1hr - p_{ws}(\Delta t = 0)}{m} - \log \left( \frac{k}{\phi\mu_o c_i r_w^2} \right) + 3.23 \right]$$

$$p_{wf} = p_i - \frac{162.6q_o\mu_o\beta_o}{kh} \left[ \log t + \log \left( \frac{k}{\phi\mu_o c_i r_w^2} \right) - 3.23 + 0.869s \right]$$

$$p = p_i + 70.6 \frac{qB\mu}{kh} \left[ \ln \left( \frac{1,688\phi\mu c_i r^2}{kt} \right) \right]$$

$$\frac{(3.975 \times 10^5)\phi\mu c_i r_w^2}{k} < t < \frac{948\phi\mu c_i r_e^2}{k}$$

$$p1h = p_i + m \left[ \log \left( \frac{k}{\phi\mu_o\beta_o c_i r_w^2} \right) - 3.23 + 0.869s \right]$$

$$p(r,t) = LS(r,t) = p_i - \frac{70.6Q\mu}{kh} \left[ -E_i \left( \frac{948.1\Phi\mu c_i r^2}{kt} \right) \right]$$

$$K = \frac{162.6q_o\mu_o\beta_o}{mh}$$

TABLE 1.1—VALUES OF THE EXPONENTIAL INTEGRAL,  $-Ei(-x)$

| $-Ei(-x), 0.000 < x < 0.209, \text{interval} = 0.001$ |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| x   | 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     |
| 0.00  | +°                    | 6.332                 | 5.639                 | 5.235                 | 4.948                 | 4.726                 | 4.545                 | 4.392                 | 4.259                 | 4.142                 |
| 0.01  | 4.038                 | 3.944                 | 3.858                 | 3.779                 | 3.705                 | 3.637                 | 3.574                 | 3.514                 | 3.458                 | 3.405                 |
| 0.02  | 3.355                 | 3.307                 | 3.261                 | 3.218                 | 3.176                 | 3.137                 | 3.098                 | 3.062                 | 3.026                 | 2.992                 |
| 0.03  | 2.959                 | 2.927                 | 2.897                 | 2.867                 | 2.838                 | 2.810                 | 2.783                 | 2.756                 | 2.731                 | 2.706                 |
| 0.04  | 2.681                 | 2.658                 | 2.634                 | 2.612                 | 2.590                 | 2.568                 | 2.547                 | 2.527                 | 2.507                 | 2.487                 |
| 0.05  | 2.468                 | 2.449                 | 2.431                 | 2.413                 | 2.395                 | 2.377                 | 2.360                 | 2.344                 | 2.327                 | 2.311                 |
| 0.06  | 2.295                 | 2.279                 | 2.264                 | 2.249                 | 2.235                 | 2.220                 | 2.206                 | 2.192                 | 2.178                 | 2.164                 |
| 0.07  | 2.151                 | 2.138                 | 2.125                 | 2.112                 | 2.099                 | 2.087                 | 2.074                 | 2.062                 | 2.050                 | 2.039                 |
| 0.08  | 2.027                 | 2.015                 | 2.004                 | 1.993                 | 1.982                 | 1.971                 | 1.960                 | 1.950                 | 1.939                 | 1.929                 |
| 0.09  | 1.919                 | 1.909                 | 1.899                 | 1.889                 | 1.879                 | 1.869                 | 1.860                 | 1.850                 | 1.841                 | 1.832                 |
| 0.10  | 1.823                 | 1.814                 | 1.805                 | 1.796                 | 1.788                 | 1.779                 | 1.770                 | 1.762                 | 1.754                 | 1.745                 |
| 0.11  | 1.737                 | 1.729                 | 1.721                 | 1.713                 | 1.705                 | 1.697                 | 1.689                 | 1.682                 | 1.674                 | 1.667                 |
| 0.12  | 1.660                 | 1.652                 | 1.645                 | 1.638                 | 1.631                 | 1.623                 | 1.616                 | 1.609                 | 1.603                 | 1.596                 |
| 0.13  | 1.589                 | 1.582                 | 1.576                 | 1.569                 | 1.562                 | 1.556                 | 1.549                 | 1.543                 | 1.537                 | 1.530                 |
| 0.14  | 1.524                 | 1.518                 | 1.512                 | 1.506                 | 1.500                 | 1.494                 | 1.488                 | 1.482                 | 1.476                 | 1.470                 |
| 0.15  | 1.464                 | 1.459                 | 1.453                 | 1.447                 | 1.442                 | 1.436                 | 1.431                 | 1.425                 | 1.420                 | 1.415                 |
| 0.16  | 1.409                 | 1.404                 | 1.399                 | 1.393                 | 1.388                 | 1.383                 | 1.378                 | 1.373                 | 1.368                 | 1.363                 |
| 0.17  | 1.358                 | 1.353                 | 1.348                 | 1.343                 | 1.338                 | 1.333                 | 1.329                 | 1.324                 | 1.319                 | 1.314                 |
| 0.18  | 1.310                 | 1.305                 | 1.301                 | 1.296                 | 1.291                 | 1.287                 | 1.282                 | 1.278                 | 1.274                 | 1.269                 |
| 0.19  | 1.265                 | 1.261                 | 1.256                 | 1.252                 | 1.248                 | 1.243                 | 1.239                 | 1.235                 | 1.231                 | 1.227                 |
| 0.20  | 1.223                 | 1.219                 | 1.215                 | 1.210                 | 1.206                 | 1.202                 | 1.198                 | 1.195                 | 1.191                 | 1.187                 |
| $-Ei(-x), 0.00 < x < 2.09, \text{interval} = 0.01$    |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| x   | 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     |
| 0.0   | +°                    | 4.038                 | 3.335                 | 2.959                 | 2.681                 | 2.468                 | 2.295                 | 2.151                 | 2.027                 | 1.919                 |
| 0.1   | 1.823                 | 1.737                 | 1.660                 | 1.589                 | 1.524                 | 1.464                 | 1.409                 | 1.358                 | 1.309                 | 1.265                 |
| 0.2   | 1.223                 | 1.183                 | 1.145                 | 1.110                 | 1.076                 | 1.044                 | 1.014                 | 0.985                 | 0.957                 | 0.931                 |
| 0.3   | 0.906                 | 0.882                 | 0.858                 | 0.836                 | 0.815                 | 0.794                 | 0.774                 | 0.755                 | 0.737                 | 0.719                 |
| 0.4   | 0.702                 | 0.686                 | 0.670                 | 0.655                 | 0.640                 | 0.625                 | 0.611                 | 0.598                 | 0.585                 | 0.572                 |
| 0.5   | 0.560                 | 0.548                 | 0.536                 | 0.525                 | 0.514                 | 0.503                 | 0.493                 | 0.483                 | 0.473                 | 0.464                 |
| 0.6   | 0.454                 | 0.445                 | 0.437                 | 0.428                 | 0.420                 | 0.412                 | 0.404                 | 0.396                 | 0.388                 | 0.381                 |
| 0.7   | 0.374                 | 0.367                 | 0.360                 | 0.353                 | 0.347                 | 0.340                 | 0.334                 | 0.328                 | 0.322                 | 0.316                 |
| 0.8   | 0.311                 | 0.305                 | 0.300                 | 0.295                 | 0.289                 | 0.284                 | 0.279                 | 0.274                 | 0.269                 | 0.265                 |
| 0.9   | 0.260                 | 0.256                 | 0.251                 | 0.247                 | 0.243                 | 0.239                 | 0.235                 | 0.231                 | 0.227                 | 0.223                 |
| 1.0   | 0.219                 | 0.216                 | 0.212                 | 0.209                 | 0.205                 | 0.202                 | 0.198                 | 0.195                 | 0.192                 | 0.189                 |
| 1.1   | 0.186                 | 0.183                 | 0.180                 | 0.177                 | 0.174                 | 0.172                 | 0.169                 | 0.166                 | 0.164                 | 0.161                 |
| 1.2   | 0.158                 | 0.156                 | 0.153                 | 0.151                 | 0.149                 | 0.146                 | 0.144                 | 0.142                 | 0.140                 | 0.138                 |
| 1.3   | 0.135                 | 0.133                 | 0.131                 | 0.129                 | 0.127                 | 0.125                 | 0.124                 | 0.122                 | 0.120                 | 0.118                 |
| 1.4   | 0.116                 | 0.114                 | 0.113                 | 0.111                 | 0.109                 | 0.108                 | 0.106                 | 0.105                 | 0.103                 | 0.102                 |
| 1.5   | 0.100                 | 0.0985                | 0.0971                | 0.0957                | 0.0943                | 0.0929                | 0.0915                | 0.0902                | 0.0889                | 0.0876                |
| 1.6   | 0.0863                | 0.0851                | 0.0838                | 0.0826                | 0.0814                | 0.0802                | 0.0791                | 0.0780                | 0.0768                | 0.0757                |
| 1.7   | 0.0747                | 0.0736                | 0.0725                | 0.0715                | 0.0705                | 0.0695                | 0.0685                | 0.0675                | 0.0666                | 0.0656                |
| 1.8   | 0.0647                | 0.0638                | 0.0629                | 0.0620                | 0.0612                | 0.0603                | 0.0595                | 0.0586                | 0.0578                | 0.0570                |
| 1.9   | 0.0562                | 0.0554                | 0.0546                | 0.0539                | 0.0531                | 0.0524                | 0.0517                | 0.0510                | 0.0503                | 0.0496                |
| 2.0   | 0.0489                | 0.0482                | 0.0476                | 0.0469                | 0.0463                | 0.0456                | 0.0450                | 0.0444                | 0.0438                | 0.0432                |
| $-Ei(-x), 2.0 < x < 10.9, \text{interval} = 0.1$      |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| x   | 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     |
| 2   | $4.89 \times 10^{-2}$ | $4.26 \times 10^{-2}$ | $3.72 \times 10^{-2}$ | $3.25 \times 10^{-2}$ | $2.84 \times 10^{-2}$ | $2.49 \times 10^{-2}$ | $2.19 \times 10^{-2}$ | $1.92 \times 10^{-2}$ | $1.69 \times 10^{-2}$ | $1.48 \times 10^{-2}$ |
| 3   | $1.30 \times 10^{-2}$ | $1.15 \times 10^{-2}$ | $1.01 \times 10^{-2}$ | $8.94 \times 10^{-3}$ | $7.89 \times 10^{-3}$ | $6.87 \times 10^{-3}$ | $6.16 \times 10^{-3}$ | $5.45 \times 10^{-3}$ | $4.82 \times 10^{-3}$ | $4.27 \times 10^{-3}$ |
| 4   | $3.78 \times 10^{-3}$ | $3.35 \times 10^{-3}$ | $2.97 \times 10^{-3}$ | $2.64 \times 10^{-3}$ | $2.34 \times 10^{-3}$ | $2.07 \times 10^{-3}$ | $1.84 \times 10^{-3}$ | $1.64 \times 10^{-3}$ | $1.45 \times 10^{-3}$ | $1.29 \times 10^{-3}$ |
| 5   | $1.15 \times 10^{-3}$ | $1.02 \times 10^{-3}$ | $9.08 \times 10^{-4}$ | $8.09 \times 10^{-4}$ | $7.19 \times 10^{-4}$ | $6.41 \times 10^{-4}$ | $5.71 \times 10^{-4}$ | $5.09 \times 10^{-4}$ | $4.53 \times 10^{-4}$ | $4.04 \times 10^{-4}$ |
| 6   | $3.60 \times 10^{-4}$ | $3.21 \times 10^{-4}$ | $2.86 \times 10^{-4}$ | $2.55 \times 10^{-4}$ | $2.28 \times 10^{-4}$ | $2.03 \times 10^{-4}$ | $1.82 \times 10^{-4}$ | $1.62 \times 10^{-4}$ | $1.45 \times 10^{-4}$ | $1.29 \times 10^{-4}$ |
| 7   | $1.15 \times 10^{-4}$ | $1.03 \times 10^{-4}$ | $9.22 \times 10^{-5}$ | $8.24 \times 10^{-5}$ | $7.36 \times 10^{-5}$ | $6.58 \times 10^{-5}$ | $5.89 \times 10^{-5}$ | $5.26 \times 10^{-5}$ | $4.71 \times 10^{-5}$ | $4.21 \times 10^{-5}$ |
| 8   | $3.77 \times 10^{-5}$ | $3.37 \times 10^{-5}$ | $3.02 \times 10^{-5}$ | $2.70 \times 10^{-5}$ | $2.42 \times 10^{-5}$ | $2.16 \times 10^{-5}$ | $1.94 \times 10^{-5}$ | $1.73 \times 10^{-5}$ | $1.55 \times 10^{-5}$ | $1.39 \times 10^{-5}$ |
| 9   | $1.24 \times 10^{-5}$ | $1.11 \times 10^{-5}$ | $9.99 \times 10^{-6}$ | $8.95 \times 10^{-6}$ | $8.02 \times 10^{-6}$ | $7.18 \times 10^{-6}$ | $6.44 \times 10^{-6}$ | $5.77 \times 10^{-6}$ | $5.17 \times 10^{-6}$ | $4.64 \times 10^{-6}$ |
| 10  | $4.15 \times 10^{-6}$ | $3.73 \times 10^{-6}$ | $3.34 \times 10^{-6}$ | $3.00 \times 10^{-6}$ | $2.68 \times 10^{-6}$ | $2.41 \times 10^{-6}$ | $2.16 \times 10^{-6}$ | $1.94 \times 10^{-6}$ | $1.74 \times 10^{-6}$ | $1.56 \times 10^{-6}$ |



Total No. of Questions : 8]

SEAT No. :

**P4054**

[Total No. of Pages : 4

**[4760]- 475A**

**M.E. (Petroleum Engg.) (Semester - II)**

**GIS AND COMPUTER APPLICATIONS IN PETROLEUM INDUSTRY  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Attempt any two questions each from Section I and from Section II.*
- 3) *Assume additional data if required.*
- 4) *Use of graph paper is allowed.*

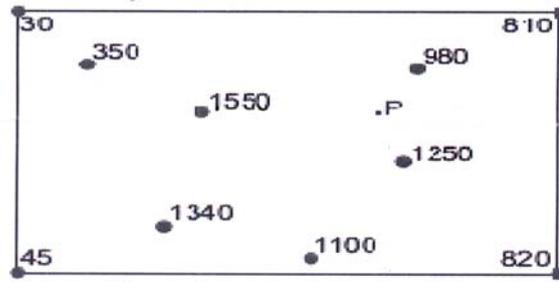
**SECTION - I**

- Q1)** a) Raster and vector have developed as two partially independent traditions in GIS. Summarize the dimensions of the raster-vector debate, particularly in the importance of spatial objects in the two systems. **[15]**
- b) Classify natural and artificial spatial objects giving suitable examples of each. **[10]**

OR

- Q2)** a) Summarize the arguments for raster GIS and application areas in which it has advantages and disadvantages. **[15]**
- b) How is data stored in BSQ and BIP or in full raster Structure? **[10]**
- Q3)** a) Write down and illustrate 16 Boolean combinations for polygons A and B. **[15]**
- b) Values given adjacent to points are representation of depth of sandstone, a pay horizon, encountered and modelled during exploration. **[10]**

**P.T.O.**



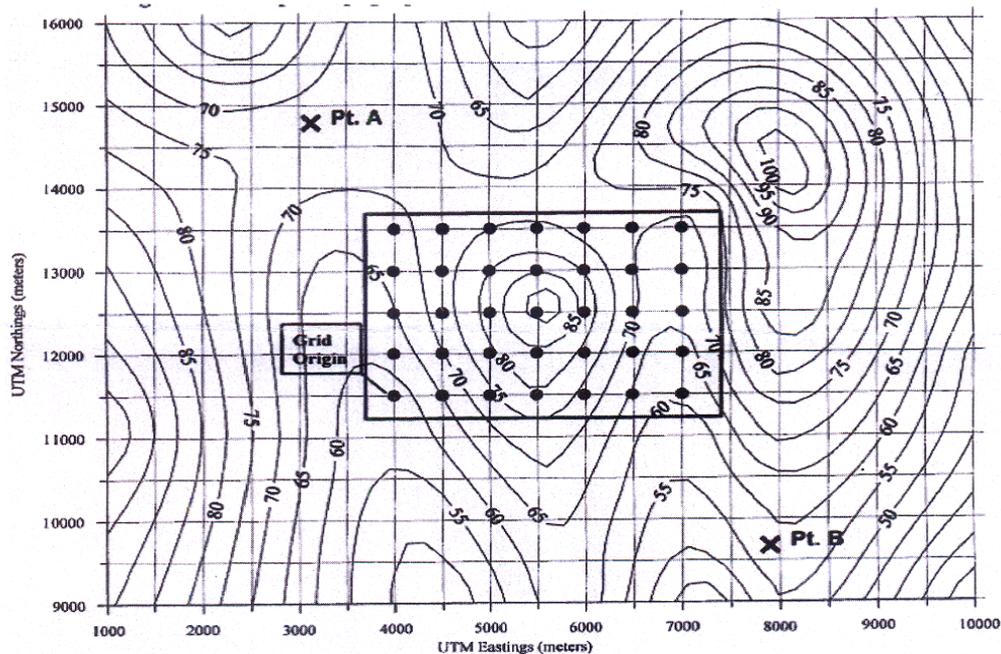
How is this database useful in the interpretation of continuous surface? What is the value at point P?

OR

- Q4) a)** Discuss the relative importance of each map projections: equal-area, equidistant and conformal. [10]
- b) How does Structured Query Language help in the creation of maps based on selective attribute data? What are the major types of SQL? [15]

**SECTION - II**

- Q5) a)** The vector-line subsurface marker horizon map below is overlain with a raster grid of columns and rows. Determine the value for each intersecting point in the grid market at the centre. Prepare a table to create a raster-based, grid DEM data set [10]



Find out their respective elevations using interpolatin method. How is autocorrelation attempted in this map?

- b) Distinguish between perspective models and predictive models. Discuss and illustrate their field of applications. [15]

OR

- Q6)** a) A terminal for the storage of oil is under consideration outside a metro city. The site must be located so that all conditions mentioned below are fulfilled: [15]

- i) Be in an area where unconsolidated superficial material has minimum thickness,
- ii) Permeability of fundation material (bedrock) is low, preventing contamination below the surface,
- iii) Slope is gentle where river flooding is unlikely,
- iv) Bedrock is not fractured.
- v) It should be located in the agricultural zoning outside the limit of metro city and near to the industry, it should not be a prime land,
- vi) The site should have excellent transportation facility,
- vii) There are certainly other factors like cost of land and size of the land (Approximately 2 km<sup>2</sup>), which should be taken into consideration.

Develop a stepwise procedure starting with the types of maps required. How will you create a suitability map by using the above conditions for the selection of this site?

- b) What is the difference between deterministic and probabilistic approach in the mapping of oil spill hazard and contingency planning using GIS and Remote Sensing techniques? [10]

- Q7)** a) Define Fractals. Illustrate the importance of scale dependency, self-similarity and scaling. How fractals are useful in GIS operations. [15]

- b) Figure given below shows infromation about an object showing variation in values. Assume value of 1 for the open squares with no value.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 9 |   |   |   |   |   |   | 2 | 3 |   |
| 8 |   |   |   |   | 2 | 2 | 3 | 2 |   |
| 7 |   |   |   | 2 | 2 | 3 | 2 | 2 |   |
| 6 |   |   |   | 2 | 3 | 2 | 2 |   |   |
| 5 |   |   | 2 | 3 | 2 |   |   |   |   |
| 4 |   | 2 | 2 | 3 | 2 | 2 |   |   |   |
| 3 | 2 | 2 | 3 | 2 | 2 |   |   |   |   |
| 2 | 2 | 3 | 2 |   |   |   |   |   |   |
| 1 | 3 | 2 |   |   |   |   |   |   |   |
|   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Prepare a continuous surface map giving shape of the object. [10]

OR

Q8) a) Answer **any three** of the following [15]

- i) Spatiotemporal Analysis in GIS
- ii) Design of GIS projects
- iii) Buffers and Dilations
- iv) Autocorrelation
- v) Multivariate Maps

b) Design a template for the creation of a 3D Reservoir model taking into consideration available geologic, geophysical and detailed reservoir data. Also list out information on attributes to be included in the DBMS, which would allow a means to review the reservoir model and update the same. [10]



Total No. of Questions : 8]

SEAT No. :

**P4055**

[Total No. of Pages : 2

[4760] - 476

**M.E. (Petroleum Engineering)**  
**ENVIRONMENTAL MANAGEMENT TECHNOLOGY AND**  
**SAFETY MEASURES**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer Any Two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** Discuss the protocol for 'field investigation' of a contaminated site, assuming the contamination is due to spilling of petroleum products. Support your discussion by considering the following points: **[25]**

- a) Levels of protection
- b) Work zone controls
- c) Knowledge of safety procedures.

**Q2)** Write notes on: **[25]**

- a) Sources and Classification of Water Pollutants
- b) Quality Environment Management: Planning and resource allocation
- c) Meteorological Aspects of Air Pollutant Dispersion

**Q3)** a) Explain pollution due to drilling and production operations and environmental impact of discharge in the onshore and offshore areas. **[15]**  
b) Discuss in details various methods available for oil spill control in marine environment. **[10]**

**Q4)** Discuss in detail on Environmental Regulations, sensitive habitans, Health and Safety Laws and quality assurance. **[25]**

**P.T.O.**

## SECTION - II

- Q5)** Write notes on the following: **[25]**
- a) Wastewater Treatment Technologies, solid waste disposal
  - b) Disaster management in oil Industries
  - c) Methods for treatment of produced water
- Q6)**
- a) Describe the types of audits involved in environment management of oil Industry. How do they incorporate legal, ethical, social and political issues? **[15]**
  - b) Write a note on “Integrated Environmental Biotechnology in Petroleum Industry” **[10]**
- Q7)** Write notes on: **[25]**
- a) Decommissioning of oil and gas installations
  - b) Environmental impact assessment
  - c) Environmental Regulations in Oil Industries
- Q8)**
- a) Describe in brief various types of audits involved in environment management of oil industry. How do they incorporate legal, ethical, social and political issues. **[15]**
  - b) Describe the environment and safety related issues regarding high sulfur crude and high sulfur natural gas. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P4371**

**[4760] - 477**

[Total No. of Pages :3

**M.E. (Petroleum)**  
**ADVANCE NATURAL GAS ENGINEERING**  
**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Attempt any three questions from each section.*
- 2) *Answers to the two sections must be written in separate answer book.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Neat diagram must be drawn wherever necessary.*
- 5) *Use of non programmable calculator is allowed.*
- 6) *Assume suitable data if necessary and clearly state it.*

**SECTION - I**

**Q1)** Explain pseudocritical and pseudoreduced properties of natural gas and its use in natural gas engineering? **[16]**

**Q2)** a) Draw the graph of  $B_g$  and  $\mu_g$  versus pressure and explain in detail. **[8]**  
b) Calculate the inflow performance relationship curve using the pressure squard method Pwf values from 0 to 5000 Psi, with an increment of 1000Psi. Assume that the flow is in pseudo-steady state. **[8]**

**Q3)** a) Write about inflow performance of gas reservoir? **[8]**  
b) Explain in detail about Gas well testing. **[8]**

**Q4)** a) Why is gas flow in porous media different from liquid flow? **[6]**  
b) Explain all the constants in the gas flow meter equation. **[12]**

**P.T.O.**

## SECTION -II

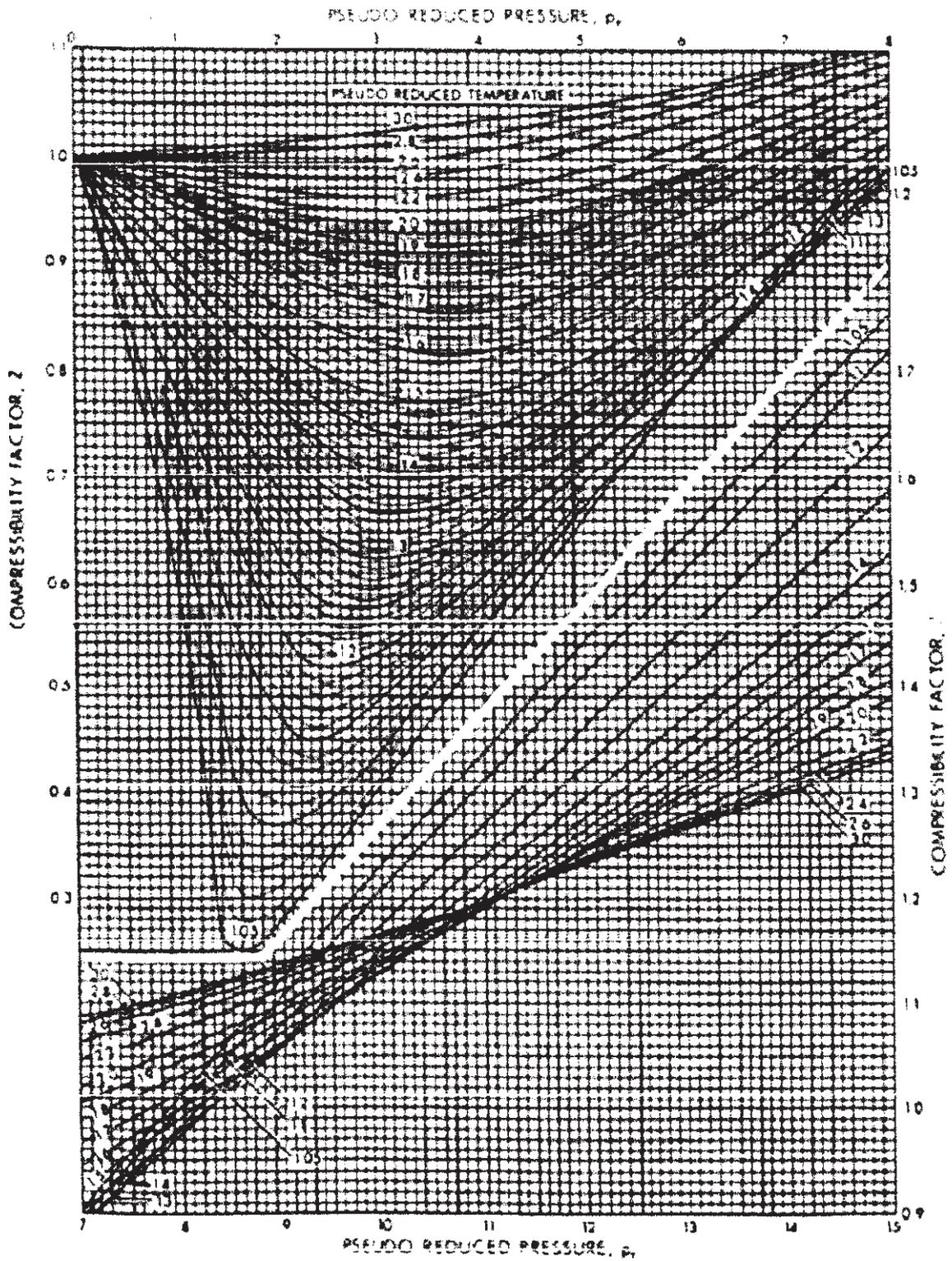
- Q5) a) i)** What is the criterion for choosing a H<sub>2</sub>S removal process? [9]
- ii)** Draw a process flow diagram showing the removal of Hydrogen Sulphide and explain the process? [10]
- b)** Write chemical reactions involved in sponge iron process and Alkanolamine process? [6]

**Q6)** What is the criterion for choosing a CO<sub>2</sub> removal process? Draw a process flow diagram showing the removal of carbon dioxide and explain the process? [16]

**Q7)** Calculate the gas flow rate in cubic ft/hr through a horizontal pipeline. Data given: D = 12.09, L = 1000 miles, e = 0.0006 in, T = 80F, Specific gravity of gas = 0.7, Tb = 520R, Pb = 147 psia, P1 = 600 psia, P2 = 200 psia, f = 0.01223, Z = 0.9188,  $\mu = 0.0099\text{cp}$ . [16]

- Q8) a)** Explain effect of liquid loading in gas wells? [9]
- b)** Write about gas compression processes? [9]

| Compound         | Chemical Composition           | Symbol (for calculations) | Molecular Weight | Critical Pressure (psf) | Critical Temp. (R) |
|------------------|--------------------------------|---------------------------|------------------|-------------------------|--------------------|
| Methane          | CH <sub>4</sub>                | C <sub>1</sub>            | 16.04            | 673                     | 344                |
| Ethane           | C <sub>2</sub> H <sub>6</sub>  | C <sub>2</sub>            | 30.07            | 709                     | 550                |
| Propane          | C <sub>3</sub> H <sub>8</sub>  | C <sub>3</sub>            | 44.09            | 618                     | 666                |
| iso-Butane       | C <sub>4</sub> H <sub>10</sub> | i-C <sub>4</sub>          | 58.12            | 530                     | 733                |
| n- Butane        | C <sub>4</sub> H <sub>10</sub> | n-C <sub>4</sub>          | 58.12            | 551                     | 766                |
| iso-Pentane      | C <sub>5</sub> H <sub>12</sub> | i-C <sub>5</sub>          | 72.15            | 482                     | 830                |
| n-Pentane        | C <sub>5</sub> H <sub>12</sub> | n-C <sub>5</sub>          | 72.15            | 485                     | 847                |
| n-Hexane         | C <sub>6</sub> H <sub>14</sub> | n-C <sub>6</sub>          | 86.17            | 434                     | 915                |
| n-Heptane        | C <sub>7</sub> H <sub>16</sub> | n-C <sub>7</sub>          | 100.2            | 397                     | 973                |
| n-Octane         | C <sub>8</sub> H <sub>18</sub> | n-C <sub>8</sub>          | 114.2            | 361                     | 1024               |
| Nitrogen         | N <sub>2</sub>                 | N <sub>2</sub>            | 28.02            | 492                     | 227                |
| Carbon Dioxide   | CO <sub>2</sub>                | CO <sub>2</sub>           | 44.01            | 1,072                   | 548                |
| Hydrogen Sulfide | H <sub>2</sub> S               | H <sub>2</sub> S          | 34.08            | 1,306                   | 673                |



Total No. of Questions : 10]

SEAT No. :

**P4056**

**[4760]- 478**

[Total No. of Pages :2

**M.E. (Petroleum)**

**ARTIFICIAL LIFT TECHNIQUES  
( 2008 Course) (Semester- II)(512111 a) (Elective-III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from Section-I and Section-II each.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** Classify different types of artificial lift systems and discuss the working of Continuous gas lift, Intermittent gas lift and SRP in brief. **[18]**

**Q2)** Discuss usability of PCP, SRP and jet pump only in terms of excellent/good/fair/poor in a tabular form for following well conditions. Low PI, Low GOR, adaptability to deviated wells, capability to produce sand and high volume lift capability. **[16]**

**Q3) a)** Calculate the casing pressure at 8000 ft, required to open the valve if,  $A_b = 0.75 \text{ inch}^2$ ,  $R = 0.087$ ,  $P_d = 740 \text{ Psi}$ ,  $P_t = 330 \text{ psi}$ . What is the tubing effect caused by tubing pressure? How much pressure it would require to open the valve in the casing if, tubing pressure is zero psi at valve depth. Also explain meaning of spread and find its value for this valve. **[8]**

b) Draw the schematic sketch and explain any one type of gas lift valve. **[8]**

**P.T.O.**

- Q4) a)** Which method or methods of artificial lifting you will propose for the following requirements and Why? Write in brief. [8]  
i) Heavy oil production from unconsolidated formation along low GOR.  
ii) High GOR, low production rate wells.

- b) Write and explain the procedure to decide depth of point of gas injection in case of continuous gas lift. [8]

- Q5) a)** Draw neat schematic sketch of surface and subsurface components of an ESP and indicate them. [8]  
b) Draw typical standard performance curve for an electrical submersible pump and define all the parameters required to read it. [8]

### SECTION-II

- Q6)** Draw neat schematic sketch of surface and subsurface set up of Sucker rod pumping system and discuss working of it in detail. [16]

- Q7)** Derive equation to know ideal counterbalance and calculate: PPRL, MPRL, counterbalance required and peak torque for following well conditions. Pumping depth = 7000ft, Desired fluid production = 200 bpd, Stroke length = 64 in, Volumetric efficiency = 73%, Pumping speed = 20 spm, Pump diameter = 1<sup>1/4</sup> inch. Rod number = API No.76(1.791 lb/ft), Fluid specific gravity = 0.95. Torque factor = 34. Indicate all the components. [18]

- Q8)** Draw the typical graphs to demonstrate the following: [16]  
a) Reservoir inflow Vs tubing outflow for increasing tubing, diameters. Show three tubing sizes.: Natural Flow conditions.  
b) Choke performance curves.  
c) Pressure drop inside a production tubing Vs production rate at optimum GLR point for various values of GLR.  
d) Production rate Vs tubing diameter to demonstrate liquid loading conditions.

- Q9)** What is nodal analysis? Discuss it in detail, along with examples. [16]

- Q10)** Write short notes on, [16]  
a) Formation damage.  
b) Properties of Fracturing fluids.  
c) Design considerations in acidization job.  
d) DST and RFT.



Total No. of Questions : 6]

SEAT No. :

**P3758**

**[4760]-48**

[Total No. of Pages : 2

**M.E. (Civil-Structures)**  
**MANAGEMENT IN STRUCTURAL ENGINEERING**  
**(2008 Course) (Semester-II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume Suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Differentiate time study and motion study on the basis of concept and application. **[10]**
- b) Explain the concept of interpersonal behavior. **[5]**
- c) What are the functions of finance management? Also explain the key activities of finance manager. **[10]**
- Q2)** a) What are the principles advocated by ISO for maintaining the quality. **[9]**
- b) Explain, in detail, the working of fire extinguisher. **[8]**
- c) Explain the factors affecting durability of concrete. **[8]**
- Q3)** a) Explain the working principle of: **[15]**
- i) Hammer test
  - ii) Ultrasonic pulse velocity method.
  - iii) Half cell electric potential test.

***P.T.O.***

- b) Enlist the parameters to be included in structural audit report. [5]
- c) Discuss the applications of structural audit report. [5]

**SECTION-II**

- Q4)** a) Differentiate between retrofitting, restoration and rehabilitation. [5]
- b) Explain the different chemical based methods used for restoration. [10]
  - c) Write specifications for: [10]
    - i) RCC jacketing.
    - ii) sealing of honeycombed areas with cement mortar.
    - iii) shear wall.
- Q5)** a) Differentiate between jump form and slip form. [8]
- b) Explain the different methods adopted for construction safety. [9]
  - c) Explain the different methods of material handling. [8]
- Q6)** Write short note on : [25]
- a) Planning and execution of demolition.
  - b) Recycling of demolition waste.
  - c) Role of structural drawings in demolition of structure.
  - d) Method of implosion.
  - e) Demolition plan.



Total No. of Questions : 8]

SEAT No. :

**P4057**

**[4760]-480**

[Total No. of Pages : 3

**M.E. (Petroleum Engineering)**  
**PIPING DESIGN AND ENGINEERING**  
**(2008 Course) (Elective-III-C) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any two questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

- Q1) a)** A 150 NB schedule 40 pipe (OD = 168.28mm) is employed to gaseous products at 40 bar pressure. Material of construction is carbon steel with safe stress value of 850 kg/cm<sup>2</sup> at the operating temperature. Joint efficiency factor = 85% and corrosion allowance = Nil. **[15]**

Other data supplied:

- i) Moment of Inertia for 150 NB schedule 40 pipe (I) = 1170 cm<sup>4</sup>
- ii) Section Modulus (z) = 140 cm<sup>3</sup>
- iii) Weight of empty pipe = 30 kg per meter.
- iv) Weight of pipe, full of water = 48 kg per meter.
- v) Take E = 2.1 × 10<sup>6</sup> kg/cm<sup>2</sup>.

Calculate the following:

- 1) Longitudinal tensile stress due to internal pressure.
  - 2) Safe support span (weight of gaseous products being small can be ignored)
  - 3) Safe span if same pipe is employed for water service at the same temperature.
- b) Write a brief note on: Pipeline construction for cross country and offshore systems. **[10]**

**P.T.O.**

- Q2)** a) Discuss in detail leak detection and emergency planning consideration for piping system. [12]
- b) Discuss in brief flow patterns and flow regimes in multiphase mixtures. [13]
- Q3)** a) Write short notes on: [10]
- i) Basic design considerations for pipeline facilities.
- ii) HAZOP Studies.
- b) Discuss in brief piping fabrication and inspection and non-destructive testing methods used in Piping Engineering and design. [15]
- Q4)** a) Discuss in brief Piping systems for petroleum products, yard piping. [13]
- b) Discuss in brief the issues in Line sizing for steam, vacuum and slurry pipeline. [12]

### SECTION-II

- Q5)** Write short notes on: [25]
- a) Piping Networks.
- b) Expansion Loop for pipeline systems.
- c) Thermal Insulation for piping systems.
- Q6)** a) Calculate the minimum required wall thickness and choose suitable pipe schedule for 250 NB (OD = 273 mm) pipe under following conditions: [15]

Internal Pressure = 30 kg/cm<sup>2</sup>

Joint efficiency factor = 85%

Corrosion allowance = 1.7mm

Material of construction = Carbon steel, having maximum allowable stress = 900 kg/cm<sup>2</sup> at operating temperature

Assume standard mill tolerance

Also calculate maximum allowable internal pressure for above pipe of adopted schedule.

b) Write a note on: Plot plan and Equipment Layout [10]

**Q7) a)** Discuss various factors to be considered for piping design for flow through perforated pipes and porous media. [10]

b) Sand of a mean diameter 0.2mm is to be conveyed in water flowing at 0.5 kg/s in a 25 mm ID horizontal pipe 100 m long. What is the maximum amount of sand which may be transported in this way if the head developed by the pump is limited to 300 kN/m<sup>2</sup>? Assume fully suspended heterogeneous flow. [15]

**Q8)** A process vessel is to be designed for the maximum operating pressure of 500 kN/m<sup>2</sup>. The vessel has the nominal diameter of 1.2 m and tangent to tangent length of 2.4m. The vessel is made of IS: 2002:1962 Grade 2B quality steel having allowable design stress value of 118 MN/m<sup>2</sup> at working temperature. The corrosion allowance is suggested to be 2mm for the life span expected for the vessel. The vessel is to be fabricated according to class 2 of Indian Standard specifications which stipulate the weld joint efficiency of 0.85. [25]

a) Determine the standard plate thickness to fabricate this vessel.

b) If the spherical vessel having the same diameter and thickness is fabricated with the same quality steel, what maximum internal pressure the sphere will withstand safely?



Total No. of Questions : 8]

SEAT No. :

**P4058**

[Total No. of Pages : 2

**[4760] - 485**

**M.E. (IT) (Semester - I)  
APPLIED ALGORITHMS  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**SECTION - I**

- Q1) a)** Prove the following by contradiction: **[4]**  
“There are infinitely many prime numbers”
- b)** Solve the following Recurrences. **[8]**
- i)  $t(n) = \begin{cases} 0 & , \text{if } n = 0 \\ 2t_{n-1} + 1 & , \text{otherwise} \end{cases}$
- ii)  $t(n) = \begin{cases} 0 & , \text{if } n = 0 \\ 1 & , \text{if } n = 2 \\ 2t_{(n/2)} + 2, & \text{if } n > 2 \end{cases}$
- c)** What is Mathematical Induction? Prove the following by MI: **[6]**  
Function square(n) {  
if (n=0) then return 0;  
Else return 2n + square(n-1)-1 }
- Q2) a)** What is worst case, average case and best case time complexity of an algorithm? Write merge sort algorithm and analyze the same to find out its worst case, average case and best case complexity. **[8]**
- b)** Write an algorithm for quick sort and prove that worst case time complexity of quick sort is  $O(n^2)$ . **[8]**
- Q3) a)** What is B-Tree? Explain working of insertion operation of B-Tree with example. **[8]**
- b)** You are given the Cartesian coordinates of n points on a plane. Give an algorithm to compute the closest pair of points in a time of  $O(n \log n)$  in the worst case. **[8]**

**P.T.O.**

- Q4)** a) What is Convex Hull? Write and explain jarvis march algorithm to find convex hull. [8]  
 b) What is voronoi diagrams? Explain with example. Give its applications. [8]

**SECTION - II**

- Q5)** a) Write and explain Floyd-Warshall's Algorithm to compute Transitive Closure of the graph.(Assume Suitable Graph). [8]  
 b) What is online and offline algorithms? Explain with suitable examples.[8]

- Q6)** a) What is persistence data structure? Explain delete operation in Splay tree. [8]  
 b) Find the optimal tour for the instance of traveling sales person problem given below using approximation algorithm. [10]

|    |    |    |    |
|----|----|----|----|
| 0  | 19 | 14 | 16 |
| 19 | 0  | 17 | 12 |
| 14 | 17 | 0  | 13 |
| 16 | 12 | 18 | 0  |

- Q7)** a) Differentiate between [8]  
 i) CRCW v/s CREW  
 ii) EREW v/s. CREW  
 b) What is red-black tree? Write an algorithm for red-black tree delete operation. [8]

- Q8)** a) Write and explain PRAM's list ranking algorithm. What is its time complexity? [8]  
 b) Write short note on: [8]  
 i) NP-Hard Problems  
 ii) Approximate Algorithms



Total No. of Questions : 8]

SEAT No. :

**P4059**

[Total No. of Pages : 2

[4760] - 486

M.E. (IT)

**SOFTWARE ENGINEERING METHODOLOGIES**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section .*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) The incremental model delivers a series of releases called increments that provide progressively more functionality for the customers as each increment delivers. Discuss this statement with an example of a hypothetical system. **[9]**
- b) What are the advantages of providing static and dynamic views of the software process in RUP and Agile. **[9]**
- Q2)** a) Explain why inheritance is a potentially error-prone construct? Why its use should be minimized when developing critical systems in an object-oriented language? **[8]**
- b) Compare spiral model and RUP based on similarities and dissimilarities. **[8]**
- Q3)** a) Suppose a program for solving a problem costs C and a software for solving that problem costs 9C. Where do you think this extra 8C cost is spent? Suggest a possible breakdown of this extra cost. **[8]**
- b) What is Automatic Static Analysis? Which fault classes are checked by Static Analysis? **[8]**

**P.T.O**

- Q4)** Write short note : **[16]**
- a) Distributed systems architecture.
  - b) Extreme programming.
  - c) MVC framework for GUI design.
  - d) Hardware and software requirements the tablet PC.

**SECTION - II**

- Q5)** a) Explain with suitable example the intermediate COCOMO model. **[8]**  
b) Explain the following features of an activity diagram with reference to a hypothetical online bus booking system. Concurrency, adornments for activity edges, input/output pins, activity partitions. **[8]**
- Q6)** a) Explain any one design metric. Why design metrics are, by themselves, an inadequate method of predicting design quality? **[8]**  
b) What are the principal activities in software quality management? What is quality assurance? What are the standards that may be established as a part of quality assurance process? **[8]**
- Q7)** a) Draw state machine model and thread diagram for the following system :  
“The software which controls a compact disc player”. **[8]**  
b) Explain why regression testing is necessary and how automated testing tools can assist with this type of testing. **[8]**
- Q8)** Write Short Note : **[18]**
- a) Nonfunctional Software requirements.
  - b) Object oriented principals and their advantages.
  - c) Risk management.
  - d) Control testing and integration testing.



Total No. of Questions : 12]

SEAT No. :

**P4060**

**[4760] - 487**

[Total No. of Pages :3

**M.E. (I.T.)**

**ADVANCED OPERATING SYSTEMS**

**( 2008 Course) (Semester - I) (Elective-I)**

*Time :3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 from section I and Q7 or Q8, Q9 or Q10, Q11 or 12 from section II.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain any five Unix commands for system administration. [10]  
b) Explain any two Inter process communication mechanisms. [8]

OR

- Q2)** a) Differentiate between multiuser and multitasking O.S. Explain the architecture of any multiuser operating system. [10]  
b) Give the significance of process synchronization primitives. Explain any two Process synchronization primitives. [8]

- Q3)** a) Enlist and explain services performed by Multitasking OS. [8]  
b) Explain the concept of Mailbox in multitasking OS. Give the Functional Specification of primitive CreateMBox (). [8]

OR

- Q4)** a) Explain the various System Lists maintained by KMOS. [8]  
b) Draw and explain process state transition diagram in KMOS. [8]

**P.T.O.**

- Q5)** a) Discuss the design issues of Multiprocessor Systems. [8]
- b) Explain various interconnection types with eg. What are the differences between Separate supervisors and Master-Slave Systems? [8]

OR

- Q6)** a) Discuss the various multiprocessor design considerations. [8]
- b) Explain the wave scheduling with eg. [8]

### SECTION - II

- Q7)** a) Define Zones. Describe the data structure required for Zone management. [10]
- b) Explain the following system calls with eg. [8]
- i) kcalloc()
- ii) kfree

OR

- Q8)** a) Differentiate between kcalloc() and vmalloc() system calls with example. [10]
- b) Explain the concept of statically allocating on the stack. [8]
- Q9)** a) Discuss I/O structure and role of DMA. [8]
- b) Explain the characteristics of I/O devices. [8]

OR

- Q10)**a) Explain the concept of disk caching with suitable example. [8]  
b) What is an I/O interface? Explain in detail its type. [8]

- Q11)**a) Explain system calls [8]  
i) mount  
ii) read  
iii) lseek  
iv) link  
b) Explain in detail VFS. [8]

OR

- Q12)** Write short notes on following: [16]  
a) Slab coloring.  
b) File descriptors  
c) Contiguous memory management  
d) File Unification.



Total No. of Questions : 8]

SEAT No. :

**P4061**

**[4760]-488**

[Total No. of Pages :2

**M.E. (Information Technology)  
SOFTWARE ARCHITECTURE**

**(Theory)(2008Course) (Elective-I) (Semester-I)(514404A)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Assume Suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain following with suitable example: [6]  
i) Behavior of each software element is a part of architecture.  
ii) Architecture is the overall structure of the system.  
b) Explain different engineering concerns addressed by different views.[12]
- Q2)** a) Explain the following software architecture terminology: [6]  
i) Architectural style and architectural pattern.  
ii) Reference architecture and domain specific software architecture.  
iii) Product-line Architecture.  
b) What is execution architecture view? Explain design of execution architecture view with suitable example. [10]
- Q3)** a) Why Document software architecture. Brief seven rules for sound documentation? [8]  
b) What are Archetypes? What are business archetypes? Explain in brief archetype patterns and analysis patterns. [8]
- Q4)** a) Explain any two of the following design patterns in details: [10]  
i) Builder  
ii) Proxy  
iii) Iterator.

***P.T.O.***

- b) Consider an application where there is an excel sheet to hold exam results i.e student-wise marks. We could like to draw a Bar-chart showing comparison of individual students as well as PIE chart to show comparison between total passed, failed and First class students. [6]
- i) What is observer pattern?
- ii) Show how observer pattern can be applied in above scenario.

## SECTION II

- Q5)** a) Explain how design patterns solve design problems. [8]
- b) “Chain of responsibility, a behavioral pattern, provides loose coupling between sender of request to its receiver”. Explain [8]
- Q6)** a) Discuss design and programming challenges associated with building concurrent and network systems. [8]
- b) Write in brief on any two: [8]
- i) Patterns for distributed computing.
- ii) Fault tolerance and exception handling.
- iii) LOOKUP as resource management pattern.
- Q7)** Explain any three of the following concept: [16]
- i) Database Oriented Middleware and EAI.
- ii) User Interface Level EAI.
- iii) Transactional Middleware and EAI.
- iv) Levels of EAI.
- Q8)** a) What is Domain Logic pattern? Explain any three primary patterns in Domain Logic. [6]
- b) Explain the following: [12]
- i) Web Services.
- ii) Data Source architectural pattern.
- iii) XML: Optimistic and Pessimistic concurrency control.



Total No. of Questions : 10]

SEAT No. :

**P4062**

**[4760] - 489**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**REAL TIME AND EMBEDDED SYSTEMS**  
**(Elective - I) (2008 Course) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions for each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are embedded computing system? Explain with diagram, Discuss challenges in embedded computing system design. **[8]**
- b) Briefly describe functional Vs. nonfunctional requirement of embedded computing system. **[8]**
- Q2)** a) What are interrupt source in ARM processor describe the interrupt mechanism in ARM processor briefly. **[8]**
- b) Draw the functional block diagram of SHARC processor and discuss each block in brief. **[8]**
- Q3)** a) Explain embedded system design process with stages and what are the support tools required for the embedded system design process. **[9]**
- b) Write the feature of the I2C bus, explain the design benefits with I2C bus. **[9]**
- Q4)** a) Briefly describe the major level of abstraction in the embedded system design process. Discuss the requirement stage in detail. **[8]**
- b) List various modes of operation of ARM processor and discuss these modes with respect to their operational usability. **[8]**

***P.T.O.***

- Q5)** a) How bus arbitration is handled in I2C bus explain with the help of state transition graph for I2C bus master. [8]
- b) Explain with diagram the CAN bus data packet format. [8]

## SECTION - II

- Q6)** a) What are advantages and disadvantages of cyclic scheduler? [8]
- b) What is CRC card methodology? Discuss the steps necessary for analyzing the system for using this methodology. [8]
- Q7)** a) Draw flow chart for Ethernet CSMA/CD algorithm and explain the same. [8]
- b) Discuss and show that clock driven scheduling performs better in deterministic system. [8]
- Q8)** a) Explain the Design review process and set of documents required for the same. [10]
- b) What are assumption for Priority driven scheduling of periodic tasks. [8]
- Q9)** a) Give the classification of the scheduling algorithm, compare and contrast static Vs. dynamic algorithm with example. [8]
- b) Briefly describe the difference between waterfall and spiral development module. [8]
- Q10)** Write short notes on any four: [16]
- a) Debugging tools in embedded system.
  - b) Schedulable set of jobs and optimal scheduling.
  - c) Quality assurance in embedded system.
  - d) Timing constraints in Real Time System.
  - e) Concurrent engineering.



Total No. of Questions : 6]

SEAT No. :

**P3759**

**[4760]-49**

[Total No. of Pages : 2

**M.E. (Civil-Structure)**

**EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**

**(2008 Course) (Semester - II) (Elective - III)**

*Time : 4 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Attempt any two questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non programmable electronic calculator is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *Use of IS 1893 (2002) Part -I is permitted.*

**SECTION - I**

- Q1)** a) What are the causes of earthquake? Explain with neat sketches the elastic Rebound Theory? **[7]**
- b) Classify and describe with suitable sketches, different types of waves generated by an earthquake. **[8]**
- c) Describe the difference between magnitude and intensity of an earthquake? **[10]**
- Q2)** a) What are the lessons learnt from past earthquakes? Explain philosophy behind earthquake resistant design of structures? **[10]**
- b) Explain the interior of the earth with neat sketches? Classify the earthquakes based on different parameters? **[15]**
- Q3)** Determine the design eccentricity in Y-direction for a three storey building as shown in Figure 3.1. The total seismic weight /floor = 450 kN. The column size = 400mm X 600 mm. Assume grade of concrete = M25. **[25]**

**P.T.O.**

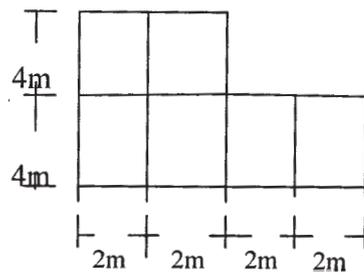


Figure 3.1

### SECTION - II

- Q4)** a) What is the necessity of ductile detailing? Explain with neat sketches the detailing for flexural member as per IS 13920 (1993) [10]
- b) What is liquefaction of soil? Explain the effects and various methods to reduce the effects of lequefaction? [15]
- Q5)** a) Define the shear wall and its classification? Describe the structural behavior of shear wall? [10]
- b) What is Base Isolation? Explain energy dissipation devices to improve earthquake resistance of buildings? [15]
- Q6)** a) What is strengthening and retrofitting? Explain in brief the techniques for retrofitting of traditionally build constructions? [10]
- b) Explain the terms active and passive control system? What are different types of steel frames used in earthquake prone areas. [15]

*EEE*

Total No. of Questions : 12]

SEAT No. :

**P4063**

**[4760] - 490**

[Total No. of Pages :3

**M.E. (Information Technology)**

**BIOINFORMATICS**

**(514422 C) (Elective - I) (2008 Course) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer Question 1 or 2, 3 or 4, 5 or 6 from Section - I and question 7 or 8, 9 or 10, 11 or 12 from Section - II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain Central Dogma of Molecular Biology. Why is Bioinformatics referred to as an information science? [8]
- b) Enlist the major databases in Bioinformatics. Which databases play a major role in protein structure prediction? [8]

OR

- Q2)** a) Explain the various tools for information retrieval in bioinformatics. [8]
- b) State the various data mining techniques in Bioinformatics. Explain any four. [8]

- Q3)** a) Explain the concept of DNA replciation in bioinformatics. [8]
- b) Explain the terms Intons and Exons and their significance. [8]

OR

- Q4)** a) List different algorithms in Bioinformatics. What is the significance of Genome rearrangement in the field of Bioinformatics? [8]
- b) Discuss protein purification and characterization in detail. [8]

*P.T.O.*

- Q5) a)** Write short notes on: **[10]**
- BLAST
  - Pairwise Sequence Alignment (PSA).
- b) What are the types of machine learning processes? Explain any two machine learning processes. **[8]**

OR

- Q6) a)** Explain Hidden Markov model for Sequence Alignment. What is Gene Mapping? **[10]**
- b) Explain significance of FASTA matches and steps followed in a FASTA search. **[8]**

### **SECTION - II**

- Q7) a)** What are the various types of structure prediction methods for genes? Explain Gene mapping in detail and its need. **[10]**
- b) What is multiple sequence alignment? Explain algorithms that perform multiple sequence alignment. **[8]**

OR

- Q8) a)** List the various gene structure prediction methods. Explain any two in detail with appropriate examples. **[10]**
- b) What are microarrays? Explain the spotting process in microarrays for data analysis. **[8]**

- Q9) a)** Explain Genomics and Proteomics with their similarities and differences. **[8]**
- b) Explain the need of structure visualization in Bioinformatics. Discuss any one technique for structure visualization in detail. **[8]**

OR

- Q10) a)** Explain the need of Protein Folding in Bioinformatics. Which databases in Bioinformatics support protein folding visualization? **[8]**
- b) Discuss Protein Structure classification in brief. **[8]**

- Q11)a)** What is drug receptor? Explain the role of drug receptors in Drug Discovery. [8]
- b) How does drug discovery help in targeting drugs for disease diagnosis? [8]

OR

- Q12)a)** Discuss how drug discovery is helpful in Bioinformatics with neat diagram. [8]
- b) Discuss cell cycle in detail for Bioinformatics. [8]



Total No. of Questions : 8]

SEAT No. :

**P4064**

[Total No. of Pages : 2

[4760] - 491

**M.E. (IT) (Semester - I)**

**INFORMATION ASSURANCE & SECURITY**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answers to the two sections should be written in separate answer books*
- 2) *Answer three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain any one tool that is used for digital forensics. [9]  
b) What are the domains of Security standard ISO 27001. [9]
- Q2)** a) What are replay attacks and SQL injection? [8]  
b) What are different types of hackers? Explain. [8]
- Q3)** a) Explain Covering tracks in hacking. [8]  
b) Write short note on cyber safety in the internet Server. [8]
- Q4)** a) Explain IPSEC tool of VPN. [8]  
b) Explain IDS systems. [8]

***P.T.O.***

## SECTION - II

- Q5)** a) Explain principals of cryptography design protocol. [9]  
b) State any 4 sections of IT law 2000. [9]
- Q6)** a) Explain online payment systems. [8]  
b) Draw diagram of wireless system and also list the safety measures. [8]
- Q7)** a) List and state antivirus tools. [8]  
b) Plan and write an information security policy for a hospital. [8]
- Q8)** a) Write security policies for email access in organization. [8]  
b) Compare symmetric and asymmetric key systems. [8]



Total No. of Questions : 8]

SEAT No. :

**P4065**

[Total No. of Pages : 2

[4760] - 492

**M.E. (Information Technology)**  
**NETWORK PROGRAMMING (Elective - II)**  
**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer three questions from each section.*
- 2) *Answer three questions from Section I and three questions from Section II.*
- 3) *Answers to the two sections should be written in separate answer books*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Draw and explain the allocation of port number schemes. [8]  
b) Explain TCP State Transition Diagram for Opening & Closing a connection. [8]
- Q2)** a) Explain why would an application call shutdown with an argument of SHUT\_RDWR instead of just calling close? [8]  
b) Write a program to establishes a TCP connection with a server and the server simply sends back the current time and date in a human-readable format. [8]
- Q3)** a) Write detailed steps that allow an IPV4 TCP client to communicate with an IPV6 server with suitable diagram. [8]  
b) List types of operations are supported on a routing socket and explain types of messages exchanged across a routing socket. [8]

***P.T.O.***

**Q4)** Write short notes on : **[18]**

- a) Byte Ordering Functions.
- b) Byte Manipulation Functions.
- c) Buffer Sizes & Limitations.

**SECTION - II**

**Q5)** a) Write a program to issue RTM\_GET Command on routing Socket. **[8]**

b) Define following resource records (RR). **[8]**

- i) AAAA ii) PTR
- iii) MX iv) CNAME

**Q6)** a) Write a program that prints the default TCP, UDP and SCTP send and receive buffer sizes and run it on the systems to which you have access. **[8]**

b) Assume two TCP clients start at about the same time. Both set the SO\_REUSEADDR socket option and then call bind with the same local IP address and the same local port (say 1500). But, one client connects to 198.69.10.2 port 7000 and the second connects to 198.69.10.2 (same peer IP address) but port 8000. Describe the race condition that occurs. **[8]**

**Q7)** a) Explain the use of get host by name and get servby name with detailed Program. **[8]**

b) Why does the parent keep the listening socket open instead of closing it after all the children are created? Explain with suitable code. **[8]**

**Q8)** Write short notes on : **[18]**

- a) SNTP
- b) Iterative Server
- c) Interoperability of IPv6 Client.



Total No. of Questions : 10]

SEAT No. :

**P4066**

[Total No. of Pages : 2

[4760] - 493

**M.E. (Information Technology)**

**GEOGRAPHICAL INFORMATION SYSTEMS (Elective - II)**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Solve any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What is a cartographic model? What is qualitative and quantitative mapping? [8]
- b) Explain the main software components of a geographical information system. [8]
- Q2)** a) Explain GIS architecture with suitable diagram. Identify the fundamental GIS operations. [8]
- b) Enlist and explain the essential elements of effective GIS operations?[8]
- Q3)** a) Explain Vector data representation model with example. [8]
- b) What are the common errors in GIS database? Explain with suitable examples how these errors can be corrected? [8]
- Q4)** a) Compare Raster and Vector data models. Comment on Raster and Vector data structures. [8]
- b) What are the data quality components in GIS? Explain the different types of accuracy applicable to GIS data. [8]

**P.T.O.**

- Q5)** a) Explain the factors affecting microwave measurements. [9]  
b) What are sensor parameters? Explain the three types of resolutions. [9]

## SECTION - II

- Q6)** a) Explain various preprocessing methods required to be applied on remotely sensed raw data. [8]  
b) Explain the image enhancement techniques and their significance in image processing of GIS images. [8]

- Q7)** a) Explain the image transformations relevant for remote sensing community. [8]  
b) What is interpretation? Explain the various methods for interpretation. [8]

- Q8)** a) Write in details about different forms of kriging. [8]  
b) Explain the process of spatial data processing with example. [8]

- Q9)** a) Define and compare : Geo Coding and Geo Referencing. [8]  
b) Explain the application of GIS and remote sensing in hazard mitigation and water shed management. [8]

**Q10)** Write a short note on following : [18]

- a) Triangular Irregular Network
- b) Drainage texture
- c) Radar Principle
- d) Spatial Resolution.



Total No. of Questions : 12]

SEAT No. :

**P4067**

[Total No. of Pages : 2

**[4760]- 494**

**M.E. (Information Technology)  
NET CENTRIC COMPUTING  
(2008 Pattern) (Elective - III)**

*Time : 3 Hours]*

*[Max Marks :100*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Enlist the network elements and draw a neat diagram of network architecture. [8]
- b) Explain the process of evolving today's network from telephone network. [8]

OR

- Q2)** a) Explain the packet transmission process in datagram and virtual circuit network. [8]
- b) Describe principles of communication network. [8]

- Q3)** a) Explain in detail various delays in ATM networks. [10]
- b) Explain in brief wave-division multiplexers system. [8]

OR

- Q4)** a) Describe basic architecture of wireless networks. [6]
- b) Draw a neat diagram of ATM header. And explain the header structure. [6]
- c) Explain ATM Adaptation layer. [6]

- Q5)** a) How control decisions are taken in circuit switched, datagram, and virtual circuit network. [8]
- b) How queuing theory calculates utilization of server? [8]

**P.T.O.**

OR

- Q6)** a) Explain in detail parameters specified in the Quality of Service. [8]  
b) State different algorithms to carry out dynamic routing optimization?[8]

**SECTION - II**

- Q7)** a) Discuss the importance of KEEPALIVE message in BGP. [8]  
b) Explain two-crossing problem in mobile IP routing. [8]

OR

- Q8)** a) Describe label swapping in IP switching. [8]  
b) Describe in detail concept of NAT and its variants. [8]

- Q9)** a) Explain in detail addressing and formats of mobile IP. [8]  
b) Describe in detail various features of IPv6. [8]

OR

- Q10)**a) Define auto configuration and explain renumbering in IPv6. [8]  
b) Describe H.323 a protocol suit for IP telephony. [8]

- Q11)**a) State phases of Destination-Sequenced Distance-Vector protocol used in MANET. [9]  
b) Explain working of DSR protocol for ad hoc networks. [9]

OR

- Q12)**Write short notes on: [18]  
a) Link-clustered architecture for a network.  
b) Challenges of Ad hoc networks.  
c) Taxonomy of various Routing protocols.



Total No. of Questions : 8]

SEAT No. :

**P4068**

[Total No. of Pages : 2

[4760] - 495

**M.E. (I.T.) (Semester - II)**

**ADVANCED TRENDS IN DATABASE SYSTEM**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is a Distributed Database? Explain the architecture of Distributed Database. [10]
- b) Explain and state difference between centralized and client server architecture. [6]
- Q2)** a) Explain subject-oriented, integrated, time-variant, nonvolatile with respect to Data Warehousing in detail. [8]
- b) What is Data Cube? Explain difference between OLAP and OLTP. [8]
- Q3)** a) What is Data Mining? Explain the steps in knowledge Discovery? [8]
- b) Explain multidimensional model with suitable example. [8]
- Q4)** Write Short Notes on (any three) [18]
- a) Metadata
  - b) Load Manager in Data Warehousing
  - c) XML Facets
  - d) Dashboards

***P.T.O.***

## SECTION - II

- Q5)** a) Explain what is ECA? Enlist the applications of active databases. [8]  
b) Discuss the design and implementation issues in active databases. [8]
- Q6)** a) State difference between object oriented and object relational databases. [8]  
b) What are TP Monitors? Explain 3 Tier TP Monitor Architecture. [8]
- Q7)** a) Explain Web Crawler Architecture with suitable diagram and how is it different from Web Mining. [8]  
b) Discuss the Challenges with Web Mining. [8]
- Q8)** Write Short Notes on (any three) [18]
- a) Data Mart
  - b) Collaborative Filtering
  - c) Business Intelligence
  - d) Cloud Data Store



Total No. of Questions : 10]

SEAT No. :

**P4069**

**[4760] - 496**

[Total No. of Pages :3

**M.E. (Information Technology)**

**MANAGEMENT TRENDS IN INFORMATION TECHNOLOGY**

**(2008 Course) (Semester - II) (514427)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any THREE questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** What is ERP? What are the benefits of Enterprise Resource Planning in any organization? **[8]**
- b) “Pay-thru-me” (PTM) is a small enterprise providing household related services to about 1000 customers. Most of their customers are regular customers and rely on PTM for their bill payment, grocery purchase and bank related processes. You as a system analyst need to give IT solution. What activities you would automate to make services effective? **[8]**
- Q2) a)** What are software efforts? Explain with a neat sketch; the steps involving in the software efforts and cost estimation process. **[8]**
- b) Discuss the performance of Indian IT industry with particular reference to ITS and ITeS. Which sectors are the major consumers of IT in India at present and which sectors offers greater potential in future? **[8]**
- Q3) a)** What is project plan? Explain five distinct aspects which the Project Manager should consider when preparing a project communications plan. **[8]**
- b) How do you go about deciding the applications of computers in a business organization? Give examples of IT application in the industries like railways and insurance. **[8]**

***P.T.O.***

- Q4)** a) Define a milestone in the software development. How it is represented in the WBS? [8]
- b) Discuss on the efforts measures in software estimation process. State their significance and purpose. [8]

**Q5)** Discuss any three of the following: [18]

- a) MIS and Decision Support
- b) Business Process Re-Engineering
- c) PCMM
- d) Supply Chain Management
- e) Learning Organizations

## **SECTION - II**

- Q6)** a) GRP Institute of Management has decided to opt for automated management system for their admission process. As an expert, You are asked to list the major modules to be considered and estimate the cost of such management system. [8]
- b) Compare and contrast the issues of CPM and PERT model. Illustrate the use of network diagram for CPM analysis. [8]
- Q7)** a) As a RFID steering committee head, suggest a suitable RFID system implementation for an electronic toll collection, monitoring and receipt printing system for Maharashtra Government. The system will be implemented at 65 toll plazas throughout the State of Maharashtra. [8]
- b) Explain two types of team-building activities of Project Human Resource Management. [8]
- Q8)** a) Explain the major parts in building the software quality assurance (SQA) plan and its role in product development life cycle. [8]
- b) Are IT companies taking enough care of employee welfare? If not; what suitable actions could be taken from government in this respect. [8]

**Q9) a)** Explain the importance of ethics in IT business? Also explain approaches to making ethical judgements. **[8]**

b) What steps must be taken to encourage ethical conduct in schools and colleges learning IT courses? **[8]**

**Q10)** Write short note on any THREE of the following: **[18]**

a) Scope of Copyright Act

b) Trade Secrets

c) IPR

d) Change Control

e) Objectives of Security Policy



Total No. of Questions : 10]

SEAT No. :

**P4070**

**[4760]-497**

[Total No. of Pages : 2

**M.E. (Information Technology)**  
**INTERNET AND WEB TECHNOLOGIES**  
**(2008 Course)(Elective-III) (Semester-II) (514411)-A**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers 3 questions from Section-I and 3 questions from Section-II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks*
- 5) *Assume Suitable data, if necessary*

**SECTION-I**

- Q1)** a) Explain how name resolution happens in DNS. Enlist all resource records and function. Explain when DNS uses TCP and when does it use UDP protocol. **[6]**
- b) How DHCP assigns addresses dynamically? Explain stepwise procedure carried out by DHCP server and DHCP client. **[6]**
- c) List four techniques used by firewalls to control access and enforce a security policy. **[4]**
- Q2)** a) Explain SNMP model with its major components. **[8]**
- b) Explain LDAP data model along with its architecture. **[8]**
- Q3)** a) How does SSL handshake work? **[8]**
- b) Explain proxy server. Why are proxy servers useful? **[8]**
- Q4)** a) Explain the importance of SOAP protocol. State its advantages. **[8]**
- b) Explain Struts. How the validation is performed in strut applications? **[8]**

**P.T.O.**

**Q5)** Answer any three short notes(with illustration): **[18]**

- a) WSDL      b) UDDI      c) AJAX      d) WEB 2.0      e) Java Beans

**SECTION-II**

**Q6)** a) What is the difference between Internet and WWW? can Internet work without WWW? **[8]**

b) Explain N-tier web system. State its advantages and disadvantages. **[8]**

**Q7)** a) Explain persistent and non persistent HTTP connection with suitable diagrams. **[8]**

b) With neat diagram, explain the role of TELNET protocol. Which RFC specify the requirements of TELNET protocol?. **[8]**

**Q8)** a) Explain the servlet life cycle. **[8]**

b) Compare and Contrast applets with servlets. **[8]**

**Q9)** a) Draw and explain CORBA architecture. Explain the role of stub and skeleton. **[8]**

b) Explain JSR 168 portlet API with an example. **[8]**

**Q10)** Write a short note on(any three): **[18]**

a) RSS feeds

b) JNDI

c) Java mail

d) ASP Vs Active X technology

e) MVC design patterns



Total No. of Questions : 8]

SEAT No. :

**P4071**

**[4760]- 498**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**ADVANCED TOPICS IN OPERATING SYSTEMS**  
**( 2008 Course) (Semester-II) (Elective-III (b)) (514411)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right hand indicates full marks.*
- 3) *Answer to the two section should be written in separate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**SECTION-I**

**Q1) a) Explain the Linux OS architecture in detail. [8]**

b) Explain the UNIX Solaris OS architecture in depth. [10]

**Q2) How a process gets created in Windows OS.Explain with neat diagram. [16]**

**Q3) Explain the following with respect to Linux. [16]**

- a) Creation of lightweight processes
- b) Wait mechanism
- c) Fork mechanism
- d) Execve mechanism

**Q4) a) Explain how a virtual memory is implemented in Linux? [8]**

b) Explain the task\_struct fields of Linux OS in detail. [8]

***P.T.O.***

## SECTION-II

- Q5)** a) What is a file system? How can it be configured on Windows OS? What are different file system formats available in Windows OS? Explain FAT-32 file system format. [8]
- b) What is FS driver? Explain FS driver architecture in Windows. [8]
- Q6)** a) Linux supports different file system formats at the same it also supports EXT4 format for its on files. Justify. [8]
- b) Explain the inode structure in Linux OS. [8]
- Q7)** a) What do you mean by buffering ? Where is the location of buffer? Explain the Buffer Head structure in Linux. [7]
- b) How is I/O performed on Windows? Explain I/O system components in Windows. [9]
- Q8)** Write short notes on the following any three [18]
- a) Block Device Architecture in Linux
  - b) Request structure in Linux.
  - c) The bio structure in Linux.
  - d) Device driver and its interfaces in Windows.
  - e) Setting up network in Windows.



Total No. of Questions : 10]

SEAT No. :

**P4372**

**[4760] - 499**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**MOBILE COMPUTING AND M-COMMERCE**  
**(2008 Pattern) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Q4 and Q6 are compulsory.*
- 3) *Answer three questions from each section.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right side indicate full marks.*
- 6) *Use of Calculator is allowed.*
- 7) *Assume Suitable data , if necessary*

**SECTION - I**

- Q1)** a) Explain frequency reuse concept along with Uplink and downlink frequency in GSM architecture? [8]
- b) Explain any 4 address identifiers used in GSM. [8]
- Q2)** a) Explain GPRS services with functional diagram. [8]
- b) Which are different types of short message services explain it with diagram. [8]
- Q3)** a) Explain different types of Handoff in CDMA. [8]
- b) Explain Location tracking in GSM with diagram. [8]
- Q4)** a) Explain different types of Frequency hopping spread spectrum. [6]
- b) Discuss different types of WLAN with reference to its frequency band, data rate, protocol stack and security. [12]

**P.T.O.**

- Q5)** Write a short not on (any two): **[16]**
- a) Mobile IP
  - b) Blue tooth
  - c) Wi-Max

**SECTION - II**

- Q6)** a) Explain in detail the functionality of mobility management layer in GSM? **[12]**
- b) Explain different databases used in GSM architecture. **[6]**
- Q7)** a) Explain m-commerce life cycle? **[8]**
- b) Explain basic Cellular system and comment on representation of cell shape in cellular system. **[8]**
- Q8)** a) What are the emerging issues in mobile commerce? **[8]**
- b) Discuss Emerging applications of M-commerce. **[8]**
- Q9)** Write short notes on any two. **[16]**
- a) Mobile Computing architecture
  - b) EDGE
  - c) Wi-MAX
- Q10)**a) Explain with examples how m-commerce has greater capabilities compared to the conventional e-commerce. **[8]**
- b) Discuss the framework of m-commerce research. **[8]**



Total No. of Questions : 6]

SEAT No. :

**P3925**

**[4760]-5**

[Total No. of Pages : 2

**M.E. (Civil-Construction and Management)  
DISASTER MANAGEMENT  
(2008 Course)(Elective-I) (Semester-I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, wherever necessary.*

**SECTION-I**

- Q1)** a) Enlist various types of water based disasters. Which of these disasters are man made and natural disasters? Discuss about preventive measures related to these disasters. [9]
- b) Discuss about the physical, economic and environmental losses that occur on account of earthquakes and landslides. [9]
- Q2)** a) Discuss the detailed procedure involved in the emergency planning of any one natural disaster. [8]
- b) With the help of neat labeled sketch, enlist and explain various terms and concepts with respect to volcanoes. [8]
- Q3)** a) Explain the concept of early warning systems and discuss its application in any one type of disaster. [8]
- b) Urban flooding is a major disaster in metropolitan cities. Discuss the causes, effects and engineering solutions for the same. [8]

***P.T.O.***

## SECTION-II

- Q4)** a) Explain what you mean by SPHERE HANDBOOK. Discuss in detail various sections and chapters of this handbook. **[18]**
- Q5)** a) Enlist various stake holders involved in a disaster management programme. Explain the role of various government and non-government organizations in emergency response and relief. **[10]**
- b) Discuss the role of remote sensing and GIS in land use pattern for shelter planning in a disaster affected site. **[6]**
- Q6)** Write short notes on : **[16]**
- a) Disaster relief management.
- b) Water supply interventions in Emergencies.
- c) Water quality standards and test procedures.
- d) Climate change and economic impacts.



Total No. of Questions : 6]

SEAT No. :

**P4752**

[Total No. of Pages : 2

**[4760] - 50**

**M.E. (Civil Structure)**

**STRUCTURAL STABILITY**

**(2008 Pattern) (Elective - III) (Semester - II)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of nonprogrammable pocket Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

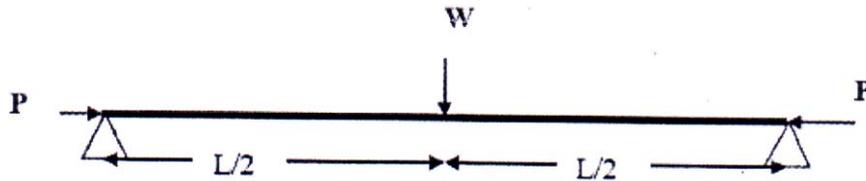
**SECTION - I**

- Q1)** a) Explain the concept of stability of structure with reference to the equilibrium conditions. [12]
- b) Explain Euler's theory of columns stability, write assumptions and limitations. [13]
- Q2)** a) Describe the dynamic approach for column buckling with an example.[10]
- b) Derive the higher order governing equation for stability of columns. Hence analyse the column with one end clamped and other hinged boundary condition. [15]
- Q3)** a) Stability of structure is an eigen value problem. Discuss. [10]
- b) Differentiate between elastic buckling and Inelastic buckling of columns. [15]

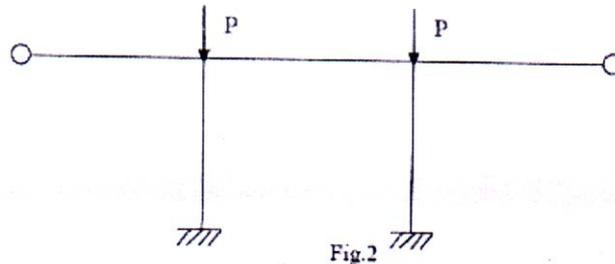
**P.T.O.**

## SECTION - II

- Q4) a)** A beam column subjected to a uniformly distributed load and an axial load is shown in figure 1. Obtain the expression for maximum deflection and maximum moment. [13]



- b) Compute the critical load of the frame shown in figure 2 by the energy method. All the members have the same  $EI$  and  $L$ . [12]



- Q5) a)** Explain the equilibrium approach for the buckling analysis of beam columns with example. [10]
- b) With suitable sketches discuss the different modes of buckling of portal frames. [5]
- c) Derive the general formula for stiffness matrix  $[k_{cr}]$ . [10]
- Q6) a)** Explain the role of finite element method in structural stability analysis. What is stress stiffness matrix? [10]
- b) Derive the governing moment equilibrium equation for the buckling of a thin plate. [15]



Total No. of Questions : 6]

SEAT No. :

**P4072**

**[4760]- 500**

[Total No. of Pages :2

**M.E. (Information Technology)**  
**USER INTERFACE DESIGN**  
**( 2008 Pattern) (Elective-III ) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer sheet.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Assume suitable data,if necessary.*

**SECTION-I**

- Q1)** a) Discuss general principles and goals of User Interface Design. [8]  
b) Human memory plays an important role in how well people deal with an interface. Describe two important differences between short-Term Memory and Long-Term Memory. [8]
- Q2)** a) Analysis of stakeholders is an important step for the usability design. What is a stakeholder? What kind of aspects of the stakeholders do we need to analyze before designing a system? Why is stakeholder analysis important for a system design? [8]  
b) Express your opinion- “ A design should be User-Centric”. [8]
- Q3)** a) We can't measure user friendliness.As a result this concept is not too useful when designing interfaces. Instead we identify specific things about the interface that we can measure that relate to the effectiveness and success of the product.Name at least five specific attributes that describe an interface's effectiveness. Discuss. [10]  
b) You have to design an interface for Vending Machine,which serves tea or coffee. Considering various user communities, their requirements and tastes, apply object action interface modeling technique to design this interface. Sketch the task and interface models. [8]

**P.T.O.**

## SECTION-II

- Q4)** a) Consistency could be considered a major category of interactive principles, on the same level as learnability, Flexibility and robustness. If this had been the case, which principles would appear in support of consistency? [8]
- b) Aging users are a growing proportion of computer users, and some developers of word processors see an opportunity to provide a special version for these users. Critics think that the current MS Word 7.0 in Windows is adequate for these users. Give three possible design changes you would make for elderly users and justify them. [8]
- Q5)** a) What influence does the social environment in which you work have on your interaction with the computer? What effect does the organization (commercial or academic) to which you belong have on the interaction? Discuss. [8]
- b) Evaluate Microsoft Word interface using the “Eight golden rules of interface design”. [8]
- Q6)** a) Explain the guidelines for data display and data entry? [8]
- b) Explain following usability principles with reference to an interface (e.g. MS Word, Web-page) you know. [10]
- i) Match between System and the Real World
  - ii) Error Prevention
  - iii) Visibility of System Status



Total No. of Questions : 8]

SEAT No. :

P4073

[Total No. of Pages : 2

[4760]-502

**M.E. (Information Technology)**  
**ADVANCE NETWORK PROGRAMMING**  
**(2008 Pattern) (Elective - IV)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer three questions from Section I and three questions from Section II.*
- 3) *Answers to the two sections should be written in separate books.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain with neat diagram TCP connection establishment & termination. [8]  
b) Explain Functionality provided by transport layer. [8]
- Q2)** a) Explain different steps taken place during Crashing, Rebooting and Shutdown of Server Host. [8]  
b) Compare the various socket address structure of IPV4, IPV6, Unix domain and data link. [8]
- Q3)** a) Discuss in detail Multicast and Broadcast forms of addressing. [8]  
b) State & Explain Pseudo code name and Index functions. [8]
- Q4)** Write Short Notes on: [18]  
a) Thread synchronization  
b) Resource records(RR)  
c) TCP prethreaded server.

**P.T.O.**

## SECTION - II

- Q5)** a) Write a program that prints the default TCP, UDP, and SCTP send and receive buffer sizes and run it on the systems to which you have access.[8]  
b) Assume two TCP clients start at about the same time. Both set the SO\_REUSEADDR socket option and then call bind with the same local IP address and the same local port (say 1500). But, one client connects to 198.69.10.2 port 7000 and the second connects to 198.69.10.2 (same peer IP address) but port 8000. Describe the race condition that occurs. [8]
- Q6)** a) Write a program to issue RTM\_GET Command on routing Socket.[8]  
b) Explain Mapping of IPv4 and IPv6 multicast address to Ethernet addresses. [8]
- Q7)** a) Compare the descriptor usage in a server using fork versus a server using a thread, assuming 100 clients are being serviced at the same time. [8]  
b) Explain in detail Web Client and Simultaneous Connections using threads. [8]
- Q8)** Write short notes on: [18]  
a) Broadcast addresses  
b) Interoperability of IPv6 Client  
c) TCP Prethreaded Server.

**XXXX**

Total No. of Questions : 8]

SEAT No. :

**P4074**

[Total No. of Pages : 2

**[4760]-503**

**M.E. (Information Technology)**  
**SERVICE ORIENTED ARCHITECTURE**  
**(Elective - IV) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from Each Section.*
- 2) *Question 1 and 5 are compulsory.*

**SECTION - I**

- Q1)** a) Consider Online Banking system and model it with SOA. [12]  
b) Explain enterprise service BUS. [6]
- Q2)** a) How the security problems are addressed in SOA. [8]  
b) Illustrate SOA Governance policies? [8]
- Q3)** a) Write short note on IBM on demand operating environment. [8]  
b) Explain Message Exchange Patterns for Enterprise SOA in real time systems. [8]
- Q4)** a) Explain Web Services and security in SOA in detail. [8]  
b) Identify and justify 4 web portals application based on interdisciplinary businesses, explain with example. [8]

***P.T.O.***

## **SECTION - II**

- Q5)** a) Consider First year admission System in a engineering college, assume suitable constraints and model it with SOA Architecture. [12]  
b) List and explain Stakeholders involved in SOA life cycle. [6]
- Q6)** a) What are advantages and disadvantages of using SOA implementations in Business. [8]  
b) What are the different standards used to implement SOA. [8]
- Q7)** a) Draw and Explain basic SOA architecture. [8]  
b) Illustrate SOA service registry. [8]
- Q8)** a) Explain different tools used in SOA Business solutions. [8]  
b) Explain Consumer centric SOA and in detail. [8]

**XXXX**

Total No. of Questions : 6]

SEAT No. :

**P4075**

[Total No. of Pages : 1

**[4760] - 504**

**M.E. (Instrumentation & Control) (Semester - I)**

**TRANSDUCER DESIGN**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Write Section-I and Section-II on separate answer sheet.*
- 3) *Neat diagram must be drawn whenever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** Design a temperature measurement system using a Pt-100 resistance temperature detector which must provide an output of 500 mV at 200°C. **[25]**
- Q2)** With neat diagram explain piezoelectric transducer design with all required circuit blocks in details. Also mention the importance of each circuit in the same. **[25]**
- Q3)** Design a strain gauge load cell which gives 0 to 500 mV output for input weight 0 to 5 kg. (Given: output of strain gauge load cell for 5 kg is 2.5 mV and power supply is  $\pm 12$  V.) **[25]**

**SECTION - II**

- Q4)** Discuss LASER transducer and explain its applications for welding, surface hardening and printing in detail. **[25]**
- Q5)** Explain design of LVDT transducer for linear displacement measurement in which it gives output in the form of DC voltage. **[25]**
- Q6)** List various chemical sensors and explain in detail with their applications. **[25]**



Total No. of Questions : 8]

SEAT No. :

**P4076**

[Total No. of Pages : 2

[4760] - 505

**M.E. (Instrumentation & Control) (Process and Biomedical Instru.)**

**MATHEMATICAL METHODS IN INSTRUMENTATION**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Use of electronic pocket calculator is allowed.*

**SECTION - I**

**Q1)** Explain singular value Decomposition of the matrix with suitable example. **[18]**

**Q2)** Explain Gram-Schmidt method of vector orthonormalisation with suitable example. **[16]**

**Q3)** Using Gauss Elimination method, obtain the solutions of the following : **[16]**

$$x + 2y + z = 3;$$

$$2x + 3y + z = 6;$$

$$x - y - z = -3$$

**Q4)** a) Explain any one orthogonal transformations with suitable examples. **[8]**

b) Explain euclidean distance and euclidian inner products of the vectors. **[8]**

**P.T.O**

**SECTION - II**

- Q5)** State and explain axioms of probability. **[16]**
- Q6)** Suppose that a pair of fair dice are to be tossed and let the random variable X denotes the multiplication of the points. Obtain the probability distribution for X. **[16]**
- Q7)** Explain Baye's theorem with suitable example. **[16]**
- Q8)** Discuss the need of various mathematical performance metrics in analysis of biomedical/process signal processing with suitable examples. **[18]**



Total No. of Questions : 6]

SEAT No. :

**P4077**

**[4760] - 506**

[Total No. of Pages :2

**M.E. (Instrumentation and Control)**  
**COMMUNICATION PROTOCOLS FOR INSTRUMENTATION**  
**(2008 Course) (Semester - I) (506103)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** Attempt following.

- a) With neat sketch explain the OSI model in detail with each levels function. **[10]**
- b) Discuss multidrop Networks of RS-485 with suitable diagrams. **[10]**
- c) Explain different types of communication systems in detail. **[5]**

**Q2)** Attempt following.

- a) Define open standard communication protocols and explain any two in brief. **[10]**
- b) Explain crossover and straight cable wiring in Ethernet protocol. **[10]**
- c) Explain TCP/IP Addressing. **[5]**

**Q3)** Attempt following.

- a) With neat diagram explain different levels of the factory communications net-work. **[10]**
- b) Explain guidelines used for designing of Fieldbus. **[10]**
- c) Discuss Fieldbus advantages and limitations in detail. **[5]**

**P.T.O.**

## SECTION - II

**Q4)** Attempt following.

- a) Explain Foundation Fieldbus two-level architecture with neat sketch. **[10]**
- b) Describe the different terminologies used in foundation field bus. **[10]**
- c) Write short note on ZigBee wireless protocol. **[5]**

**Q5)** Attempt following.

- a) Explain the steps involved in calibration of the HART Field devices. **[10]**
- b) Explain Z-wave with any application. **[10]**
- c) Differentiate wireless protocols with other existing protocols. **[5]**

**Q6)** Attempt following.

- a) Explain Bluetooth based industrial application in detail. **[10]**
- b) Explain HART protocol in detail. **[10]**
- c) Discuss the standards used in communication protocol systems. **[5]**



Total No. of Questions : 12]

SEAT No. :

**P4373**

**[4760] - 507**

[Total No. of Pages :3

**M.E. (Instrumentation Process & Biomedical)  
ANALYTICAL INSTRUMENTATION  
(2008 Course) (Semester - I) (5061104)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer three questions from section I and three questions from section II.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Give Detail Classification of Instrumental Method of Chemical Analysis. [8]
- b) Explain following term give two example of each [8]
- i) Quantitative analysis
  - ii) Qualitative analysis

OR

- Q2)** a) Explain Conductometry with neat sketch. [8]
- b) Difference between classical and instrumental method for chemical analysis on the basis of merit and demerit. [8]
- Q3)** a) Draw electromagnetic spectrum show one source and one detector in each region. [8]
- b) Which are the laws of photometry, derive mathematical expression to combine all the laws & deviation from it. [10]

OR

*P.T.O.*

**Q4)** a) List various types of nebuliser, Explain ultrasonic nebuliser with neat sketch. [10]

b) Explain AAS with neat sketch. [8]

**Q5)** a) Explain Direct Coupled Plasma with neat sketch. [8]

b) Explain flame photometer with neat sketch. [8]

OR

**Q6)** a) Explain Magnetic deflection type Mass Spectrometer with neat sketch. [8]

b) Write a short notes on [8]

i) Mass Detector

ii) FTMS

### **SECTION - II**

**Q7)** a) Explain with neat sketch Ratio Recording fluorimeter. [8]

b) Explain with neat sketch Spectrofluorimeter. [8]

OR

**Q8)** a) Explain Gas Chromatography with neat sketch. [8]

b) Explain any one Type of detector used in Gas Chromatography. [8]

**Q9)** a) Explain HPLC with neat sketch. [10]

b) Define retention time & retention volume in GC. Explain with neat sketch electron capture detector with neat sketch. [8]

OR

- Q10)a)** Explain Reciprocating Pump used in HPLC system. [10]  
b) Explain X-ray Instrumentation With Neat sketch. [8]

- Q11)a)** State & Prove Braggs Law of X-ray Diffraction. [8]  
b) Explain GM Counter with neat sketch. [8]

OR

- Q12)a)** Explain NMR With Neat sketch. [8]  
b) What is ESCA? Explain in brief Auger emission spectroscopy. [8]



Total No. of Questions : 6]

SEAT No. :

**P4078**

**[4760] - 508**

[Total No. of Pages : 1

**M.E.(Instrumentation & Control) (Process)**

**INDUSTRIAL AUTOMATION**

**(Elective - I) (Semester - I)**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any two questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** List and define the various major types of PLC analog inputs and outputs. Describe the data flow and number conversions involved in PLC analog operation. **[25]**

**Q2)** What is OPC? Explain with an example, How OPC is actually used in the field? **[25]**

**Q3)** Write notes on: **[25]**  
a) Model predictive controller.  
b) SCADA

**SECTION - II**

**Q4)** Discuss in brief with suitable block diagram any four major components of the DCS. Also list and explain the basic functions of DCS system. **[25]**

**Q5)** Explain in brief different types of sequencer? Develop programmable ladder diagram for stirred tank heater. Assume suitable sequence. **[25]**

**Q6)** Design and develop PLC based Flow control system. Implement PI control action. **[25]**



Total No. of Questions : 8]

SEAT No. :

**P4727**

[Total No. of Pages : 3

**[4760] - 51**

**M.E. (Civil) (Structure)**

**STRUCTURAL RELIABILITY**

**(2008 Pattern) (Elective - III) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) State and review critically the principal advantages of Probability Based Limit State Design Method over the Deterministic Methods of Design of Civil Engineering Structures. **[6]**
- b) Enlist the sources of uncertainty in the reliability based structural analysis of reinforcing steel in RCC structures, brick masonry structures and explain in brief how those are accounted for in the analysis. **[6]**
- c) Derive an expression for probability of failure for the case of load (S) and resistance (R) following the log normal distribution. **[5]**

- Q2)** a) Define the term 'Structural Reliability' with explanation of each significant element in that definition. **[6]**
- b) From the statistical analysis of live load survey, it is found that live load follows the lognormal distribution with parameters \_\_\_\_\_. **[5]**

Median of live load = 1217 N/m<sup>2</sup>

Standard deviation of live load = 0.368

Determine the characteristic load for the probability of live load exceeding lifetime maximum live load being 0.05, if there is no change in tenancy during the lifetime of the building.

**P.T.O.**

- c) Samples of soil are collected from various depths below ground level and tested in the laboratory to determine their shear strength. The collected field data are given below: [5]

|                                     |      |      |      |      |      |      |
|-------------------------------------|------|------|------|------|------|------|
| Depth (m)                           | 2    | 3    | 4    | 5    | 6    | 7    |
| Shear strength (KN/m <sup>2</sup> ) | 14.8 | 20.3 | 32.2 | 39.0 | 42.0 | 56.4 |

Determine the sample covariance and correlation coefficient between the depth of the soil and its shear strength. What do you infer?

- Q3)** a) Derive the expressions for the reliability of a series system and a parallel redundant system. [6]  
 b) Derive the expression for 'Reliability Index' for the case of load (S) and resistance (R) following normal distribution. [6]  
 c) It is given that the ratio of the mean value of the cube strength of M15 Concrete (design mix) to its characteristic strength is 1.4 and the coefficient of variation of the strength of concrete is 0.18. Determine the allowable stress for the probability of failure of concrete equal to 0.001 and coefficient K value equal to (-3.091) for the given probability. [5]
- Q4)** a) Explain the formulation of probability model for wind load along with the various variables involved. [6]  
 b) Enlist the sources of uncertainty contributing the variation in the strength of concrete. Briefly explain Chi-Square Test to be applied while selecting a probabilistic model fit to the given data. [5]  
 c) What is meant by the Lifetime Maximum Sustained Load? Enumerate the assumptions used in the stochastic analysis of it. [5]

### SECTION - II

- Q5)** a) Explain the Inverse Transformation Technique and derive expression for generating random deviates of y having Uniform Distribution. [6]  
 b) Write note on Applications of Monte Carlo Method. [6]  
 c) Explain the procedure stepwise to generate normal variants from the distribution of Y following the normal distribution with mean u and variance s<sup>2</sup>. [5]

- Q6)** a) Explain Monte Carlo Method with respect to its objective and procedural steps? [6]
- b) What is meant by Safety Checking Formats for a design code? Explain in brief CEB & LRFD formats. [5]
- c) Explain how the system reliability concept can be extended for decision making with design risk. [5]
- Q7)** a) Explain stepwise procedure to determine partial safety factors for the given reliability index. [6]
- b) Explain in brief the steps involved in the development of reliability based design criteria. [6]
- c) Write short note on Reliability based design criteria for RCC beams in limit state of collapse calibrated in IS code. Comment on the observations and conclusion on safety factors. [5]
- Q8)** a) Explain how to analyze the risk associated with a decision. [6]
- b) Write short note on decision tree analysis. [5]
- c) Comment on how the statistical tools can be used for improving the managerial decisions with calculated desired risk. [5]



Total No. of Questions : 8]

SEAT No. :

**P4079**

**[4760] - 511**

[Total No. of Pages : 2

**M.E. (Instrumentation & Control)**  
**FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION**  
**(2008 Pattern) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*
- 5) *Answer any three questions from each section.*

**SECTION - I**

- Q1)** a) Explain the amplitude, frequency and electrodes used for ECG, EEG and EMG biopotentials. Explain various properties of ideal bioelectrode. [8]  
b) Explain in brief various techniques used for blood pressure measurement. [10]
- Q2)** a) Draw and explain Einthoven triangle. [8]  
b) What is Biofeedback? Describe any two applications of it. [8]
- Q3)** a) What is a synchronised DC defibrillator? Explain its working with the help of a block diagram. [8]  
b) Describe various methods of respiratory flow measurement. Explain any one method in detail. [8]
- Q4)** a) What is motion artifact? How to reduce the effect of it? [6]  
b) With the help of a graph describe the generation of biopotentials like action potential and resting potential for a cell. [10]

**SECTION - II**

- Q5)** a) Explain how Laser Flow Cytometry is used for RBC and WBC counting. [8]  
b) Describe ultrasound type of blood flow meter based on transit time principle. [8]

**P.T.O.**

- Q6)** a) Define Let Go current, microshock and macroshock. Discuss precautions to be taken to minimize shock hazards. [10]  
b) Enlist various types of dialyzers and explain parallel plate type dialyzer with suitable diagram. [8]
- Q7)** a) What are different types of errors in vision? How to correct them? [8]  
b) Draw the block diagram of Beksey audiometer and explain the procedure used to measure human auditory response. [8]
- Q8)** a) Write a short note on 'Lithotripsy'. [8]  
b) What is a Bedside Monitor? Describe its construction and working in detail with suitable diagram. [8]



Total No. of Questions : 8]

SEAT No. :

P4080

[Total No. of Pages : 3

[4760] - 513

M.E. (Instrumentation and Control) (Process & Bio)

CONTROL SYSTEM DESIGN

(2008 Pattern)

Time : 3 Hours]

[Maximum Marks : 100

Instructions to the candidates:

- 1) Answer 3 questions from Section - I and 3 questions from Section - II.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

**SECTION - I**

Q1) a) Design a lead compensator for a control system having OLTF as

$$G(s)H(s) = \frac{1}{s(s+4)(s+6)}$$

It is desire to have peak overshoot for a step input is as 25% and settling time is 10 sec. [12]

- b) Explain Lag and Lead respect to the following points. [6]
- i) Pole - zero location.
  - ii) Its Frequency response
  - iii) Its Effect on transient and steady state response.

Q2) Apply Bode plot method to design a lag compensator for unity feedback system having.

$$G(s) = \frac{K}{s(s+2)(0.1s+1)}$$

such that P.M.  $\approx 38^\circ$ , G.M. at least 10 dB and  $e_{ss} = 0.2$  rad for unit ramp input. [16]

P.T.O.

**Q3) a)** Design a controller for the following first order system :

$$G_p(s) = \frac{1e^{-3s}}{(20s+1)}$$

using the direct synthesis approach, and given that the desired closed - loop behavior is :

$$G_{CL} = \frac{1e^{-3s}}{(8s+1)} \quad [8]$$

b) 
$$\begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} \frac{2}{s+2} & \frac{-2e^{-2.3s}}{0.1s+1} \\ \frac{-3e^{-7.5s}}{0.8s+1} & \frac{0.8}{s+1} \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

Find the RGA for the given system. [8]

**Q4)** Consider a unity feedback system has forward path transfer function.

$$G(s) = \frac{K}{s(s+5)}$$

Design a digital control scheme for the system to meet the following specifications : [16]

- i)  $K_v \geq 10$
- ii) Peak overshoot  $\leq 25\%$
- iii) Settling time  $\leq 4 \text{ Sec.}$

### SECTION - II

**Q5)** Determine the state controllability and observability of the system. [16]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -6 & 0 & 0 \\ 0 & -5 & 0 \\ 0 & 0 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

**Q6)** Consider a system having transfer function.

$$G(s) = \frac{2}{s^2 + 3s + 2}$$

Obtain the model state space model. Verify that the system is observable, If so, determine the observer gain matrix using Ackerman's method such that closed - loop poles are at  $s_1 = -1, s_2 = -2$  [16]

**Q7)** A control system represented by the following state equations.

$$\dot{X} = Ax + Bu$$

where

$$A = \begin{bmatrix} 0 & 1 \\ -4 & -6 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

The performance index J is given by

$$J = \int_0^{\infty} (x^T Qx + u^T Ru) dt$$

where

$$Q = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}, R = [1]$$

Determine the optimal feedback gain matrix K [16]

**Q8) a)** Consider the system

$$\dot{X} = Ax + Bu$$

where the state feedback control  $u = -Kx$ . Assume that system is completely state controllable. Derive the Ackerman's formula for calculating state feed back gain matrix to place the desired closed loop poles at  $s = \mu_1, s = \mu_2, \dots, s = \mu_n$  [12]

b) With an example explain the concept of robust controller. [6]



Total No. of Questions : 8]

SEAT No. :

**P4081**

[Total No. of Pages : 2

**[4760] - 514**

**M.E. (Instrumentation & Control)  
ADVANCED SIGNAL PROCESSING  
(Process Instru. and Biomedical Instru.)  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

**SECTION - I**

**Q1)** a) Explain in briefly the Short Time Fourier Transform. What are the disadvantages of STFT. [10]

b) Write the short note Wigner distribution [8]

**Q2)** a) Explain with one application Homomorphic deconvolution. [8]

b) Write a short note on efficient structures of interpolation and decimation.[8]

**Q3)** a) State the different models in stochastic processes? Explain any one. [8]

b) Write a short note on vector processes. [8]

**Q4)** What do you mean by adaptive filtering? Describe the LMS algorithm for adaptive filtering. Explain one application of adaptive filtering. [18]

**P.T.O.**

**SECTION - II**

- Q5)** a) Write a short note on non- parametric methods of power spectrum estimation. [10]  
b) Write a short note on ARMA modeling [8]
- Q6)** a) Explain in detail the basic structure of Echo cancellation model. [8]  
b) Describe the RMS algorithm for adaptive filtering. [8]
- Q7)** Write a short notes on: [16]  
a) Continuous Wavelet Transform.  
b) Discrete Cosine Transform
- Q8)** a) What is Orthogonal transform? Explain Sine and Cosine Transform. [8]  
b) Explain in brief the digital broadcasting and multimedia systems. [8]



Total No. of Questions : 8]

SEAT No. :

**P4082**

**[4760] - 515**

[Total No. of Pages :2

**M.E. (Instrumentation and Control)**  
**ORGANISATIONAL BEHAVIOUR AND MANAGEMENT**  
**(2008 Course) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from section I and section II.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Explain various models of organizational behavior and its role to face the challenges and opportunities in business profile. **[16]**

**Q2)** Differentiate between personality, emotions and perception. Explain perception in individual decision making. **[16]**

**Q3)** a) Describe Victor Vroom's Expectancy Theory of Motivation. **[8]**

b) What is personality? What are its determinants? How it influences work behavior? **[8]**

**Q4)** a) Discuss the role, functions and skills of organizational management. **[9]**

b) Describe the functions and activities of manager. **[9]**

**SECTION - II**

**Q5)** State and explain the concept of organization system. What are its different components? How it brings balance in organization's policies and practices. **[16]**

**P.T.O.**

**Q6)** What are the various stages of group development? Explain in detail. Describe how group dynamic brings effectiveness in Group decision making process. **[18]**

**Q7)** Explain conflict management in detail. How conflict resolution takes place in business? Explain contingency approach to conflict management. **[16]**

**Q8)** Write short notes on:

a) Human resources policies and practices. **[8]**

b) Masslow's need hierarchy. **[8]**



Total No. of Questions : 6]

SEAT No. :

**P4083**

**[4760]-516**

[Total No. of Pages : 2

**M.E. (Instrumentation and Control)**

**MODERN CONTROL THEORY**

**(2008 Course) (Elective-II) (Semester-II) (5061111-A)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** Determine the transfer function matrix for MIMO systems given by:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 1 & 2 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} -1 & 0 \\ 1 & 0 \\ 0 & 2 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

**[25]**

**Q2)** Attempt following for a state model with matrix A as

$$A = \begin{bmatrix} 0 & 2 & 0 \\ 4 & 0 & 1 \\ -48 & -34 & -9 \end{bmatrix}$$

Determine:

- a) Characteristic equation,
- b) Eigen values and,
- c) Eigen vectors.

**[25]**

**P.T.O.**

**Q3)** A linear dynamic time invariant systems is represented by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 1 & 2 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} -1 & 0 \\ 1 & 0 \\ 0 & 2 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Determine the state controllability and observability for above systems. [25]

### SECTION-II

**Q4)** Find the Smith McMillan form of

$$G(s) = \begin{bmatrix} \frac{1}{s^2 + 4s + 3} & 0 \\ -1 & \frac{2(s+1)^2}{s^2 + 4s + 3} \end{bmatrix}$$

Hence find its poles and zeros. [25]

**Q5)** For given system discuss on stability by finding K for following cases [25]

- a) System without sample-and-hold.
- b) System with sample-and-hold with  $T = 0.4$  sec.
- c) System with sample-and-hold with  $T = 3$  sec.

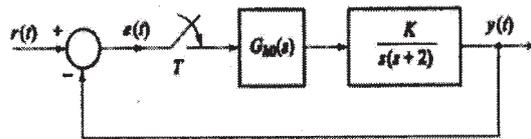


Figure 1: Closed loop sampled data system

**Q6)** By using the Nyquist criterion, determine whether the closed loop system having the following open loop transfer function is stable or not. If not, how many closed loop poles lie in the right half s-plane.

$$G(s) H(s) = \frac{1 + 4s}{s^2(1 + s)(1 + 2s)} \quad [25]$$

Total No. of Questions : 8]

SEAT No. :

**P4084**

**[4760]-519**

[Total No. of Pages : 2

**M.E. (Instrumentation & Control) (Biomedical Instrumentation)**

**BIOSIGNAL PROCESSING**

**(2008 Course) (Elective-II) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

**SECTION-I**

**Q1) a)** Define signal. Give the classification of signals. What are the different operations that are performed on signals. **[10]**

b) Determine the linear convolution of the two sequences given below using graphical method: **[8]**

$$x(n) = \{3, 2, 1, 2\}$$

$$h(n) = \{1, 2, 1, 2\}$$

**Q2) a)** Explain with the examples the classification of systems. **[8]**

b) Determine the impulse response  $h(n)$  for the system described by the second order difference equation

$$y(n) - 4y(n - 1) + 4y(n - 2) = x(n - 1). \quad \mathbf{[8]}$$

**Q3) a)** State and explain the initial value and final value theorem of z-transform. **[8]**

b) Find the inverse z-transform of the following using convolution method.

$$X(z) = \frac{1}{1 - 3z^{-1} + 2z^{-2}} \quad \mathbf{[8]}$$

**P.T.O.**

- Q4)** a) Find the DFT of the following sequence using DIT FFT algorithm  
 $x(n) = \{1, 0, 1, 0, 1, 0, 1, 0\}$ . [8]
- b) Write a short note on DIF FFT radix 2 algorithm. [8]

### SECTION-II

- Q5)** a) Write a short note on Gibbs phenomenon. [8]
- b) Design a filter with [8]

$$H_d(e^{j\omega}) = e^{-j3\omega} \quad -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4}$$

$$= 0 \quad \frac{\pi}{4} < |\omega| \leq \pi \quad \text{using a Hamming window with } N = 7.$$

- Q6)** a) Design a Butterworth filter using bilinear transformation method for the following specifications [14]

$$0.8 \leq |H(e^{j\omega})| \leq 1; 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.2; 0.6\pi \leq \omega \leq \pi$$

- b) Distinguish between Butterworth and Chebyshev filter. [4]
- Q7)** a) Write a short note on Huffman coding. [8]
- b) Compare FIR and IIR filters. [8]

- Q8)** Write a short notes on: [16]
- a) DSP processor.
- b) Finite word length effect.



Total No. of Questions : 6]

SEAT No. :

**P4292**

**[4760] - 52**

[Total No. of Pages :2

**M.E. (Civil -Structures)**

**NON-LINEAR ANALYSIS OF STRUCTURE**

**(2008 Pattern) (Semester - II) (Elective - III) (501411)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answer to the two sections should be written in separate books.*
- 3) Figures to the right indicate full marks.*
- 4) Neat diagrams must be drawn wherever necessary.*
- 5) Use of non programmable calculator is allowed.*
- 6) Assume Suitable data , if necessary*

**SECTION - I**

- Q1)** a) State and explain types of nonlinearities, with examples, in case of beams. **[10]**
- b) Find the solution for a moment curvature by non linear analysis of a simply supported beam subjected to concentrated load at midspan.**[15]**
- Q2)** a) Explain 'Displacement Equations Approach' of nonlinear analysis of plates. **[8]**
- b) Write the strain energies due to stretching, bending and kinetic energy of an orthotropic plate. Use Hamilton's principle and stress function approach to derive governing equations. **[17]**
- Q3)** a) Derive the equation for maximum deflection of rectangular plate by nonlinear analysis. **[17]**
- b) State a system of four equations governing the large amplitude flexural vibrations of anisotropic plates. **[8]**

**P.T.O.**

## SECTION - II

- Q4)** a) Obtain the deflection components of cantilever column at post-buckling stage due non linear behaviour. [20]
- b) Explain Ramberg-Osgood stress strain relationship. [5]
- Q5)** a) Explain Incremental procedure of analysis of material nonlinear problems. [10]
- b) Explain with diagrams and derivation, the deformation of square pinned-fixed frame for compressive loading. [15]
- Q6)** a) Write steps involved in elastic plastic analysis of frames. [12]
- b) Obtain stiffness matrix for a member with a hinge by Elastic-Plastic Analysis. [13]



Total No. of Questions : 6]

SEAT No. :

**P4085**

[Total No. of Pages : 2

**[4760]-521**

**M.E. (Instrumentation & Control) (Process)**  
**ADVANCED PROCESS INSTRUMENTATION**  
**(Elective - III) (Semester - II) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answers to the two sections should be written in separate answer books.*
- 2) Answer any two questions from each section.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right side indicate full marks.*
- 5) Use of Calculator is allowed.*
- 6) Assume Suitable data if necessary.*

**SECTION - I**

**Q1)** Consider a perfectly mixed stirred tank heater, with single feed stream & a single product stream. Assuming that the flow rate & temperature of the inlet stream can vary, and that the rate of heat added per unit time can vary,

- a) Derive the modeling equations for this system. State your assumptions clearly & explicitly.
- b) Derive the transfer function between output temperature and heating rate input assuming heat storage in heater mass to be negligible. Comment on the result. **[25]**

**Q2)** Explain with suitable examples (Any two)

**[25]**

- a) Cascade Control
- b) Selective Control
- c) Feedforward Control

**Q3)** Explain with neat sketch Smith Predictor. Design Smith Predictor for FOPDT process. Also enlist its shortcomings. **[25]**

**P.T.O.**

## SECTION - II

- Q4)** Draw a neat schematic diagram of a fuzzy controller. Comment on the specialty of a fuzzy controller, as compared to other control actions. Explain anyone process where fuzzy controller suits the most with justification. [25]
- Q5)** What is an IMC? Discuss in brief steps to follow during the design of an Internal Model Control System for FOPDT process and second order process with RHP zero. [25]
- Q6)** Write note on: [25]
- a) DMC controller tuning
  - b) RGA
  - c) Decoupling

**xxxx**

Total No. of Questions : 8]

SEAT No. :

**P4086**

[Total No. of Pages : 2

**[4760] - 524**

**M.E. (Biomedical Instrumentation) (Sem. - II)**

**BIO-IMAGING MODALITY**

**(2008 Pattern) (Elective - III(a))**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain why we use different methods of imaging for diagnosis. Explain the typical use of different types of imaging. [8]  
b) Explain the various controls on the Panel of the X-ray machine. [8]
- Q2)** a) Explain the operation and the applications of X-ray fluroscopic system that is used for real imaging. [8]  
b) What are the benefits of Digital Mammography over standard Mammography equipments. Also discuss the limitations of Digital Mammography. [8]
- Q3)** a) Explain the method that overcomes the drawbacks of X-ray imaging system. Explain atleast three image reconstruction methods in the same. [10]  
b) What is the difference between diagnostic mammography and screening mammography? What is magnification mammography? [8]
- Q4)** a) List the factors affecting the spacial resolution of the image in CT scan. Explain atleast two factors in detail. [8]  
b) Discuss Beam Restriction in detail. [8]

***P.T.O.***

## SECTION - II

- Q5)** a) Specify the frequency ranges for abdominal, brain examination and for ophthalmic and pediatric study in M-scan Mode. Explain the advantages of ultrasound imaging over the other imaging modalities. [10]
- b) Explain Pulse echo-ultrasound A-scan Mode system with block diagram. Also write its applications. [8]
- Q6)** a) Discuss various magnets used in MRI to produce appropriate magnetic field. [8]
- b) Enlist clinical applications of SPECT and give the reason why SPECT is accepted instead of conventional nuclear medical imaging. [8]
- Q7)** a) Explain Medical thermography and the benefits of thermal imaging. [8]
- b) Explain the principle of PET imaging system. Why NaI crystal is popular in nuclear imaging. Which component of PET system makes it costlier system? [8]
- Q8)** a) Draw and explain block diagram of infrared imaging. [8]
- b) Explain the basic principle of MR imaging. Enlist advantages of MRI techniques. [8]



Total No. of Questions : 10]

SEAT No. :

**P4087**

[Total No. of Pages : 4

[4760] - 527

M.E. (Polymer)

**MATHEMATICAL AND STATISTICS METHODS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket Calculator is allowed.*
- 6) *Assume Suitable data, if necessary.*

**SECTION - I**

**Q1) a)** Use L.U Decomposition method to solve following system of equations:[8]

$$5x - 2y + z = 4$$

$$7x + y - 5z = 8$$

$$3x + 7y + 4z = 10$$

b) Determine the numerically largest eigen value and corresponding eigen vector of the matrix:

$$A = \begin{bmatrix} 10 & -2 & 1 \\ -2 & 10 & -2 \\ 1 & -2 & 10 \end{bmatrix}$$

taking initial approximation as  $\bar{x} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$  [8]

**Q2) a)** Using Gauss - Seidel method, solve [8]

$$54x + y + z = 110$$

$$2x + 15y + 6z = 72$$

$$-x + 6y + 27z = 85$$

b) Solve by newton - Raphson method [8]

$$x + 3\log_{10} x - y^2 = 0$$

$$2x^2 - xy + 5x + 1 = 0$$

with initial values  $x_0 = 3.4, y_0 = 2.2$ .

**P.T.O.**

- Q3) a)** Reduce the following matrix to tridiagonal form, using Householder's method. [8]

$$A = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}$$

- b) Solve the following system of equations, using Cholesky's method. [8]

$$4x_1 - 2x_2 = 0$$

$$-2x_1 + 4x_2 - x_3 = 1$$

$$-x_2 + 4x_3 = 0$$

- Q4) a)** Find the Z - transform of the following (any two) [8]

i)  $f(k) = \frac{3^k}{k!}, k \geq 0$

ii)  $f(k) = 4^k + 5^k, k \geq 0$

iii)  $f(k) = ke^{-ak}, k \geq 0$

- b) If  $f(k) = 2^{\frac{1}{k}}, g(k) = 3^{\frac{1}{k}}, k \geq 0$  find Z - transform of the convolution  $f(k) * g(k)$ . [4]

- c) Solve the difference equation:

$$f(k+2) + 3f(k+1) + 2f(k) = 0, f(0) = 0, f(1) = 1. \quad [6]$$

- Q5) a)** Find the inverse Z - transform of the following (any two): [8]

i)  $\frac{3z^2 + 2z}{z^2 - 3z + 2}, 1 < |z| < 2$

ii)  $\frac{z^3}{(z-1)\left(z-\frac{1}{2}\right)^2}, |z| > 1$

iii)  $\frac{z}{\left(z-\frac{1}{4}\right)\left(z-\frac{1}{5}\right)}$  using inversion integral method.

- b) Apply Sylvester's theorem to find  $\sin [A]$  where  $A = \begin{bmatrix} 1 & 20 & 0 \\ -1 & 7 & 1 \\ 3 & 0 & -2 \end{bmatrix}$  [8]

### SECTION - II

- Q6) a)** Solve the following system of equations using Runge-Kutta fourth order method: [8]

$$\frac{dy}{dx} + xz = 0, \quad \frac{dz}{dx} = y^2 \quad \text{with } y(0) = 1, z(0) = 1 \quad \text{for } x = 0.2 \text{ taking } h = 0.2.$$

- b) Using Adam's Bashforth method, determine the solution of [8]

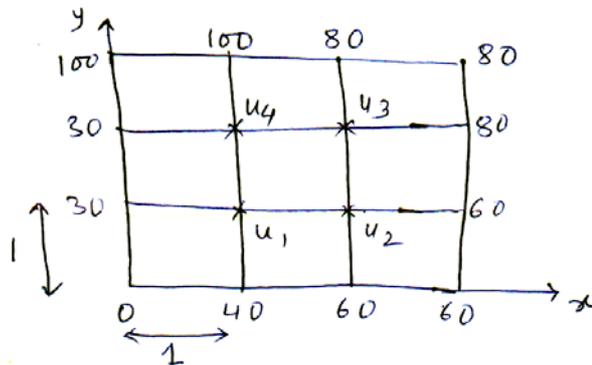
$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2} \quad \text{at } x = 1.4.$$

Given  $y(1) = 1, y(1.1) = 0.996, y(1.2) = 0.986, y(1.3) = 0.972$

- Q7) a)** Solve  $\frac{dy}{dx} = (x + y), y(0) = 1, h = 0.1$ . Use modified Euler's method to find  $y(0.2)$ . [8]

- b) Evaluate the function  $u(x,y)$  at the points 1, 2, 3 and 4 on the grid where  $u(x,y)$  satisfies the equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0, h = k = 1$ .

Grid is shown below: [8]



- Q8) a)** Find the extremal of the following function  $\int_{x_0}^{x_1} (y'^2 + 2yy'' - 16y^2) dx$  .[8]  
 b) Solve the boundary value problem  $y'' + y + x = 0$  ( $0 \leq x \leq 1$ ),  $y(0) = y(1) = 0$  by Rayleigh - Ritz method. [8]

- Q9) a)** Apply Galerkin's method to solve boundary value problem  $y'' + \pi^2 y = x$  with  $y(0) = 1$  and  $y(1) = -0.9$  taking the approximate solution as

$$\bar{y}(x) = 1 - 1.9x + c_1x(1-x) + c_2x^2(1-x) \quad [8]$$

- b) In experiment on pea breeding, the following frequencies of seeds were obtained: [8]

| Round and Green | Wrinkled and Green | Round and Yellow | Wrinkled and Yellow | Total |
|-----------------|--------------------|------------------|---------------------|-------|
| 222             | 120                | 32               | 150                 | 524   |

Theory predicts that the frequencies should be in proportion 8 : 2 : 2 : 1. Examine the correspondence between theory and experiment.

$$\text{Given } \chi_{3,0.05}^2 = 7.815$$

- Q10)a)** A sample of 900 members is found to have a mean of 3.4 cm. Can it be reasonably regarded as a truly random sample from a large population with mean 3.25cm. and standard deviation 1.61 cm.

$$\text{Given : } |Z| = 1.96 \text{ at } 5\% \text{ level of significance.} \quad [6]$$

- b) Out of twenty persons who were reported to be attacked by brain fever only 18 survived. Using the large sample test, test the hypothesis at 5% level that if, attacked by brain fever survival rate is 85% against the alternative that it is more.

$$\text{Given : } Z_{\alpha} = 1.645 \text{ where } \alpha = 5\% \text{ (level of significance).} \quad [6]$$

- c) Two random samples give the following results:

| Sample | Size | Sample mean | Sum of squares of deviations from mean |
|--------|------|-------------|--|
| 1      | 10   | 15          | 90                                     |
| 2      | 12   | 14          | 108                                    |

Test whether the sample come from the same normal population at 5% level of significance. Given :  $F_{0.05} = 2.90$  for (9,11) degrees of freedom.[6]



Total No. of Questions : 10]

SEAT No. :

**P4374**

**[4760] - 529**

[Total No. of Pages :2

**M.E. (Polymer Engineering)  
POLYMER PROCESSING AND TESTING  
(2008 Course) (Semester - I) (509117)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question number 1 & 6 are compulsory. Out of the remaining attempt 2 questions from Section I & 2 questions from Section II.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Numbers to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic table, electronic pocket calculators is allowed.*

**SECTION - I**

- Q1)** a) Discuss the term Quality control and Standards and Standard Organizations, Preparations of test Samples and Conditioning. [14]  
b) Explain the concepts of statics in testing. [6]
- Q2)** a) Explain Short term and long term mechanical properties, their Significance and importance. [10]  
b) Explain in detail Fatigue testing. [5]
- Q3)** a) Explain any two thermal properties used for polymers. [6]  
b) Write a note on Barrier Properties. [9]
- Q4)** Write a note on: [15]  
a) Fire Resistance Test  
b) Weathering Test
- Q5)** a) Discuss any two Electrical test methods with one example. [6]  
b) Explain ultrasonic testing of polymeric products. [9]

*P.T.O.*

## SECTION - II

- Q6)** a) Explain in detail modeling of extrusion. [15]  
b) Compare twin and single screw extrusion. [5]
- Q7)** a) Explain with neat sketch of Film Extrusion line. [6]  
b) Explain with neat diagrams different types of Extrusion die. [9]
- Q8)** a) Explain flow analysis through pipe die. [7]  
b) Explain in detail heat transfer analysis in Thermoforming. [8]
- Q9)** a) Write a short note on different types of blow molding techniques. [8]  
b) Write a note on Reactive Extrusion. [7]
- Q10)** Explain in detail Reaction Injection Molding and role of rheology in Injection. [15]



Total No. of Questions : 6]

SEAT No. :

P3760

[Total No. of Pages : 2

[4760] - 53

**M.E. (Civil Structures)**

**BIO MECHANICS AND BIO MATERIALS (Elective - IV)**

**(2008 Pattern) (Semester - II)**

*Time :4 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Solve any two questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain soft tissue and Hard tissue with suitable illustration. Explain engineering properties of hard tissue. [8]
- b) Explain various elastic models applicable to soft tissue and hard tissue. Draw suitable diagram to illustrate. [9]
- c) Enlist and Explain applications of study of human Biomechanics. [8]
- Q2)** a) Explain material bio compatibility and List bio compatible materials used widely in treating human illnesses. Illustrate your answer with suitable application. [8]
- b) Explain various non metallic materials used as bio compatible materials with its Advantages and application. [9]
- c) Explain use of ceramics as replacement components /artificial fixation devices. [8]

**P.T.O.**

- Q3)** a) Explain bone cement, PMMA. Explain its advantage as biomaterial. [8]
- b) Explain silicon rubber, UHMWPE, ultra high molecular weight polyethylene as biocompatible material. [9]
- c) Explain properties of stainless steel, cobalt base alloys, Titanium base alloys when used as prosthesis material. [8]

### SECTION - II

- Q4)** a) Explain in brief anisotropy, transverse isotropy, orthotropy for bone tissue. [9]
- b) Explain geometry of the articulating joint for ankle joint, Knee joint, Hip joint. Show joint forces acting on each. [9]
- c) Explain device to measure wear of cartilage on cartilage material. [7]
- Q5)** a) Explain the term gait analysis. [8]
- b) Enlist and explain various measurement techniques for body motion. [9]
- c) How gait analysis helps in various applications of Biomechanics study. [8]
- Q6)** a) What are the fundamental design consideration for engineering design of prosthesis. [8]
- b) Explain step by step structural design cycle of a fixation device in biological environment. [9]
- c) What is the classification of prosthetics devices. enlist prosthetics widely used and the situations in which they are required to be used. [8]



Total No. of Questions : 8]

SEAT No. :

P4375

[4760] - 530

[Total No. of Pages :2

**M.E. (Polymer Engineering)**  
**POLYMER REACTION ENGINEERING**  
**(2008 Course) (Semester - I) (Elective - I(a)) (509118)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question number 1&5 are compulsory. Out of the remaining attempt 2 questions from Section I & 2 questions from Section II.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Numbers to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic table, electronic pocket calculators is allowed.*

**SECTION - I**

**Q1)** Styrene is polymerized in Batch reactor at 80°C. The initial concentration of Styrene is 10.05gmole/lit, and the concentration of initiator is kept constant at 0.07 gmole/lit throughout the polymerization. The rate constant are as  $k_0 = 3 \times 10^{-6} \text{ sec}^{-1}$ ,  $k_p = 175 \text{ lit/gmole.sec}$ ,  $k_c = 3.6 \times 10^7 \text{ lit/gmole.sec}$ . Volume of reacting mixture is 6000 liters and the reaction time of 320 min.

Find the feed rate of the Initiator, percentage of monomer polymerized, polydispersity index. Assume same reaction is carried out in Batch reactor find out the change in number average and weight average molecular weight.

**[18]**

- Q2) a)** Explain with one example “Effect of Molecular weight and Molecular weight Distribution on properties”. **[6]**
- b) Explain the different mechanism steps for Free Radical Polymerization. **[5]**
- c) Distinguish between Chain Growth and Step Growth Polymerization. **[5]**

**P.T.O.**

**Q3)** A polydisperse sample of polymer is prepared by mixing three monodisperse samples in following proportions: **[16]**

10gm - 10,000 molecular weight

20gm - 50,000 molecular weight

20gm - 1,00,000 molecular weight

Find number average and weight average degree of polymerization and PDI of the sample.

Define Instantaneous fractional degree of polymerization and weight degree of polymerization and derive the necessary expression for the Instantaneous fractional degree of polymerization and weight degree of polymerization under free radical polymerization.

**Q4) a)** Describe with neat diagram role of Emulsifier. **[6]**

b) Write a note on Gel Effect and Characterization of Polymers. **[10]**

### **SECTION -II**

**Q5)** Discuss in detail applicable model for kinetics of Emulsion polymerization. **[18]**

**Q6) a)** Explain with three different ways how to control molecular weight in Step growth polymerization also explain applicable model for high conversion under step growth polymerization. **[10]**

b) Explain in detail Co-ordination polymerization for olefins. **[6]**

**Q7) a)** Discuss in detail Suspension Polymerization Reactor with one example. **[10]**

b) Explain with neat process diagram PS production. **[6]**

**Q8)** Write a short note. **[16]**

a) Design Consideration in Polymerization reactors.

b) Reactors for tailor making polymers.



Total No. of Questions : 8]

SEAT No. :

P4723

[Total No. of Pages : 3

[4760] - 531

M.E. (Polymer)

TRANSPORT PHENOMENA IN POLYMERS

(2008 Pattern) (Elective - I)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 5 questions from the following.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.*
- 4) *Assume Suitable data, if necessary.*

- Q1)** a) What is vector? Define any vector which is often used in Polymer Industries and indicate its significances. [6]
- b) Define Cartesian tensor and represent it mathematically. [6]
- c) Explain Curl of vector field with help of suitable mathematical expression and its usage in Transport Phenomena. [8]
- Q2)** a) With help of neat diagram represent all the body and surface forces important for Polymer flow. [6]
- b) Correlate Stress and Strain of the polymeric materials with help of neat diagram. Provide a mathematical expression correlating stress with strain. [8]
- c) Discuss the Cauchy's principles and its usage in polymer deformation. [6]
- Q3)** a) Derive the necessary expression for velocity profile of non-Newtonian fluids flowing through circular cross-section. [8]
- b) Discuss with applicable diagram the dimensionless velocity profile for power law non-Newtonian fluids through a pipe. [4]
- c) Discuss the power correlation in mixing for a non-Newtonian fluid. [8]

**P.T.O.**

- Q4)** a) With help of neat diagram explain stress vector and provide necessary mathematical background. [6]
- b) Discuss the similarity between Heat Transfer, Mass Transfer and Momentum Transfer. [8]
- c) What are Analogies? Write a detailed note on benefits and usability of Analogies. [6]
- Q5)** a) Draw a neat diagram of flow between cylinders with viscous heat generation and obtain the mathematical expression. [8]
- b) Derive the necessary expression of permeability for diffusion in polymeric film. [6]
- c) Write a short note on controlled release through polymeric film and its practical applications. [6]
- Q6)** a) Estimate the rate at which gas bubbles of gas A are absorbed by the liquid B as the gas bubbles rise at their terminal velocity  $v_t$  through a clean and quiescent liquid. [6]
- b) Discuss the principle of operation of Ion-Exchange Resin. Explain and elaborate the multi-component mass transfer through polymeric membranes in this context. [8]
- c) A polyethylene film of 0.32 mm thick is being considered for used in packaging pharmaceutical product at 20°C. If the partial pressure of oxygen outside the package is 0.18 atm and inside it is 0.02 atm. Calculate the diffusional flux of oxygen at steady state. Assume that the resistances to diffusion outside and inside of the film are negligible compared to the resistance of the film.
- Data provided: Diffusivity =  $0.8 \times 10^{-10}$  m<sup>2</sup>/s and solubility is 0.052 m<sup>3</sup> solute / (m<sup>3</sup> solid. atm). [6]
- Q7)** a) Show that dispersivity for laminar flow in a parallel-plate channel with plate spacing  $2H$  can be represented by the following equation: (symbols have their usual significances). [8]

$$\frac{K}{D} = 1 + \frac{Pe^2}{210} = 1 + \frac{2}{105} \left( \frac{UH}{D} \right)^2$$

- b) Obtain the expression of velocity for turbulent flow near the wall. Draw a neat sketch of the process and label it properly. [8]
- c) Explain the importance of viscous dissipation in polymer processing. [4]

- Q8)* a) Suppose that a small water droplet is suspended in a stream of dry nitrogen at ambient temperature and moderate pressure. Obtain the mathematical expression representing the time required by the droplet to evaporate completely. Consider the temperature and composition of bulk gas is provided. [10]
- b) What are the different Models for diffusion through polymer films containing impermeable domains of various shapes. Provide the mathematical expressions as well as the physical significances. [10]



Total No. of Questions : 10]

SEAT No. :

P4376

[Total No. of Pages : 2

[4760] - 533

M.E. (Polymer Engineering)

POLYMER RHEOLOGY

(2008 Pattern) (Elective - II(a))

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question number 1 & 5 are compulsory. Out of the remaining attempt 2 questions from Section -I & 2 questions from Section - II.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Numbers to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic table, electronic pocket calculators is allowed.*

**SECTION - I**

- Q1)** a) Explain in detail with one case study Viscous and Elastic Effect in Polymer Melts. [10]  
b) Explain with neat diagram Creep and Stress Relaxation. [5]  
c) Discuss in detail Time dependent Fluids. [5]
- Q2)** Explain in detail Analysis of Flow through Annulus by using Power Law and Ellis Model. [15]
- Q3)** a) Explain in detail Normal Stresses and Weissenburg effect. [10]  
b) Write a note on Tensor. [5]
- Q4)** a) Explain Ryan Johnson criteria. [6]  
b) Explain Rheological models for extensional viscosity. [9]

**P.T.O.**

- Q5)** a) Explain in detail Analysis of Flow through parallel plates by using Power Law. [6]  
b) Explain in detail Boltzmann Principle of Superposition. [9]

**SECTION - II**

**Q6)** Explain in detail Maxwell and Vigot-Kelvin Model. [20]

- Q7)** a) Explain in detail different theories of glass transition. [9]  
b) Write a note on WLF Equation. [6]

- Q8)** a) Explain with neat diagram, principle, working of any two Rheometers. [10]  
b) Explain in detail Effect of fillers on rheological behaviour of polymer melts. [5]

- Q9)** Write a short note. [15]  
a) Rheology of polymer Blends  
b) Rheology of Extrusion

- Q10)**a) Explain any four parameters influencing polymer rheology. [8]  
b) Write a note “Rheology of phase separated block & graft copolymers”. [7]



Total No. of Questions : 8]

SEAT No. :

**P4706**

**[4760] - 535**

[Total No. of Pages :2

**M.E. (Polymer Engineering)  
PACKAGING TECHNOLOGY  
(2008 Course) (509119) (Elective - II (c)) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question number 1 & 5 are compulsory. Out of the remaining attempt 2 questions from Section I & 2 questions from Section II.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Numbers to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic table, electronic pocket calculators is allowed.*

**SECTION - I**

- Q1)** Discuss in detail different Physico-chemical properties for packaging materials. Differentiate between different packaging materials based on the above. [18]
- Q2)** a) Explain with one example “Principles of Corrosion and its prevention”. [6]  
b) Explain can lining compounds and lacquers for containers used for food packaging. [5]  
c) Explain different Physical characteristics of the product. [5]
- Q3)** Explain with example characteristics of packaging materials for susceptibility to water, water vapour, gases. [16]
- Q4)** a) Describe in detail product-package relationship influencing Package design. [6]  
b) Write a note on heat and light effect on packaging materials. [10]

*P.T.O.*

## SECTION - II

**Q5)** Discuss in detail Different types of adhesives and theory and principles of adhesion. **[18]**

**Q6) a)** Explain in detail manufacture and applications of Adhesive tapes with examples. **[10]**

b) Distinguish between vegetable, animal, inorganic and synthetic based Adhesives. **[6]**

**Q7) a)** Discuss in detail Types of cushioning materials and properties with one example. **[10]**

b) Explain Resilient materials and Non-Resilient materials used for cushioning materials. **[6]**

**Q8)** Write a short note: **[16]**

a) Printing techniques.

b) Sterilization of packaging materials.



Total No. of Questions : 10]

SEAT No. :

P4377

[Total No. of Pages :2

[4760]-536

M.E. (Polymer Engineering)

POLYMER PHYSICS AND CHARACTERIZATION

(2008 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Question number 1 & 6 are compulsory. Outof the remaining attempt 2 questions from Section - I & 2 questions from Section - II.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Numbers to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of logarithmic table, electronic pocket calculators is allowed.*

**SECTION - I**

- Q1)** a) Explain in detail Flory-Huggins theory. [15]  
b) Explain the term Theta solvent. [5]
- Q2)** a) Discuss the term Molecular configuration in solutions. [7]  
b) Explain Light Scattering Measurement of solution properties. [8]
- Q3)** a) Explain significance of Electric properties. [6]  
b) Write a note on Mechanical Properties Analysis. [9]
- Q4)** a) Explain suitable technique to measure thermal relaxations. [8]  
b) Explain any one method to study surface properties. [7]
- Q5)** a) Write a note on "DSC and its applications". [8]  
b) Explain in detail TGA with one example. [7]

**P.T.O.**

## SECTION - II

**Q6)** Explain in detail any one method to measure molecular weight and its distribution [20]

**Q7) a)** Explain anyone method to measure dielectric properties. [7]

b) Explain conductivity measurements of polymers. [8]

**Q8) a)** Explain X-ray studies of polymers. [7]

b) Explain in detail working of UV spectroscopy. [8]

**Q9)** Write a short note: [15]

a) Shear flow and Elongational flow

b) Stress Relaxation

**Q10)a)** Explain in detail different parameters influencing rheological Properties of polymers. [7]

b) Write a note on Optical Microscopy. [8]



Total No. of Questions : 8]

SEAT No. :

**P4088**

**[4760] - 538**

[Total No. of Pages :3

**M.E. (Polymer Engineering)**  
**PROCESSING AND MECHANICS OF COMPOSITES**  
**(2008 Course) (Semester - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Q.no. 1 and 5 are compulsory. Answer any other two questions from section I and any other two questions from section II.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

**Q1)** Answer any four:

**[20]**

- a) Give plane stress condition for orthotropic lamina.
- b) Explain the circumferential and polar winding in case of filament winding.
- c) Discuss the process of pultrusion for thermosets and thermoplastic.
- d) Discuss hot-melt impregnation method for incorporation of fibres into thermoplastic resins.
- e) Write in short about vinyl esters used as matrix material in fibre reinforced composites.

**Q2)** a) Show that Hoffman's biaxial theory reduces to Tsai-Hill failure theory for equal strength in tension and compression. **[7]**

- b) Draw schematic drawing of resin transfer moulding and discuss the process parameters affecting the quality of the product. Write with reference to some important applications. **[8]**

**Q3)** a) Discuss the effect of pressure rise in the die on pultruded product. **[7]**

- b) A unidirectional lamina is stressed to 50 MPa in the direction of fibres. Find the strains in the global co-ordinate system which is at 60 degrees to the local co-ordinate system. Use following data. **[8]**

$$E_1 = 200 \text{ GPa}, E_2 = 50 \text{ GPa}, G_{12} = 2 \text{ GPa}, \nu_{12} = 0.2$$

**P.T.O.**

- Q4)** a) Write expressions for the restrictions on Poisson's ratios for orthotropic lamina in terms of engineering constants. [5]
- b) Show that maximum fibre volume fraction for a lamina when fibres are arranged in rectangular array (fibre at corners of square and one at the centre) is 0.785. [5]
- c) For a randomly oriented discontinuous fibre lamina, calculate tensile modulus, shear modulus and Poisson's ratio if following data is known.
- $E_f = 200 \text{ GPa}$ ,  $E_m = 5 \text{ GPa}$ ,  $\rho_f = 2.54 \text{ kg/mm}^3$ ,  $\rho_m = 1 \text{ Kg /mm}^3$ ,  $L_f = 25 \text{ mm}$   
 $d_f = 2.5 \text{ mm}$ . [5]

### SECTION - II

- Q5)** Answer any four: [20]
- a) Give governing equations for the bending of composite lamina.
- b) Give expression for
- i) Extensional stiffness matrix
  - ii) Bending - extension coupling stiffness matrix
  - iii) Bending stiffness matrix
- c) Calculate extension stiffness matrix and bending stiffness matrix for a single layer specially orthotropic lamina having 1 mm thickness. Engineering constants of the lamina are:
- $E_1 = 200 \text{ GPa}$   $E_2 = 50 \text{ GPa}$   $G_{12} = 2 \text{ GPa}$   $\nu_{12} = 0.2$
- d) Write governing vibration differential equations for laminated plates.
- e) Write assumptions of classical lamination theory.
- Q6)** a) Discuss the step by step procedure for design of laminates using ply by ply failure analysis. [7]
- b) Analyse bending of balanced symmetric laminate beam. [8]
- Q7)** Define and give force and moment equations for the following types of laminates. [15]

- a) Regular antisymmetric angle ply laminate
- b) Regular antisymmetric cross ply laminate
- c) Regular symmetric cross ply laminate

**Q8)** a) Calculate [A], [B], [D] matrices for  $[+45 / -45]_s$  symmetric laminate. Each lamina is 5 mm thick. Engineering constants for the lamina are: **[10]**

$$E_1 = 100 \text{ GPa} \quad E_2 = 50 \text{ GPa} \quad G_{12} = 5 \text{ GPa} \quad \nu_{12} = 0.3$$

- b) What is quasi - isotropic laminate? **[5]**



Total No. of Questions : 6]

SEAT No. :

P3761

[Total No. of Pages : 2

[4760] - 54

**M.E. (Civil) (Structure)**

**MECHANICS OF MODERN MATERIALS**

**(2008 Pattern) (Semester - II) (Elective - IV)**

*Time :4 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of nonprogrammable pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Explain FRPC(fiber reinforced polymer composite) and its constituent structure and materials. [8]
- b) What do you understand by Piezoelectric material and its applications. [5]
- c) What is direct and converse effect. [4]
- d) Explain classification of materials used in FRC and situations where these class of materials are advantageous. [8]
- Q2)** a) Explain elasticity model for composite material. [8]
- b) Explain orthotropic, anisotropy of composite material. [8]
- c) Write compliance and stiffness matrices for plane stress and axisymmetric condition, for cross ply laminate material. [9]
- Q3)** a) Explain theories of failure applicable for FRC. [12]
- b) Explain stress strain behavior of FRC. [13]

**P.T.O.**

## SECTION - II

- Q4)** a) Obtain Naviers equation for orthotropic laminate with two opposite side simply supported. [9]
- b) Explain and sketch : [16]
- i) Orthotropic, Anisotropic laminate.
  - ii) Symmetric, balanced laminate.
  - iii) Antisymmetric and cross ply laminate.
- Q5)** a) Explain factors affecting mechanical properties of composite laminate. [10]
- b) Find coefficient of thermal expansion for a 90 degree orthotropic laminate. [15]
- $E_1 = 60 \text{ GPa}, E_2 = 14 \text{ Gpa}, E_3 = 14 \text{ GPA}$
- $\mu_{12} = 0.29 = \mu_{21}$
- $\alpha_1 = 0.9 \cdot 10^{-6} / \text{c}^\circ, \alpha_2 = 27 \cdot 10^{-6} / \text{c}^\circ$
- Q6)** a) Explain manufacturing of composite sketch important details. [8]
- b) List tests carried out for determination of properties of composite. [9]
- c) State advances in technology for high performance of composites. [8]



Total No. of Questions : 6]

SEAT No. :

**P4378**

**[4760] - 545**

[Total No. of Pages : 1

**M.E. (Printing)**

**PROBABILITY, STATISTICS AND QUEUING THEORY  
(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *Attempt any Two Questions from each section.*
- 2) *Assume Suitable data, if necessary.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Explain concept of probability, Random variable, Binomial and poisson Theory. **[25]**

**Q2)** Explain Regression Analysis and Binomial distribution. Explain multivariate probability with suitable printing Application. **[25]**

**Q3)** Explain Residual Analysis & non-linear regression. What is Resolution of Fit of a model. **[25]**

**SECTION - II**

**Q4)** Explain Types of control **[15]**

- a) Charts
- b) Explain Acceptance Sampling method. **[10]**

**Q5)** Explain Design of Experiment for Quality improvement in printing Technique. **[25]**

**Q6)** a) Explain Queuing models. **[15]**

- b) Explain Kendels notation. **[10]**



Total No. of Questions : 6]

SEAT No. :

**P4379**

[Total No. of Pages : 1

[4760] - 546

**M.E. (Printing)**

**PRINTING TECHNOLOGY MANAGEMENT**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any two questions from each section.*
- 2) *Answer to the two sections should be written in separate book.*
- 3) *Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Explain Print Production Systems and operation management. [25]

**Q2)** a) Classify production System. [10]

b) Explain concept of product life cycle. [15]

**Q3)** Explain in detail supply chain management to Printing Process. [25]

**SECTION - II**

**Q4)** Explain Inventory control models. [25]

**Q5)** Explain concept of Quality management. [25]

**Q6)** a) Explain OC Curves. [10]

b) Explain Types of Sampling plans. [15]



Total No. of Questions : 6]

SEAT No. :

**P4089**

**[4760]-547**

[Total No. of Pages : 2

**M.E. (Printing Engineering & Graphic Communication)**

**MODERN TRENDS IN PRINTING**

**(2008 Pattern) (Semester-I) (508103)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answers to two sections should be written in separate books.*
- 3) Draw neat diagram wherever necessary.*
- 4) Figures to right indicate full marks.*

**SECTION-I**

**Q1) a)** Explain in detail effect of offset process parameters on printability. **[15]**

b) Mention the features of Offset printing process. **[10]**

**Q2) a)** Explain in detail inking system for flexography. **[15]**

b) Explain the processing of photopolymer plate. **[10]**

**Q3) a)** Explain in detail making of a Gravure cylinder. **[15]**

b) Describe the unit configurations of a gravure press. **[10]**

**SECTION-II**

**Q4) a)** Explain the effect of nip pressure on print quality. **[10]**

b) Explain the types of impression pressurization systems. **[15]**

***P.T.O.***

**Q5) a)** Mention the loading systems on a web press. [10]

b) Explain the principle and working of ELS. [15]

**Q6) a)** Explain the factors governing ink transfer in gravure. [15]

b) Mention the safety precautions to be considered for gravure cylinder. [10]



Total No. of Questions : 6]

SEAT No. :

**P4090**

**[4760] -549**

[Total No. of Pages :2

**M.E. (Printing Engg. & Graphic Communication)  
PRINTING AND PACKAGING MATERIALS  
(2008 Course) (Semester - I) (Elective - I) (508104 B)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Figures on right indicate marks.*

**SECTION - I**

- Q1)** a) Explain Plating process for Gravure. [10]  
b) Discuss Thermal CTP in detail. [15]
- Q2)** a) State and explain different types of papers used for printing & packaging. [10]  
b) What is roughness property of paper? Explain methods of measurements. [15]
- Q3)** a) Explain the identification tests for LDPE. [16]  
b) Explain the tearing, burning and solubility tests for PET. [9]

**SECTION - II**

- Q4)** a) Mention following tests for a substrate: (Any Four). [16]  
i) Puncture resistance test.

***P.T.O.***

- ii) Chemical test
  - iii) Adhesion tape test
  - iv) COF
  - v) Modulus of elasticity.
- b) Explain different tests carried for packaging materials. [9]
- Q5)** a) Explain various ink systems used for packaging printing. [15]
- b) Comment on surface energy and Printability. [10]
- Q6)** a) What is tack? How tack is measured? [15]
- b) Write note on ink dispersion. [10]



Total No. of Questions : 6]

SEAT No. :

P3928

[Total No. of Pages : 2

[4760] - 55

M.E. (Civil) (Structures)

THEORY OF PLASTICITY

(2008 Pattern) (Open Elective - IV)

Time : 4 Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) Answer any 2 questions from each section.
- 2) Answers to the two sections should be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) All questions carry equal marks.
- 5) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) Derive Saint Venant's strain compatibility conditions for 3D elasticity problem. [10]  
b) Derive the strain displacement relationship for 3D elasticity problem. [10]  
c) Explain in brief plane stress and plane strain problems. [5]
- Q2)** a) Explain in brief Tresca's and Von-Mises-Hencky's yield criteria. [10]  
b) Explain uniqueness and stability postulates. [10]  
c) Let us consider that a metal with a yield stress of 280 MPa is subjected to a stress state with principal stresses of 300 MPa, 200 MPa and 50 MPa. Will the metal yield based on the Tresca yield criterion? [5]
- Q3)** a) Explain The von-Mises yield criterion. [10]  
b) A thick cylinder of internal radius 15 cm and external radius 25 cm is subjected to an internal pressure 'p' MPa. If the yield stress for the cylinder material is 220 N/mm<sup>2</sup>, determine (i) the pressure at which the cylinder will start yielding just at the inner radius (ii) the stresses when the cylinder has a plastic front radius of 20 cm. Assume Von-Mises yield condition and state of plane strain. [15]

**P.T.O.**

## SECTION - II

- Q4)** a) When a plasticity model is said to be isotropic hardening? Explain with example. [10]  
b) Explain the successive stages in the plastic yielding of rectangular beams [10]  
c) Explain in brief Prager's and Ziegler's kinematic hardening model. [5]
- Q5)** a) Derive the equations of radial ( $\sigma_r$ ) and transverse ( $\sigma_\theta$ ) stresses for the section of wide plate subjected moments at the ends. [15]  
b) Explain the theorems of limit analysis. [10]
- Q6)** a) Explain various types of elements used in the finite element method with applications. [10]  
b) Explain incremental methods of determining limit load. [15]



Total No. of Questions : 10]

SEAT No. :

**P4091**

**[4760] - 550**

[Total No. of Pages :2

**M.E.(Printing)**

**DESIGN OF EXPERIMENTS AND RESEARCH METHODOLOGY**

**( 2008 Course)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Answer any three questions from each section.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator, log-log paper is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Define research? What are the characteristics & objectives of research? [8]  
b) Explain the term hypothesis. What are desirable qualities of good hypothesis? [8]
- Q2)** a) Explain methods of problem solving and there types? [8]  
b) Explain Delphi method in detail [8]
- Q3)** a) Explain Development of Mathematical models [8]  
b) Which are the reasons and applications for using Heuristics [8]
- Q4)** a) Explain meaning, application and classification of simulation models [9]  
b) Explain development of creativity in problem solving [9]

OR

- Q5)** a) Explain heuristics and simulation in detail [9]  
b) Explain Steps and Features of Simulation Experiments and their Validation. [9]

**P.T.O.**

**SECTION - II**

**Q6)** Explain the Applications of Experimental Design [16]

**Q7) a)** Explain the Principles- Replication, Randomization and Blocking, [8]

b) Explain Factorial Design principles [8]

**Q8) a)** Explain Taguchi Approach to Parameter Design [8]

b) Explain the Fitting response Curves and Surfaces [8]

**Q9) a)** Explain the Analysis of Variance and Co-variance [9]

b) Compare Uni-variate and Bi-variate analysis [9]

OR

**Q10) a)** What are the Principles of Thesis Writing [9]

b) What is Hypothesis Testing? Explain parametric and Non-Parametric Tests? [9]



Total No. of Questions : 6]

SEAT No. :

**P4728**

**[4760] - 551**

[Total No. of Pages : 1

**M.E. (Printing Engineering)**  
**DIGITAL PRINTING**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

**Instructions to the candidates:**

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

**Q1)** Specify Digital Image Resolution? Explain digital resolutions as per print processes. **[18]**

OR

Explain Binary coding of Bitmaps.

**Q2)** Evaluate File formats for Large format printing. **[16]**

OR

Explain Image compression in detail.

**Q3)** Explain sensing devices design in detail. **[16]**

OR

Explain structure of CMOS sensors in detail.

**Q4)** Explain Rip systems for Laser printing systems. **[18]**

OR

Describe Thermal Printing and applications.

**Q5)** Explain Applications of variable data printing. **[16]**

OR

Explain POD system and applications in detail.

**Q6)** Describe and discuss Future trends in digital printing. **[16]**

OR

Explain Role of digital imaging and printing for E publishing.



Total No. of Questions : 6]

SEAT No. :

**P4380**

[Total No. of Pages : 1

**[4760] - 552**

**M.E. (Printing)**

**ENTREPRENEURSHIP IN PRINTING AND ALLIED FIELDS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answer to two sections should be written in separate book.*
- 3) Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Explain Print Production Process and Evaluation norms for Printing Industry. **[25]**

**Q2)** Explain supervisory structure in Printing Industry. **[25]**

**Q3)** What is standardisation? Explain Cost estimation is done in Printing Industry. **[25]**

**SECTION - II**

**Q4)** Explain ISO standard for printing process in detail. **[25]**

**Q5)** Explain financial payment details. **[25]**

**Q6)** Explain Sales Tax Structure in detail for printing processes. **[25]**



Total No. of Questions : 6]

SEAT No. :

P4092

[Total No. of Pages : 2

[4760] - 553

**M.E. (Printing Engg. And Graphic Communications)**  
**QUALITY CONTROL SYSTEMS AND PRODUCTIVITY**  
**(2008 Pattern) (Elective - II)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each sections*
- 2) *Answer to the two sections should be written in separate books*
- 3) *Neat diagrams must be drawn wherever necessary*
- 4) *Assume suitable data wherever necessary*
- 5) *Figures on right indicates marks*

**SECTION-I**

- Q1)** a) Explain the workflow from pre-press to post-press of Offset process. [13]  
b) Explain the process configuration of Gravure process. [12]
- Q2)** a) Explain the effect of standardized press settings on print quality. [10]  
b) Explain the calibration of pre-press for a conventional print process. [15]
- Q3)** a) Comment on 'Color Spaces'. [9]  
b) Write notes on (any four) [16]  
i) Automatic Viscosity controller  
ii) Trakatron  
iii) Color deviation  
iv) dot gain  
v) Contrast

**P.T.O.**

## SECTION-II

- Q4)** a) What do you mean by Six Sigma? Also explain DMAIC concept. [15]  
b) Write about Quality Challenges in Printing Industry. [10]

**Q5)** What is SPC? What is use of its implementation in printing company? [25]

**Q6)** Write in detail about process analysis in printing. [25]



Total No. of Questions : 6]

SEAT No. :

P4381

[Total No. of Pages :2

[4760]-554

**M.E. (Printing Engineering & Graphic Communication)**

**PRINT MEDIA COMMUNICATION**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each sections.*
- 2) Answer to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Assume suitable data wherever necessary.*
- 5) Figures to the right indicates marks.*

**SECTION - I**

**Q1) a)** What are the technical skills used for designing surfaces with various methods? **[15]**

b) Name the soft wares used in surface designing. **[10]**

**Q2) a)** Explain various skills used in creating designs for substrates like paper, board, glass and plastics. **[20]**

b) What is human vision system. **[5]**

**Q3)** What are the tools used for solving problems in the field of creative media production? **[25]**

**P.T.O.**

**SECTION - II**

- Q4)** a) What is D.T.P? Explain in detail. [13]  
b) Design a book for primary school children explaining numbers. [12]
- Q5)** a) Design a sport page for IPL Matches. [13]  
b) How inside pages of news paper are designed? [12]
- Q6)** a) What are the standard format of news Paper design? [13]  
b) What is typographic make up? How it is solved by using software?[12]



Total No. of Questions : 6]

SEAT No. :

**P4093**

[Total No. of Pages : 2

**[4760] - 555**

**M.E. (Printing Engineering & Graphic Communication)**

**WEB HANDLING ON PRESS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) Answer any two questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Draw neat diagram wherever necessary.*
- 4) Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain in detail defect detection system for a web. [15]  
b) Explain the technique used for continuous operation of a web. [10]
- Q2)** a) Explain in detail treatments for a web. [10]  
b) Explain in detail preconditioning of a web. [15]
- Q3)** a) Control of tension for a web is important. Explain. [10]  
b) Explain the various tension control system. [15]

**SECTION - II**

- Q4)** a) Explain in detail circumferential register control system. [15]  
b) Explain in detail lateral register control system. [10]

***P.T.O.***

**Q5) a)** Mention the types of web guiding systems. **[15]**

b) Explain in detail balancing of a roller. **[10]**

**Q6) a)** Explain the role of idle rollers on a press. **[15]**

b) Explain in detail deflection of a roller. **[10]**



Total No. of Questions : 6]

SEAT No. :

**P4094**

**[4760]-556**

[Total No. of Pages : 2

**M.E. (Printing Engg. )  
SUBSTRATES AND INKS**

**(2008 Course) (Semester-II)(508110)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume Suitable data , wherever necessary.*
- 5) *Figures to the right side indicate full marks.*

**SECTION-I**

- Q1)** a) Explain mechanical pulping process with adequate diagrams. [13]  
b) Write detailed note on Hydrogen bonding. [12]
- Q2)** a) State physical properties of paper? Elaborate measuring methods. [13]  
b) Explain ASTM and TAPPI standards for boards. [12]
- Q3)** a) Explain the various ingredients and their role in ink formulation. [13]  
b) Give typical formulation of water based Flexo printing ink for paper. [12]

**SECTION-II**

- Q4)** a) Write in detail about Metallic Inks? [10]  
b) Write notes on: (Any Three) [15]
- i) Scented Inks.                      ii) Electrographic Inks.  
iii) Fluorescent Inks.                iv) Security and special effect printing Inks

***P.T.O.***

- Q5)** a) Write What is costing? State and explain various elements of costing with appropriate examples. **[10]**
- b) Calculate paper required for printing 1500 copies of leaflet of size 8 inches \* 11 inches on offset machine. **[15]**
- Q6)** a) Comment on Environmental laws for print industry. **[13]**
- b) Write note on Sustainability and Going Green. **[12]**



Total No. of Questions : 6]

SEAT No. :

**P4095**

**[4760] - 557**

[Total No. of Pages :1

**M.E. (Printing )**

**MULTIMEDIA SYSTEMS AND COMMUNICATIONS**

**(2008 Pattern) (Semester -II) (Elective -III) (508111(A))**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Solve any two questions from each section.*
- 2) *Draw diagrams wherever necessary.*

**SECTION - I**

**Q1)** What are the specific requirements of image parameters in order to make them eligible for multimedia processing? **[25]**

**Q2)** With respect to latest developments in multimedia communication explain in details collaboration of different media such as audio, video and animation. **[25]**

**Q3)** Explain the following: **[25]**

- a) Multimedia formats
- b) Compression techniques

**SECTION - II**

**Q4)** Describe the specifications of digital camera for image capturing for multimedia applications. **[25]**

**Q5)** Explain in details the various aspects of web page design. **[25]**

**Q6)** Explain following applications of multimedia communication; **[25]**

- a) Internet radio
- b) Online shopping



Total No. of Questions : 6]

SEAT No. :

**P4382**

**[4760] - 558**

[Total No. of Pages :1

**M.E. (Printing)**

**TOTAL PRODUCTIVE MAINTENANCE IN PRINTING**

**(2008 Pattern) (Sem. -II) (Elective - III) (508111 B)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any two questions from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Figures to the right indicate full marks.*

**SECTION - I**

**Q1)** Explain stages of implementing TPM in printing process. **[25]**

**Q2)** Explain 5S technique in detail. **[25]**

**Q3)** Explain Pareto Analysis of as applied to offset printing process. **[25]**

**SECTION - II**

**Q4)** Explain planned maintenance to Gravier printing process. **[25]**

**Q5)** Explain process capability of offset printing process by using DOE Technique. **[25]**

**Q6)** Explain logistics & TPM pillan in detail. **[25]**



Total No. of Questions : 6]

SEAT No. :

**P4096**

**[4760] - 559**

[Total No. of Pages :2

**M.E. (Printing Engg. & Graphic Communication)**

**PRESS FINGER PRINTING**

**(2008 Pattern) (Semester - II) (Elective -III) (508111(c))**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Figures to the right indicate full marks.*

**SECTION - I**

- Q1) a) What is Press Finger Printing? [10]**
- b) What are requirements of pre-press conditions in finger printing? [15]
- Q2) a) State and explain variables considered for Flexo Press Optimization?[13]**
- b) Write notes on: [12]
- i) Hue error
  - ii) Grey balance
  - iii) Color variation
- Q3) a) State and explain the test forms and instruments required for press finger printing. [13]**
- b) Write notes on: [12]
- i) Balls and Beads
  - ii) Slur target

***P.T.O.***

## SECTION - II

- Q4)** a) Comment on Plan & Run Standardization Test for capabilities and Optimization. [15]  
b) Discuss importance of profiling? [10]
- Q5)** a) What is post finger printing? [13]  
b) Explain Profile Editing? [12]
- Q6)** a) Write note on Short-Term and Long-Term Variation. [13]  
b) Discuss Process stability and Process capability. [12]



Total No. of Questions : 6]

SEAT No. :

P4740

[Total No. of Pages :2

[4760]-56

M.E. (Civil) (Structures)

OPTIMIZATION TECHNIQUES

(2008 Pattern) (Elective - IV)

Time : 4 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer any two questions from each section.
- 2) Answers to the two sections must be written in separate books.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of electronic pocket calculator is allowed.
- 6) Assume suitable data, if necessary.

**SECTION - I**

- Q1)** a) A beam of uniform rectangular cross-section is to be cut from a log having a circular cross-section of diameter  $2a$ . The beam has to be used as a cantilever beam (the length is fixed) to carry a concentrated load at the free end. Find the dimensions of the beam that correspond to the maximum tensile (bending) stress carrying capacity. [13]
- b) State six structural engineering applications of optimization. [12]
- Q2)** a) Solve the following LP problems by the revised simplex method.[13]  
Minimize  $f = 5x_1 + 2x_2 + 5x_3 - 3x_4$   
Subject to  $2x_1 + x_2 - x_3 = 6$   
 $3x_1 + 8x_3 + x_4 = 7$   
 $x_i \geq 0, i = 1 \text{ to } 4$
- b) Explain revised simplex method, Duality in linear programming, Decomposition principle, and Post-optimality analysis in Linear Programming. [12]
- Q3)** a) Find the minimum of  $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$  by the cubic Interpolation method. [13]
- b) Minimize the function using the golden section method with  $n=6$ . [12]  
 $f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65 \times \tan^{-1}(1/x)$

**P.T.O.**

## SECTION - II

**Q4) a)** Show that the Newton's method finds the minimum of a Quadratic function in one iteration, [10]

$$F(X) = \frac{1}{2}X^T[A]X + B^T X + C$$

**b)** Explain [15]

- i) Indirect search method and Direct search method,
- ii) Random search method and Steepest Descent (Cauchy) method
- iii) Univariate and pattern search method,

**Q5) a)** Design the cantilever beam with  $X_1$  width,  $X_2$  depth and point load  $P$  at the end of beam, formulate the problem of determining the cross-sectional dimensions of the cantilever beam for minimum weight. The maximum permissible bending stress is  $\sigma_y$ . [12]

**b)** Minimize the interior penalty function [13]

$$f(x_1, x_2) = \frac{1}{3}(x_1 + 1)^3 + x_2$$

$$\text{Subject to } g_1(x_1, x_2) = -x_2 + 1 \leq 0$$

$$g_2(x_1, x_2) = -x_2 \leq 0$$

**Q6) a)** Explain with suitable sketch and examples Selection operator, Crossover Operator and mutation Operator in Genetic Algorithms. [12]

**b)** Differentiate biological neural network and artificial neural network? [6]

**c)** What are the activation functions in artificial neural networks? [7]



Total No. of Questions : 6]

SEAT No. :

**P4097**

[Total No. of Pages : 2

**[4760] - 561**

**M.E. (Printing Engineering & Graphic Communication)**

**ADVANCES IN CONVERTING AND PACKAGING**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from each section.*
- 2) *Answers to two sections should be written in separate books.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Figures to right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain the finishing process for a product. [15]  
b) State the ways of protecting a brand product in a package. [10]
- Q2)** a) Explain the converting process used for publication. [15]  
b) Explain in detail Coating process. [10]
- Q3)** a) Explain along with diagram Wet Lamination technique. [15]  
b) Explain along with diagram Hot-Melt Lamination technique. [10]

**SECTION - II**

- Q4)** a) Explain in detail extrusion process. [15]  
b) Explain in detail shrink wrapping. [10]

**P.T.O.**

- Q5)** a) Explain in detail Bag-in-Box for solid products. [15]  
b) Explain the role of PET bottles in packaging. [10]
- Q6)** a) Explain the techniques used to increase the shelf life of milk product. [15]  
b) Explain in detail Boil-in-Bag packaging. [10]



Total No. of Questions : 6]

SEAT No. :

**P4098**

[Total No. of Pages : 2

**[4760] - 562**

**M.E. (Printing Engineering & Graphic Communication)**

**ANALYSIS OF SPOT AND PROCESS INKS**

**(2008 Pattern) (Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any two questions from each section.*
- 2) *Answers to two sections should be written in separate books.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Figures to right indicate full marks.*

**SECTION - I**

- Q1)** a) Explain in detail solvent based inks for gravure process. [15]  
b) Explain in detail water based inks for flexo process. [10]
- Q2)** a) Explain the characteristics of resins in flexography inks. [15]  
b) Explain in detail rheology property of flexo ink. [10]
- Q3)** a) Explain the rheology of Vinyl inks. [15]  
b) Explain the role of additives on gravure print quality. [10]

**SECTION – II**

- Q4)** a) Explain the role of plasticizers in Offset inks. [10]  
b) Mention the properties of colorant in offset inks. [15]

**P.T.O.**

- Q5)** a) Solid% of ink has an impact on print quality. Explain. [10]  
b) Explain the process of shade matching. [15]
- Q6)** a) Explain the impact of press parameters on dot fidelity. [15]  
b) Explain the relation between cell geometry and ink transfer. [10]



Total No. of Questions : 6]

SEAT No. :

**P3929**

[4760] - 57

[Total No. of Pages : 3

**M.E. (Civil) (Environmental Engg.)**  
**NUMERICAL METHODS & APPLIED STATISTICS**  
**(2008 & 2010 Pattern)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any two questions from each section.*
- 2) *Answer to the two sections should be written in separate answer sheets.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to right indicate full marks.*
- 5) *Use of logarithmic tables, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*
- 7) *All questions carry equal marks.*

**SECTION - I**

- Q1) a)** Solve the system of equations given by  $4x + 3y + 2z = 4$ ,  $3x + 7y + z = 8$ ,  
 $x + y + 3z = 6$ . **[9]**
- i) Set up Gauss-Seidel iterative scheme for the solution and compare with exact solution.
- ii) Discuss the convergence of this method.
- b)** Solve the following system of non-linear equations using Newton Raphson method. **[8]**
- $$x^2 + xy + y^2 = 7 \quad \& \quad x^3 + y^3 = 9.$$
- c)** The velocity distribution of a fluid near a flat surface is given below. **[8]**
- |    |      |      |      |      |
|----|------|------|------|------|
| x: | 0.1  | 0.3  | 0.6  | 0.8  |
| y: | 0.72 | 1.81 | 2.75 | 3.45 |
- Where 'x' is the displacement from the surface in cm, and 'y' is the velocity. Using Lagrangian interpolation polynomial obtain velocity at  $x = 0.4$

- Q2) a)** Maximize  $F = x_1 + 2x_2 + x_3$ , subject to **[12]**
- $$2x_1 + x_2 - x_3 \leq 2$$
- $$-2x_1 + x_2 - 5x_3 \geq -6$$
- $$4x_1 + x_2 + x_3 \leq 6$$
- Where  $x_i \geq 0, i = 1, 2, 3$ . Using simplex algorithm

**P.T.O.**

- b) Using Graphical Method, minimize  $z = 80x_1 + 120x_2$ ,  
subject to  $x_1 \geq 2, x_2 \geq 3, 20x_1 + 50x_2 \geq 300, x_1, x_2 \geq 0$ . [7]
- c) Explain Absolute and relative measures of variation and its role in pollution analysis. [6]

**Q3) a)** Write short note on : [12]

- i) Various measures of skewness  
ii) Tests of skewness

b) A factory has two machines A & B.

'A' produces 200 units and 'B' produces 800 units forming the total output. 4% of the item produced by 'A' and 2% of item produced by 'B' are defective

- i) If a defective item is drawn at random, find the probability that it is produced by 'A'.  
ii) Find the probability that an item drawn randomly from the output is defective. [8]

c) Analyze the following frequency distribution by method of moments. [5]

|     |   |   |   |   |   |
|-----|---|---|---|---|---|
| x : | 2 | 3 | 4 | 5 | 6 |
| y : | 1 | 3 | 7 | 3 | 1 |

### SECTION - II

**Q4) a)** The number of defects per unit in a sample of 330 units selected was found as follows [9]

|                  |     |    |    |   |   |
|------------------|-----|----|----|---|---|
| No. of defects : | 0   | 1  | 2  | 3 | 4 |
| No. of units :   | 214 | 92 | 20 | 3 | 1 |

Fit a poisson distribution for the above data and test for goodness of fit.

- b) Explain the role of normal distribution in pollution analysis. [8]  
c) The joint pdf of bivariate random variable  $(x,y)$  is given by [8]

$$f_{xy}(x, y) = \begin{cases} k(2x + y), & 0 < x < 2 \text{ \& } 0 < y < 1 \\ 0 & \text{else} \end{cases}$$

where 'k' is a constant

- i) Find value of  $k$ ,  
ii) Find marginal pdf of  $x$  and  $y$   
iii) Are  $x$  and  $y$  independent

- Q5) a)** Write short notes on the following : **[15]**
- i) Randomized and Nonrandomized test.
  - ii) Point estimates and interval estimates.
  - iii) Degrees of freedom.
- b) Describe chisquare test for goodness of fit. Also state assumptions to be made while applying for the test. **[10]**

- Q6) a)** Find coefficient of correlation for the following two variates. **[10]**

|   |    |    |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|----|----|
| x | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 |
| y | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 |

- b) Given the following data.

|   |   |    |    |   |
|---|---|----|----|---|
| x | 6 | 2  | 10 | 4 |
| y | 9 | 11 | 5  | 8 |

Find regression equation and calculate standard error of estimate. **[8]**

- c) Write uses and limitations of seasonal index. **[7]**



Total No. of Questions : 10]

SEAT No. :

P3762

[Total No. of Pages : 2

[4760] - 58

**M. E. (Civil) (Environmental Engineering) (Semester - I)**

**AIR POLLUTION AND CONTROL**

**(2008 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from section I and Section II.*
- 2) Each question carries equal marks.*
- 2) Figures to the right indicate full marks.*
- 3) Your answers will be valued as a whole.*
- 4) Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) Explain Sources and classification of Air pollutants.  
b) Discuss the photochemical smog in detail.

**Q2)** Explain temperature lapse rate and stability.

**Q3)** Discuss in details about plume behavior with suitable sketches.

**Q4)** What is dispersion of Air pollutants? Explain how concentration of air pollutants is carried out.

**Q5)** Discuss the stack height and mixing depth in detail.

**P.T.O.**

## SECTION-II

**Q6)** Explain any two sampling method for air pollutants in detail.

**Q7)** Explain following with suitable sketches.

- a) Electrostatic Precipitators
- b) Settling Chambers

**Q8)** Give note on the following and explain.

- a) Automobile pollution
- b) Gaseous pollution control methods

**Q9)** Discuss in detail global problems due to air pollution with suitable example.

**Q10)** Discuss the role of Indian legislation system in controlling Air pollution.



Total No. of Questions : 8]

SEAT No. :

**P4295**

**[4760] - 59**

[Total No. of Pages :2

**M.E. (Civil Environmental Engg)**  
**PHYSICO-CHEMICAL PROCESS FOR WATER AND**  
**WASTEWATER TREATMENT**  
**( 2010 Course) (Semester-I) (501503)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions form each section.*
- 2) Use of non programmable calculators are allowed.*
- 3) Neat sketnes to be drawn wherever necessary.*
- 4) Make suitable assumptions if necessary.*
- 5) Figures to the right indicate full marks.*

**SECTION - I**

- Q1)** a) Discuss the potable water standard as per IS10500:2012 [10]  
b) Explain the Langlier index with significance. [8]
- Q2)** a) Discuss the effect of modern lifestyle on quality of sewage generated? Draw the flow diagram for treating the domestic sewage generated from urban areas. Discuss the concepts on which the design of the proposed treatment units is based. [16]
- Q3)** a) Explain the primary, Secondary and Tertiary treatment of wastewater. [9]  
b) Differentiate between ideal and non-ideal flows in reactors. Also enumerate the factors causing non-ideal flow in reactors [7]
- Q4)** a) Differentiate between Perikinetetic flocculation and orthokinetic flocculation. [7]  
b) Determine the basic dimensions; power required, paddle configuration and rotational speed for a flocculator that processes 50 MLD of raw water. Optimum value and G.t.was found to i.e.45,000. [10]

**P.T.O.**

**SECTION - II**

- Q5)** a) Design an under drainage system for rapid sand filter of size 4.5mX 3.5 m. [10]  
b) Sketch and explain the operation of Rapid sand filter. [6]
- Q6)** a) Discuss the mechanism and operational problems of filters [9]  
b) Discuss the advantages and disadvantages of pressure filter over slow sand and Rapid sand. [7]
- Q7)** a) Discuss the various factors affecting disinfection process. [10]  
b) Explain the Ion Exchange Process. [6]
- Q8)** a) Write short note on following [18]  
i) Disinfection by UV radiation.  
ii) Reverse osmosis  
iii) Electrodyasllisis



Total No. of Questions : 8]

SEAT No. :

**P4547**

[Total No. of Pages :2

**[4760] - 6**

**M.E. (Civil) (Construction Management)**

**REPAIRS,REHABILITATION,RETROFITTING OF STRUCTURES**

**( 2008 Course)(Elective-I) (501104(C)) (Semester-I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Question No 1 and 5 are Compulsory. Out of the remaining attempt any two questions from Section I and two questions from Section II.*
- 2) Answers to the two Sections must be written in separate answer books.*
- 3) Neat diagrams must be draw wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Assume suitable data whenever necessary.*

**SECTION-I**

**Q1)** Define and differentiate between repairs retrofitting and rehabilitation with an example. And discuss the method of retrofitting of RCC structure? **[18]**

**Q2)** Explain the selection procedure of repairs methods and the Explain carbon fiber wrappings procedure with suitable example? **[16]**

**Q3)** Explain the Types of seismic retrofitting with fig.? What are predictive performance models and its advantages? **[16]**

**Q4)** Application of nanotechnology for repairs, rehabilitation and various types of fiber wrappings with fig.? **[16]**

**P.T.O.**

## SECTION-II

- Q5)** What are the chemical used for repairs, rehabilitation and retrofitting and procedure adopted by BIFR for a heritage building? **[18]**
- Q6)** Describe the financial feasibility study for repairing structure with suitable example? **[16]**
- Q7)** What are the new material used in repairs, rehabilitation and types of seismic retrofitting with fig.? **[16]**
- Q8)** Elaborate the factors consider by earthquake engineer for rehabilitation a RCC building in India. **[16]**



Total No. of Questions : 8]

SEAT No. :

**P4293**

**[4760]-60**

[Total No. of Pages : 2

**M.E. (Civil) (Environmental Engineering)  
AIR AND WATER QUALITY MODELING  
(2010 Course) (Semester-I) (Elective-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Use of non programmable calculators are allowed.*
- 3) Neat sketches to be drawn wherever necessary.*
- 4) Make suitable assumptions if necessary.*
- 5) Figures to the right indicates full marks.*

**SECTION-I**

- Q1)** a) Explain the importance of model building and write the steps in the model development. **[8]**
- b) Discuss the equilibrium Principle. **[10]**
- Q2)** a) Explain Streeter-Phelps equation to determine the D.O. concentration at the downstream. **[8]**
- b) What are water quality models? Explain any one model with its assumptions and reliability. **[8]**
- Q3)** a) Discuss in details Oxygen Sag curve. **[8]**
- b) Show the effect of a change in the deoxygenation or reaeration rate on the location of the critical point and the magnitude of the D.O. deficit. **[8]**
- Q4)** a) Discuss the importance of Atmospheric stability in air quality modeling. **[8]**
- b) Discuss Nitrogen modeling in a lake. **[8]**

***P.T.O.***

## SECTION-II

- Q5)** a) Discuss the effect of wind velocity and topography on transport and diffusion of pollutants. [8]
- b) Explain the various methods for assessing the performance of the air quality model. [8]
- Q6)** a) Discuss with neat sketches plume behavior and state its special features. [8]
- b) Discuss the features of multiple cell models. [8]
- Q7)** a) Discuss Ambient air quality Indices. [8]
- b) Explain the importance of water and air quality index in the modeling studies. [8]
- Q8)** Write a short note on following: [18]
- a) Gaussian Plume model.
- b) Calibration and verification of model.
- c) NAAQS, 2009.



Total No. of Questions : 8]

SEAT No. :

**P3763**

**[4760]-61**

[Total No. of Pages : 2

**M.E. (Civil) (Environmental Engineering)**  
**ENVIRONMENTAL LEGISLATION & MANAGEMENT SYSTEM**  
**(2008 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from each section.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data if necessary clearly mentioning the same.*
- 4) Use of non-programmable scientific calculator is allowed.*

**SECTION-I**

- Q1) a) Write note on: [10]**
- i) Multilateral environmental agreements.
  - ii) Rio Declaration.
- b) Write note on EPA. [6]**
- Q2) a) Explain penalties for violation water act. [6]**
- b) Explain water sampling under water act 1974 and legal sampling procedures. [10]**
- Q3) a) Explain powers and functions of regulatory agencies under Air Act 1981. [10]**
- b) Explain responsibilities of occupier under Air Act 1981. [8]**
- Q4) a) Explain concept of absolute liability with example. [10]**
- b) Explain institutional framework of MPCB. [6]**

***P.T.O.***

## SECTION-II

- Q5)** a) Explain coastal zone regulation under EPA 1986. [6]  
b) Write and explain the responsibilities of pollution control board under hazardous waste rules. [10]
- Q6)** a) Write the objectives of ISO 14000 and its application. [6]  
b) Explain the procedure of ISO 14001 for any industry. [10]
- Q7)** a) Explain any case study for Public Interest Litigation. [10]  
b) Explain Public Liability Insurance Act. [6]
- Q8)** a) Write environmental policy and laws. [10]  
b) Write note on municipal solid waste management. [8]



Total No. of Questions : 10]

SEAT No. :

**P3764**

**[4760]-62**

[Total No. of Pages : 2

**M.E. (Civil-Environmental Engineering)**

**ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT**

**(2008 Course) (Theory) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from section-I and section-II.*
- 2) Each question carries equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Your answers will be valued as a whole.*
- 5) Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** Explain in details Any Three from following:

- a) Screening.
- b) Scoping.
- c) Check list.
- d) Evaluation of EIA.

**Q2)** a) How interaction matrix methodologies are useful in impact assessment?

- b) Discuss the importance of background information.

**Q3)** Discuss the followings:

- a) Selection Process.
- b) Indices and Indicators.

**Q4)** a) Discuss about basic information for air quality and Noise level.

- b) Give water quality standards set by governing body in India.

***P.T.O.***

- Q5)** a) Explain prediction of impact for ground water and soil.  
b) Explain how the noise impact assessment will be carried out.

## **SECTION-II**

- Q6)** a) Explain in detail the identification on surface water.  
b) How the impact on water environment assess.

**Q7)** Explain in brief with suitable example about:

- a) Cultural Resources.
- b) Socioeconomic Environment.
- c) Resettlement and rehabilitation.

- Q8)** a) What is the role of ministry of Environment and Forest in EIA Process. Discuss in brief.  
b) Explain the relation between categorization of industries and environmental clearance. Explain.

**Q9)** Discuss the following:

- a) EMP-Environmental Management Plan.
- b) Post environmental Monitoring.

**Q10)** With suitable case study explain in detail the process of EIA.



Total No. of Questions : 8]

SEAT No. :

**P4294**

[Total No. of Pages : 2

**[4760] - 63**

**M.E. (Civil) (Environmental Engineering)**

**OCCUPATIONAL SAFETY & HEALTH**

**(2008 & 2010 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) What are the rights to know laws related to occupational safety and health? Explain. [8]  
b) What are the issues that are typically included in the arrangements section of a health and safety policy document? [8]
- Q2)** a) What is heat stress? What are the effects of heat stress on human body? [8]  
b) Explain stepwise recognizing, assessment and controlling of occupational hazards. [8]
- Q3)** a) How to control hazards in sugar industry? [8]  
b) Explain Human error and fault tree analysis. [8]
- Q4)** Write short notes on following. [18]  
a) Ergonomics program.  
b) Occupational safety and health act.  
c) Task analysis.

**P.T.O.**

## SECTION - II

- Q5)** a) Explain fire development and its severity. [8]  
b) What are the product safety measures in an industry? Explain. [8]
- Q6)** a) What are the possibilities of an accident in steel industries? How to tackle the same? [8]  
b) Discuss investigation methods & different models with respect to accidents in an industrial working environment. [8]
- Q7)** a) How to mitigate health problems in steel industry? [8]  
b) What are the health problems in Pharmaceutical industries? [8]
- Q8)** Write short notes on following. [18]  
a) Personal safety equipment.  
b) Types of fires.  
c) Fire prevention.



Total No. of Questions : 8]

SEAT No. :

**P3765**

[Total No. of Pages : 2

**[4760] - 64**

**M.E. (Civil - Environmental Engg.) (Semester - I)**

**PRINCIPLES AND DESIGN OF BIOLOGICAL TREATMENT SYSTEM**

**(2008 Pattern) (Elective - II(B))**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from Section I and Section II.*
- 2) *Your answers will be valued as a whole.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of electronic pocket calculator and steam table is allowed.*

**SECTION - I**

**Q1)** Discuss any one process from the major biological treatment processes that used in wastewater treatment.

**Q2)** Explain in detail the bacterial growth patterns in Batch Reactor.

**Q3)** The following test results were obtained for a wastewater sample taken at the headworks to a wastewater treatment plant. All of the test water performed using a sample size of 50 ml. Determine the concentration of total solids, total volatile solids, suspended solids, volatile suspended solids, total dissolved solids and total volatile dissolved solids. The sample used in the solids analysis were all either evaporated, dried, or ignited to constant to constant weight. The results are

- a) Tare mass of evaporating dish = 53.5433 gm
- b) Mass of evaporating dish + residue after evaporation at 105°C = 53.5794 gm
- c) Mass of evaporating dish + residue after ignition at 550°C = 53.5625 gm
- d) Tare mass of filter paper after drying at 105°C = 1.5433 gm
- e) Mass of filter paper and residue after drying at 105°C = 1.5554 gm
- f) Mass of filter paper and residue after ignition at 550°C = 1.5476 gm

**Q4)** Discuss in detail about flow equalization.

**P.T.O.**

## SECTION - II

- Q5)* With suitable figures/sketches explain in detail Sequencing Batch Reactor process in Activate Sludge Process.
- Q6)* Draw and discuss the typical trickling filter process flow diagrams along with all the necessary legends.
- Q7)* Discuss in details the sludge digestion theory and principles.
- Q8)* With suitable example explain what is capacity building.



Total No. of Questions : 8]

SEAT No. :

P4296

[Total No. of Pages : 2

[4760] - 65

**M.E. (Civil) (Environmental Engineering)**

**ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT**

**(2010 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from Section - I and Section - II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator and steam table is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Discuss the sources of Environmental Hazards. **[8]**  
b) Discuss "Radioactive fallout" and discuss its environmental hazards. Also discuss the control measures for low and high activity liquid radioactive waste. **[8]**
- Q2)** a) The drinking water contains 1.0 mg/lit of toluene and 0.01 mg/lit of tetrachloroethylene (C<sub>2</sub>Cl<sub>4</sub>). An adult having weight of 75 kg consumes the water @ 2.5 LPD for 12 year. **[10]**  
Would the hazard index suggest that this was a safe level of exposure?  
Tetrachloroethylene is a B<sub>2</sub> carcinogen. What would be the carcinogenic risk faced by someone drinking this water?  
The reference dose (RfD) for toluene and tetrachloroethylene are as under-  
RfD (toluene) = 0.200 mg/kg-day  
RfD (Tetrachloroethylene) = 0.01 mg/kg-day  
The potency factor for oral intake of tetrachloroethylene is  $5.1 \times 10^{-2}$  (mg / kg - day)<sup>-1</sup>.  
b) Discuss risk Characterization and consequences determination. **[6]**

**P.T.O.**

- Q3)** a) Explain the different components of hazard and Risk Analysis [8]  
b) A risk assessment is to be performed for a proposed hazardous waste incinerator site. Briefly describe the specific factors that should be considered. [8]
- Q4)** a) Explain the fundamental difference between risk assessment of carcinogenic and mutagenic agents and the compounds that induce effects like malformation or neurotoxicity. [10]  
b) Describe how risk assessment might be used at a hazardous waste site to assist in establishing a specific cleanup level for removal of trichloroethylene in groundwater. [8]

### **SECTION - II**

- Q5)** Discuss in detail how will you carry out HAZOP study for a chemical Industry. [16]
- Q6)** a) What are the difference between acute and chronic exposures and how they relate to acute and chronic health effects? [8]  
b) Discuss the Risk based [8]  
i) Decision making  
ii) Environmental standard setting
- Q7)** Discuss in detail case study on Risk Assessment and Management for Petrochemical Plants. [16]
- Q8)** Write short note on Following.
- a) Emergency Preparedness plans [4]  
b) Risk cost Benefit Optimization [4]  
c) Risk assessment and Management in Nuclear power plant [10]



Total No. of Questions : 8]

SEAT No. :

P4297

[Total No. of Pages : 2

[4760] - 66

**M.E. (Civil Environmental Engg.)**

**INDUSTRIAL WATER AND WASTE WATER MANAGEMENT  
(2010 Pattern)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer ANY THREE questions from each section.*
- 2) Use of non programmable calculators are allowed.*
- 3) Neat sketches to be drawn wherever necessary.*
- 4) Make suitable assumptions if necessary.*
- 5) Figures to the right indicates full marks.*

**SECTION - I**

- Q1)** a) Discuss the effect of Industrial effluents on design of Sewers and Sewage Treatment Plants. [10]  
b) Differentiate between industrial and municipal waste waters. [8]
- Q2)** a) Explain the importance of equalization and Neutralization tanks for Industrial waste water management. [8]  
b) Discuss the concept of volume and Strength Reduction approach for Industrial Pollution Control. [8]
- Q3)** a) Explain in details Membrane Separation process. [8]  
b) Discuss the use of activated carbon for the removal of heavy metals from industrial wastewater. [8]
- Q4)** a) Discuss the methods of treating the wastewater from Textile industry with the help of neat treatment flow chart and justify the same. [10]  
b) Write a short note on oil separation by floatation. [6]

**P.T.O.**

## SECTION-II

**Q5)** Explain the manufacturing process and sources of wastewater generation for.

- a) Tannery [5]
- b) Dairy [6]
- c) Fertilizer manufacturing. [5]

**Q6)** Discuss the raw wastewater characteristics and wastewater treatment options for.

- a) Petroleum Refineries. [8]
- b) Mineral Processing industries [8]

**Q7)** Write short note on following [18]

- a) Nitrification and Denitrification.
- b) Sources and characteristics of wastewater from paper Industry.
- c) Industrial ecology for wastewater management.

**Q8)** Explain the concept of common effluent treatment plants. Discuss its operational and maintenance problem. [16]



Total No. of Questions : 10]

SEAT No. :

**P3766**

[4760] - 67

[Total No. of Pages : 2

**M.E. (Civil) (Environmental Engg.)**  
**ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY**  
**(2010 Course)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain importance of electrical conductivity; different types of solids and pH of the wastewater in treatment of wastewater with suitable example. **[10]**
- b) How knowledge of colloidal chemistry & nuclear chemistry applied to the measurement of pollution parameters. **[8]**
- Q2)** a) Explain the principle & mechanism of optical methods in the pollutant removal in industrial effluent & explain its merits & demerits. **[8]**
- b) Explain nature of nuclear radiation its impact on human health & uses of isotopes & tracers widely used in environmental engineering. **[8]**
- Q3)** a) Explain principle of Atomic Adsorption spectrophotometer (AAS) with sketch & discuss with working, advantages & disadvantages. **[8]**
- b) Explain in detail High performance Liquid chromatograph & give its limitations. How these limitations have been overcome by Gas chromatography. **[8]**
- Q4)** Discuss the selectivity of mobile phase in Gas chromatography as well as HPLC in the wastewater treatment & analysis? Also explain Limitations of HPLC. **[16]**

**P.T.O.**

**Q5)** Explain the principle of Ion chromatography and also write a short note on types of various electrodes in ion chromatography. [16]

### **SECTION - II**

**Q6) a)** List out various enzymes and metabolic reactions and what is their role in the field of environmental microbiology? Explain facultative respiration in wastewater treatment. [10]

b) Explain role of microorganisms, its cell structure, metabolism and nutrient required for its growth in wastewater treatment and in various biological process. [8]

**Q7) a)** Write Compound microscope & micrometry & their applications in the environmental Engg. [10]

b) Explain principle & applications of Microscopy and Micrometry used in Env. Engg.? Explain isolation of microorganisms? [6]

**Q8)** Explain Media & Techniques of staining & Enumeration of Micro organisms in water & wastewater. [16]

**Q9) a)** What is “Soil Bioremediation” explain it with suitable example? Explain phenomenon of self purification of natural water body. [10]

b) Explain industrial microbiology & how this knowledge used in treatment of industrial wastewater. [6]

**Q10)** Explain in detail principle, design, sketch, and drawback of Sequencing Batch Reactor (SBR) process to treat the wastewater. [16]



Total No. of Questions : 8]

SEAT No. :

**P4298**

**[4760] - 68**

[Total No. of Pages :2

**M.E. (Civil Environmental Engg.)**

**SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT**

**(2010 Course) (Semester - II) (501510)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer ANY THREE questions from EACH section.*
- 2) *Use of non programmable calculators are allowed.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Make suitable assumptions if necessary.*
- 5) *Figures to the right indicates full marks.*

**SECTION - I**

**Q1)** What are the problems and issues of solid waste and Hazardous waste management. Discuss the Environmental impacts of mismanagement of solid and Hazardous waste. **[16]**

**Q2)** a) Define Risk. What is the goal of Risk assessment? Discuss the concept of Zero risk. **[10]**

b) What is meant by

i) One in Million risks. **[3]**

ii) Acceptable risk. **[3]**

**Q3)** a) Discuss the Indian legislation on management and handling of Hazardous waste. **[6]**

b) For a multispeciality hospital, located in rural areas, how will you manage the solid waste generated from this hospital including biomedical waste. **[10]**

**Q4)** a) Describe "Radioactive fallout" and discuss its environmental hazards. **[10]**

b) Also discuss the control measures for low and high activity liquid radioactive waste. **[8]**

**P.T.O.**

## SECTION - II

- Q5)** Discuss the site selection criteria for sanitary landfills. Also Discuss the important factors to be considered in the design of landfills. State the advantages and disadvantages of land filling. **[16]**
- Q6)** a) Explain with neat diagram municipal solid waste pyrolysis system. **[8]**  
b) Discuss the recovery of energy from MSW? Explain the factors affecting the same. **[8]**
- Q7)** Discuss the different types of collection systems of MSW. Explain any one in details. **[16]**
- Q8)** Write Short note on following: **[3 × 6 = 18]**
- a) Radioactive waste management in Nuclear power plant.
  - b) Hazard identification system.
  - c) Economic analysis of Solid Waste Management.



Total No. of Questions : 8]

SEAT No. :

**P3930**

[Total No. of Pages : 3

**[4760]-69**

**M.E. (Civil- Environmental Engineering)**

**GROUND WATER CONTAMINATION AND POLLUTION TRANSPORT**

**(2008Course)(Elective-III) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary clearly mentioning the same.*
- 4) *Use of non- programmable scientific calculator is allowed.*

**SECTION-I**

- Q1)** a) Explain in detail, the importance of G. W. What are the sources of pollution for GW? Enlist 4 assumptions made in deriving general differential equations for GW flow. **[8]**
- b) Explain in detail the steady state continuity equation for GW flow in a homogeneous isotropic aquifer. **[8]**
- Q2)** a) Explain how to find yield from a well. **[10]**
- b) Explain the procedure for drawing flow nets using: **[8]**
- i) Graphical method.
  - ii) Numerical solution
- Q3)** a) Explain with suitable sketch: well interference. **[6]**
- b) Tracer injected into a well took 4.5 hours to travel up to another well 50 m apart. The difference in water surface elevation was found to be 1.25 m. the aquifer samples indicated a porosity of 35%. Determine the following:
- i) Permeability.
  - ii) Seepage velocity and
  - iii) Reynold's no. of flow. **[6]**
- Assume average grain size as 1 mm and kinetic viscosity at 27 deg C. for water as 0.008 Stokes.
- c) Explain in brief impacts of uncontrolled pollution on GW quality. **[4]**

***P.T.O.***

- Q4) a)** Assume that three piezometers are installed very close to each other but penetrate up to different depths as given below:

| Piezometer              | l   | m   | n   |
|-------------------------|-----|-----|-----|
| Elevation at surface(m) | 530 | 530 | 530 |
| Depth of piezometer(m)  | 125 | 100 | 75  |
| Depth of water(m)       | 20  | 42  | 35  |

Let L, M and N refer to the points of measurement of piezometers l, m and n respectively. Calculate:

- i) GW head at l, m and n in meters.
  - ii) Pressure head at l, m and n in m.
  - iii) Fluid pressure at M in  $N/m^2$  **[6]**
- b) Distinguish between ground surface contour and water table contours. Explain how water table contours are prepared and state their uses. **[6]**
- c) Explain the following terms: **[4]**
- i) Aquifer
  - ii) Aquiclude
  - iii) Aquifuge
  - iv) Aquitard

### SECTION-II

- Q5) a)** Explain GW availability in Maharashtra with special reference to geology of the area. **[8]**
- b) Explain need of social awareness and public participation in GW recharging activities. Support your answer with one case study from Maharashtra. **[8]**
- Q6) a)** Explain in detail relation between dispersion and GW hydrology. **[8]**
- b) Explain in detail how GW pollution phenomenon can be studied. Support your answer with special reference to a case study of open dumping site for MSW. **[8]**

- Q7)** a) Explain the importance of geotechnical investigations required for carrying out GW potential in an area. [8]
- b) Explain underground travel phenomenon of GW contamination. Support your answer with a case study. [8]
- Q8)** a) Explain the importance of water analysis and water quality requirements with special reference to GW as source for: [9]
- i) Drinking purpose.
- ii) Agricultural purpose.
- iii) Industrial Usage.
- b) Explain in detail: Sea water Intrusion. Also explain remedial measures to curb it. [9]



Total No. of Questions : 8]

SEAT No. :

**P4290**

[4760] - 7

[Total No. of Pages :2

**M.E. (Civil) (Construction Management)**  
**CONSTRUCTION SAFETY**  
**(2008 Course) (Semester - I) (Elective - I) (501104)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** Enlist various parties concerned with construction safety. Explain role of various parties in construction safety management. **[18]**

- Q2)** a) What is the procedure followed while formation of safety committee?[8]  
b) What is the purpose of writing safety manuals? Explain with an example.[8]

**Q3)** Write note on; **[16]**

- a) Responsibilities of general employees
- b) Preparing safety checklist
- c) Inspection Reports
- d) Prevention of accidents

**Q4)** Explain in detail safety of accident during fly over bridge construction at various stages. What safety measures are to be taken into account especially before, during and after construction of tunnel? **[16]**

**P.T.O.**

## SECTION - II

- Q5)** a) Explain safety measures adopted on site while working with formwork. **[8]**
- b) What precautions are taken while operating with material handling equipments? **[8]**
- Q6)** a) What are legal requirement and cost factors associated with accidents on site? **[8]**
- b) Explain benefits of financial help received from Group insurance policy issued by company. **[8]**
- Q7)** Write short notes on: **[16]**
- a) Safety while using explosives
- b) First aid on site
- Q8)** What provisions are made for an ISO approved construction company for the following: **[18]**
- a) safety policies
- b) safety methods
- c) safety equipment
- d) training provided



Total No. of Questions : 12]

SEAT No. :

**P3767**

**[4760]-70**

[Total No. of Pages : 3

**M.E. (Civil Engineering) (Environmental Engg.)**  
**AGRICULTURAL POLLUTION CONTROL AND**  
**ENVIRONMENTAL BIOTECHNOLOGY**  
**(2008 Course) (Semester - II) (Elective - III) (501511)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answer to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) What is farming system? Discuss the any two types of farming system in details. **[8]**
- b) What is water and nutrient requirements of crops? Explain. **[8]**

OR

- Q2)** a) How pesticides and fertilizers are useful for agriculture? Explain with suitable example. **[8]**
- b) Give the different types of agrochemicals and explain their uses in agricultural industry. **[8]**
- Q3)** a) The productivity of land is affected by high water table. Give your comment and remedial measures for this statement. **[8]**
- b) Explain the causes of water logging? How salinity of soil is been controlled. **[8]**

OR

**P.T.O.**

- Q4)** a) What is organic fertilizer? Give its types and explain any one in detail. [8]  
b) Explain soil and water conservation in detail. [8]
- Q5)** a) What are the different management and control methods of agricultural waste? Explain in detail. [9]  
b) Discuss about the recycle and reuse of waste water in agricultural purpose. Give its advantage. [9]

OR

- Q6)** Write the short note on following (Any three): [18]
- a) Water conservation.  
b) Bioremediation of soil.  
c) Vermi-composting of agricultural waste.  
d) Recycle and reuse of agricultural waste.

**SECTION - II**

- Q7)** a) What is the scope and importance of environmental biotechnology? [8]  
b) What is transcription? Comment on DNA replication. [8]
- OR
- Q8)** a) Explain the treatment scheme for sugar industry waste with neat sketch. [8]  
b) Explain the working of rotating discs with neat sketch. [8]
- Q9)** a) Explain the principle of oxidation ditch and oxidation pond. [8]  
b) What is UASB? What are the advantages of UASB reactor? [8]

OR

- Q10)**a) How biotechnology is beneficial in reduction of CO<sub>2</sub> emission? [8]  
b) Explain 'Activated sludge process' (ASP) with neat sketch. [8]
- Q11)**a) Discuss about membrane filtration, give its types, working and principle. [9]  
b) Explain working of bio-trickling filters with neat sketch. [9]

OR

- Q12)** Write short note on following with neat sketch (Any three): [18]
- a) Root zone treatment
  - b) Biodegradable plastics
  - c) Methane production
  - d) Bio-scrubbers

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4299**

**[4760] - 71**

[Total No. of Pages :2

**M.E. (Civil) (Environmental Engg.)  
ENVIRONMENTAL SANITATION  
(2008 and 2010 Pattern) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume Suitable data , if necessary*

**SECTION - I**

- Q1)** a) What are the other ways of communicable diseases except by communicated by discharges of intestines, nose and throat? Explain any two. **[8]**
- b) Which micro-organisms are responsible for communicable diseases? Explain any two methods of control of communicable diseases. **[8]**
- Q2)** a) Write down about the life cycle of a mosquito and explain the preventive measures to control breeding. **[8]**
- b) Describe in detail methods adopted to control Plague. **[8]**
- Q3)** a) Which disinfectants are generally used? Explain the specific use with an importance. **[8]**
- b) Explain the factors affecting Industrial sanitation. **[8]**

***P.T.O.***

**Q4)** Write short notes on: **[18]**

- a) Rodent control program
- b) Sanitation in Hospitals
- c) Light and Ventilation in Schools

**SECTION - II**

**Q5)** a) How to control dust pollution in sugar industry? Explain. **[8]**

- b) What is an Occupational hazard? Explain the common workplace hazards. **[8]**

**Q6)** a) What are the methods of excreta disposal systems in rural areas? Explain any one. **[8]**

- b) Comment in detail on Population habits in Rural area and correlate the same with environmental sanitation. **[8]**

**Q7)** a) What are the problems of water supply in rural areas? How to solve this problem? Explain. **[8]**

- b) Write down any one case study on Rural sanitation improvement schemes. **[8]**

**Q8)** Write short notes on: **[18]**

- a) Use of Grey water for farming.
- b) Soak pit with a neat sketch
- c) Industrial poisons.



Total No. of Questions : 8]

SEAT No. :

P3931

[Total No. of Pages : 2

[4760] - 72

**M.E. (Civil) (Environmental Engineering)**

**GROUND WATER CONTAMINATION AND POLLUTION  
TRANSPORT**

**(2010 Pattern) (Open Elective)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Figures to the right indicate full marks..*
- 3) *Assume suitable data if necessary clearly mentioning the same.*
- 4) *Use of non-programmable scientific calculator is allowed.*

**SECTION - I**

- Q1)** a) Explain with a neat sketch : Aquifer classification based upon the hydraulic conductivity of the media. [8]  
b) Distinguish between ground surface contours and water table contours. Explain how water table contours are prepared and state their uses.[8]
- Q2)** a) What are flow nets? Explain with suitable example any one method of constructing flow nets. [8]  
b) How dispersion studies are helpful in understanding the GW flow.[8]
- Q3)** a) Explain with reference to urban area, how contamination of GW can be reduced by adopting proper wastewater management practices? [8]  
b) Derive equations for steady state conditions involving uniform Recharge. [8]
- Q4)** a) Explain with a neat sketch: Well Interference. What is its effect on drawdown? [8]  
b) An organic waste with very high pollution strength, has contaminated a GW aquifer Explain in detail the method to be adopted for recovering this aquifer. [10]

**P.T.O.**

## SECTION - II

- Q5)** a) Explain how the rock forms affect the GW availability wrt various rock types. [8]  
b) Explain Tri-linear diagram for representing analyses of GW Quality.[8]
- Q6)** a) What is sea water intrusion? Explain Ghyben - Herzberg relation wrt confined aquifers. [10]  
b) Explain in detail relation between dispersion and GW hydrology. [6]
- Q7)** a) Explain the importance of Physico-chemical and biological analysis of GW. [8]  
b) Explain underground travel phenomenon of GW contamination. [8]
- Q8)** a) Explain in detail, the role of social media and public participation in enhancing GW potential in an area. [10]  
b) Explain the dispersion analysis of contaminant transport in fractured rock. [8]



Total No. of Questions : 8]

SEAT No. :

P4300

[Total No. of Pages : 2

[4760] - 73

**M.E. (Civil) (Environmental Engineering)**

**ENVIRONMENTAL SANITATION**

**(2008 & 2010 Pattern) (Open Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) List down the communicable diseases and their mode of transmission. [8]
- b) Which micro-organisms are responsible for communicable diseases?  
What are the methods of communication? [8]
- Q2)** a) Describe in detail methods adopted to control Plague. [8]
- b) Explain the natural and chemical factors of diseases control methods. [8]
- Q3)** a) "Food establishments must have an effective fly control program."  
Justify. [8]
- b) How will you achieve sanitation in case of Schools? [8]

**P.T.O.**

- Q4)** Write short notes on : **[18]**
- a) Insecticide
  - b) Epidemiology
  - c) Heat Stress

**SECTION - II**

- Q5)** a) Explain in detail “Industrial Plant Sanitation.” **[8]**  
b) Write down only the list of workplace Environmental ISO 14000 standards. **[8]**
- Q6)** a) Discuss in detail the various problems associated with Rural Sanitation. **[8]**  
b) What do you understand by Low cost excreta disposal system? Explain. **[8]**
- Q7)** a) Explain any one case study on sanitation. **[8]**  
b) What are the occupational hazards in industry? Explain. **[8]**
- Q8)** Write short notes on : **[18]**
- a) Noise control measures in industry.
  - b) Problems of water supply in rural area.



Total No. of Questions : 8]

SEAT No. :

P4301

[Total No. of Pages : 2

[4760] - 73A

**M.E. (Civil) (Environmental Engineering)**  
**OCCUPATIONAL SAFETY & HEALTH**  
**(2008 & 2010 Pattern) (Open Elective - IV)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:-*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Explain the important provisions made in Occupational Safety and Health Act. [8]  
b) Comment in detail on occupational safety and health administration. [8]
- Q2)** a) What is a need of ergonomics program? Explain. [8]  
b) What are the measures for preventing ergonomics hazards? Explain. [8]
- Q3)** a) How to control hazard in manufacturing & processing industries. [8]  
b) Explain Human error and fault tree analysis. [8]

**P.T.O.**

- Q4)** Write short notes on following : **[18]**
- a) OSHAS 18001 Health & Safety Standards
  - b) Task analysis

**SECTION - II**

- Q5)** a) Explain fire development and its severity. **[8]**
- b) What are the types of fire? Explain any two. **[8]**
- Q6)** a) What is heat stress? What are the health effects of heat stress? How to prevent it? **[8]**
- b) List down the causes of accidents in Chemical industry & what are the remedial measures will you take to avoid further accidents? **[8]**
- Q7)** a) What are the health problems in textile industries? **[8]**
- b) Which occupational health and safety considerations are required in waste water treatment plants? Explain. **[8]**
- Q8)** Write short notes on following: **[18]**
- a) Product safety.
  - b) Extinguishing fire.
  - c) Investigation methods of accidents.



Total No. of Questions : 10]

SEAT No. :

**P3768**

[Total No. of Pages : 2

[4760] - 74

**M.E. (Civil) (Water Resource and Environmental Engg.)**

**ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY**

**(2010 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

**Q1)** Educate in detail how formation of various physical processes of pollutants in atmosphere takes place. **[16]**

**Q2)** Enlist various metrological parameters which influence the air pollution. Explain important reactions taking place during removal of pollutants. **[16]**

**Q3)** How characteristics of pollutants are classified? Give explanation of various physical and chemical and biological parameters found in wastewater. **[16]**

**Q4)** Explain in detail the importance of Environmental chemistry and microbiology in day todays life. **[16]**

**Q5)** Write short notes on : **[18]**

- a) Contaminants in soil.
- b) Oxidizing properties of Air pollutants.
- c) Hydrocarbon decay and its environmental effects.

***P.T.O.***

## SECTION - II

**Q6)** Discuss various phases of bacterial growth. Also explain in short cell Morphology. **[16]**

**Q7)** Enlist various practices for analysis of trace pollutants. Discuss criterion for selecting particular technique. Also explain how HPLC is used in determination of particular pollutant. **[16]**

**Q8)** Discuss in detail about enzymes and their role in microbiology. **[16]**

**Q9)** Explain the importance of algae in the food chain of aquatic environment? Discuss the various uses of algae that make them commercially important. **[16]**

**Q10)** Write short notes on : **[18]**

- a) VU Spectrophotometer
- b) Staining techniques
- c) Polarography



Total No. of Questions : 8]

SEAT No. :

P3769

[Total No. of Pages : 2

[4760] - 75

**M. E. (Civil) (Water Resources and Environmental  
Engineering) (Semester - I)**

**ENVIRONMENTAL MANAGEMENT**

**(2012 Course)**

*Time :3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** Enlist the Environmental Inventory under consideration during Environmental Impact Assessment (EIA) of thermal power plant. Prepare detail EIA report to be submitted to concerned authority for approval. **[18]**

**Q2) a)** Comment on “Smart City and Environmental Engineering are two sides of same coin”. **[8]**

**b)** Write note on: **[8]**

i) Environment Decision Making

ii) Socio-economic Environment

**Q3) a)** Discuss air, water and noise environment of pilgrim centers. **[8]**

**b)** What is Rapid EIA? Right provisions for rapid EIA of based upon type of industries. **[8]**

**P.T.O.**

**Q4) Write note on:** **[16]**

- a) Clean development mechanism
- b) Transboundary pollution
- c) WHO agreements on environment
- d) Carbon Credit

**SECTION-II**

**Q5) a) State Timeline of Environmental Laws and Regulations in India. Explain major legislative provisions in Environmental Protection Act 1986. [10]**

**b) Write note on:** **[8]**

- i) Standards and setting criteria of environmental quality.
- ii) Earth Summit 1992

**Q6) What is the difference between Environmental Plan, Environment Status Report, Environment Impact assessment and environmental management system? [16]**

**Q7) a) Discuss equilibrium balance of the environment. [6]**

**b) Explain the role of CPCB and State pollution control board in India. [10]**

**Q8) Write note on:** **[16]**

- a) Provisions made in OHSAS 18001
- b) ISO 14000
- c) Sustainable Environmental Technologies
- d) Women empowerment in environment field



Total No. of Questions : 8]

SEAT No. :

**P3770**

[4760] - 76

[Total No. of Pages :2

**M.E. (Civil W.R.E.E.)**

**ADVANCED FLUID MECHANICS**

**(2012 Pattern) (Semester - I)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, and non-programmable calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** a) Derive three-dimensional form of equation of continuity in cylindrical co-ordinates. **[8]**
- b) Define two-dimensional source and sink. Derive the expressions for velocity potential function and stream function for source and sink in rectangular and polar co-ordinate system. Sketch the patterns of equipotential lines and streamlines. **[8]**
- Q2)** a) Obtain the general form of Navier-stokes' equations. **[10]**
- b) Starting from Navier-Stokes' equations, or otherwise derive the general equation of velocity distribution for steady incompressible laminar flow between fixed parallel surfaces. **[8]**
- Q3)** a) Derive Von Karman's momentum equation in integral form, for boundary layer as  $\frac{d\theta^*}{dx} = \frac{\tau_0}{\rho u^2}$ . Notations have usual meanings. **[10]**
- b) Assuming one-seventh power law velocity distribution for turbulent boundary layer, obtain the expressions for displacement thickness, momentum thickness and energy thickness in terms of nominal thickness. **[6]**

**P.T.O.**

- Q4)** Write short notes on: **[16]**
- a) Boundary layer separation and its control.
  - b) Conformal mapping.
  - c) Doublet.
  - d) Cauchy-Reimann conditions.

**SECTION - II**

- Q5)** a) Distinguish between isotropic & homogeneous turbulence. **[6]**
- b) Explain Prandtl's mixing length hypothesis. **[6]**
- c) Explain probability density function. **[4]**

- Q6)** a) Explain the statistical theory of turbulence. **[6]**
- b) For turbulent flow in a circular pipe of diameter 280 mm, the centreline velocity is 1.65 m/sec, and the point velocity at a radial distance of 70 mm is 1.5 m/sec. Calculate the discharge flowing through the pipe. Also calculate the friction factor and average height of roughness protrusions in the pipe. **[10]**

- Q7)** a) Derive the fundamental equation for velocity of propagation of compression pressure wave in an elastic medium. How will you modify this equation for gas flow under isothermal and frictionless adiabatic conditions? **[10]**
- b) Conditions immediately upstream of a compression shock wave in an air flow are :  $p_u = 34.2 \text{ kN/m}^2$  (abs);  $T_u = 0^\circ\text{C}$ ;  $r_u = 1045 \text{ m/sec}$ . Calculate the conditions immediately downstream of the shock wave. **[8]**

- Q8)** Write short notes on: **[16]**
- a) Characteristics of turbulent flow.
  - b) Moody's diagram.
  - c) Mach Angle and Mach Cone.
  - d) Pitot sphere.



Total No. of Questions : 8]

SEAT No. :

**P3932**

[4760]-77

[Total No. of Pages : 3

**M.E. (Civil) (Water Resources and Environmental Engg.)**

**GROUND WATER CONTAMINATION AND TRANSPORT**

**(2012 Course) (Semester - I) (Elective - I)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Attempt any three questions from each sections.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*
- 7) *Use data sheet.*

**SECTION - I**

- Q1) a)** Explain what are the source of Pollution for G.W.? [8]
- b) Derive a general steady state continuity equation for G.W. flow in heterogeneous anisotropic aquifer. [8]
- Q2) a)** Explain in detail various factors that affect fluctuating in GW levels.[10]
- b) Explain the procedure for drawing flow net using [8]
- i) Graphical method
  - ii) Numerical solution
- Q3) a)** Explain with suitable sketch: Well interference. [8]
- b) Trace injected into a well took 4 hours to travel up to another well 50 m apart. The difference in water surface elevation was found to be 1.0m the aquifer sample indicated a porosity of 30%. Determine the following [8]
- i) Permeability
  - ii) Seepage velocity
  - iii) Reynold's no.of flow

**P.T.O.**

**Q4) a)** Obtain an expression for discharge through a flow net for an isotropic aquifer. [8]

b) Explain piezometer test pumping. [8]

**SECTION - II**

**Q5) a)** What is meant by groundwater pollution control? Explain vyredox method for in situ chemical treatment of groundwater. [8]

b) What are various method of treatment of organic matter in ground water Explain any on method with its application & cost economics. [10]

**Q6) a)** Assume that three piezometer are installed very close to each other but penetrate up to different depth as given below: [8]

| Piezometer                 | A   | B   | C   |
|----------------------------|-----|-----|-----|
| Elevation at surface (mtr) | 500 | 500 | 500 |
| Depth of piezometer (mtr)  | 150 | 110 | 50  |
| Depth of water (mtr)       | 27  | 47  | 36  |

Let A, B, and C Refer to the point of measurement of piezometer a, b and c respectively, calculate:

- i) GW heat at a, b and c in meters.
- ii) Pressure head at a, b and c in meter.
- iii) Fluid pressure at B in N/m<sup>2</sup>.

b) Explain following terms [8]

- i) Aquifer
- ii) Aquiclude
- iii) Aquifuge
- iv) Aquitard

- Q7)** a) Discuss in briefly hydrochemical facies in GW contamination and explain its utility. [8]
- b) Explain how the rock forms affects the GW availability wrt following rock type [8]
- i) Carbonate terrain
  - ii) Crystalline rock
  - iii) Complex sedimentary system
- Q8)** a) What is the utility of GW investigation? Explain seismic refraction and reflection method of GW investigation. [8]
- b) Enlist any 4 methods of GW recharge. Explain any one in details. [8]

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3771**

**[4760]-78**

[Total No. of Pages : 2

**M.E. (WREE) (Civil Engineering)**  
**HYDROLOGY AND GROUNDWATER**  
**(2012 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION-I**

**Q1) a)** With the help of meteorological phenomenon explain the process of rainfall. **[6]**

b) The ordinates of a 3-hr unit hydrograph of a basin are as follows. Derive the flood hydrograph due to a storm of 3-hr producing a rainfall excess of 4 cm. Assume a constant base flow of 3 cumec. **[10]**

|                             |   |     |     |     |    |     |     |     |     |    |
|-----------------------------|---|-----|-----|-----|----|-----|-----|-----|-----|----|
| Time (hours)                | 0 | 3   | 6   | 9   | 12 | 15  | 18  | 21  | 24  | 27 |
| 3hr UGO (m <sup>3</sup> /s) | 0 | 1.5 | 4.5 | 8.6 | 12 | 9.4 | 4.6 | 2.3 | 0.8 | 0  |

**Q2) a)** Write a note on basics of time series models. **[8]**

b) Write a short note on Risk, Reliability and Safety Factor. **[8]**

**Q3) a)** What is meant by 'Return Period'. Give few formulae to determine it. **[8]**

b) Explain Lognormal distribution. **[8]**

**P.T.O.**

- Q4)** Write short note on: **[18]**
- a) Minimum density of rain gauge stations.
  - b) Gumbel's method.
  - c) Envelop curve.

**SECTION-II**

- Q5)** a) Briefly explain experimental verification of Darcy's law. **[8]**
- b) A well with a radius of 0.5m penetrates completely a confined aquifer of thickness 40m and permeability 30 m/day. The well is pumped so that the water level in the well remains at 7.5m below the original piezometric surface. Assuming that the radius of influence is at 500m, compute the steady state discharge from the well. **[8]**
- Q6)** a) Write a note on sea water intrusion. **[8]**
- b) Enlist and briefly explain types of wells. **[8]**
- Q7)** a) Explain methods of artificial recharge. **[8]**
- b) Write a note on ground water budget. **[8]**
- Q8)** Write short notes on: **[18]**
- a) Ground water movement.
  - b) Groundwater resource of India.
  - c) Method of images.



Total No. of Questions : 10]

SEAT No. :

**P3772**

[4760]-79

[Total No. of Pages : 2

**M.E. (Civil-WREE)**

**AIR POLLUTION ENGINEERING  
(2012 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from section-I and section-II.*
- 2) Each question carries equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Your answers will be valued as a whole.*
- 5) Assume suitable data, if necessary.*

**SECTION-I**

**Q1)** a) Discuss physics of atmosphere.

b) Discuss about Pasquill stability model.

**Q2)** a) Explain how eddy diffusion model is useful.

b) Discuss sampling time correction.

**Q3)** Give note on following:

a) Maximum Ground level concentration.

b) Line source and point source.

**Q4)** Explain how stack height determined? Assume suitable data for explanation.

**Q5)** Discuss the following:

a) Control of odour pollution.

b) Air pollution Survey.

c) Stack emission monitoring.

***P.T.O.***

## SECTION-II

**Q6)** Explain in details about:

- a) Terminal Settling Velocity.
- b) Sources of SPM.
- c) Iso-kinetic sampling.

**Q7)** Explain the working of following with suitable sketches (Any Two):

- a) Electrostatic Precipitators.
- b) Settling Chambers.
- c) Wet collector.

**Q8)** Give note on the following and explain (Any Two):

- a) Principle of absorption.
- b) Control of Nox.
- c) Incineration.

**Q9)** Discuss any one method in detail to reduce emissions from automobile sources.

**Q10)** Discuss the strategy for effective control of air pollution in India.



Total No. of Questions : 8]

SEAT No. :

**P4548**

[4760] - 8

[Total No. of Pages :2

**M.E. (Civil - Construction & Management)**  
**RESOURCES MANAGEMENT**  
**(2008 Pattern) (Elective - II) (Semester - I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Question Nos 1 & 5 are compulsory. Out of remaining attempt any 2 questions.*
- 3) *Answers to the two sections should be written in separate answer books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right side indicate full marks.*
- 6) *Use of Calculator is allowed.*
- 7) *Assume Suitable data if necessary.*

**SECTION - I**

**(Materials Management)**

- Q1)** a) Discuss the role of Materials Manager in Construction Industry. Also explain in brief the objectives & functions of a Materials management in Construction Industry. **[10]**
- b) Discuss in details the Integrated approach to materials management. **[8]**
- Q2)** a) Explain in details Materials Requirement planning. **[8]**
- b) Discuss in brief EOQ. Explain its importance in Materials Management. **[8]**
- Q3)** a) Write a note on Conventional methods of Quality control of Construction materials. **[8]**
- b) Discuss use of Materials Management Systems (MMS) in materials planning. **[8]**

**P.T.O.**

**Q4) Write Short notes on (Any four):** **[16]**

- a) Quality management.
- b) Vendor analysis.
- c) Safety stock.
- d) Site layout for stores management.
- e) JIT in Construction sector.
- f) Inventory Control Techniques.

### **SECTION - II**

#### **(Human Resources Management & Equipment Management)**

**Q5) a)** Explain the importance of training in Construction Industry. Discuss different types of training. **[10]**

b) List out various equipments required for completion of earthwork for Dam Construction project. List out the factors affecting the output of these equipments. **[8]**

**Q6) a)** Discuss in brief factors affecting Equipment Selection. **[8]**

b) Explain different types of cranes and factors affecting their selection. **[8]**

**Q7) a)** Enlist methods to calculate depreciation of construction Equipments. Explain any two methods in brief. **[8]**

b) Explain need for human resources development. Discuss on Flow diagram of HRD & HRM. **[8]**

**Q8) Write Short notes on:** **[16]**

- a) Record Keeping in case of construction equipments.
- b) Training & Selection of manpower.
- c) Equipment log book.
- d) OLDES programme of CIDC.



Total No. of Questions : 8]

SEAT No. :

**P3773**

**[4760]-80**

[Total No. of Pages : 2

**M.E. (Civil) (WR & EE)**

**SOLID AND HAZARDOUS WASTE MANAGEMENT**

**(2012 Course) (Semester-I) (Elective-I) (501604)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

**SECTION-I**

- Q1)** a) What are the functional elements of solid waste management and discuss the Environmental impacts of improper management. **[8]**
- b) Explain the hierarchy of integrated solid waste management. **[8]**
- Q2)** Discuss the classification of transfer stations for solid waste. Draw suitable sketches. **[16]**
- Q3)** Enlist various equipments used for size reduction of solid waste. Also explain in detail the working, design criteria and characteristics. **[16]**
- Q4)** Explain the principle, construction and working of the following with neat diagrams: **[18]**
- a) Waste Heat Boilers.
  - b) Pyrolysis.
  - c) Incineration.

**P.T.O.**

## SECTION-II

- Q5)** a) Explain with neat sketch a double linear hazardous waste land fill. [8]  
b) Discuss the manifest system for disposal of hazardous waste. [8]
- Q6)** Explain the goal of risk assessment. Discuss the concept of zero-risk hazardous waste management. [16]
- Q7)** a) Explain in detail how disposal and treatment of biomedical and necular waste is done. [10]  
b) Discuss the concept of vermicomposting. [6]
- Q8)** Write short notes: [18]  
a) Energy recovery from solid waste.  
b) Geotechnical Aspects of handfill sites.  
c) Wet air oxidation.



Total No. of Questions : 8]

SEAT No. :

**P4558**

**[4760] - 82**

[Total No. of Pages :2

**M.E. (Civil) (Water Resource & Environmental Engg.)**  
**ADVANCED WATER TREATMENT & WATER SUPPLY ENGINEERING**  
**(2008 Course) (Semester - I) (Elective - II) (501605)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from Section I & Section - II.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) Assume suitable data, if necessary.*

**SECTION - I**

- Q1)** Explain in detail the principle and working of reverse osmosis and micro filtration for water treatment. **[16]**
- Q2)** Discuss the principle, concept and necessity of aeration. Explain various methods of aeration with neat sketches. **[16]**
- Q3)** Explain in detail the principle, working and types of grit chambers. Discuss the process for disposal of grit. **[16]**
- Q4)** Design an aerated grit chamber for the treatment of municipal wastewater. The average flow rate is  $0.5 \text{ m}^3/\text{s}$ . Take peak factor as 2.75. **[18]**

**SECTION - II**

- Q5)** Explain construction and working process for dual media filters with a neat sketch. Explain backwashing of RSGF. **[16]**
- Q6)** Define Adsorption processes. state the factors influencing. adsorption. Discuss different types of GAC contactors with sketches. **[16]**

**P.T.O.**

**Q7) a)** What is the theory of disinfection? State the factors affecting disinfection. Discuss the chemistry of chlorination. **[8]**

b) Briefly discuss ion exchange materials and typical ion exchange reactions. **[8]**

**Q8)** Design a RSGF unit for treating 4 MLD of supply, with under drainage system and wash water troughs. **[18]**



Total No. of Questions : 8]

SEAT No. :

**P3774**

[Total No. of Pages : 2

**[4760] - 83**

**M.E. (Civil) (Water Resource and Environmental Engineering)**  
**REMOTE SENSING AND GEOGRAPHICAL INFORMATION**  
**SYSTEM FOR WATER RESOURCES MANAGEMENT**  
**(2008 Pattern) (Elective - II)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*
- 6) *All Questions are Compulsory.*

**SECTION - I**

- Q1)** a) Discuss the principles of photogrammetry and its applications in water resources. [5]  
b) Write an essay on Fundamentals of Remote Sensing System. [5]  
c) Write a note on Electromagnetic Spectrum. [3]
- Q2)** a) State and Explain the Displacement Law. [4]  
b) Discuss in detail the interaction of EMR with 'Atmosphere' [4]  
c) Describe the stages of Remote Sensing with neat sketch. [3]
- Q3)** a) Discuss the important advantages of vertical and oblique aerial photographs. [3]  
b) State the elements of image interpretation in short. [5]  
c) What are FCC images? Write its advantages. [5]
- Q4)** a) Discuss various characters of IR images. [3]  
b) Discuss the ORTHO rectification method. [5]  
c) Write a note on Concept of Analog and Digital System. [5]

**P.T.O.**

**SECTION - II**

- Q5)** a) Describe in brief Geographical information System (GIS). [5]  
b) Write in brief the Components of GIS. [5]  
c) Discuss in short buffering. [3]
- Q6)** a) What are Map Projections? [4]  
b) Write a note on Raster Data Structure. [4]  
c) Describe Supervised and unsupervised classification. [3]
- Q7)** a) Describe Spatial and Attribute Database. [3]  
b) Discuss Errors in GIS [5]  
c) Write an essay on Data collection and input processing in G.I.S. [5]
- Q8)** a) Explain RS application in Open Canal Conduit with flow chart. [3]  
b) Write in short the software's used in GIS for Water Resources. [5]  
c) Explain in brief 'DEM'. [5]



Total No. of Questions : 12]

SEAT No. :

**P4559**

**[4760] - 84**

[Total No. of Pages :3

**M.E. (Civil WREE)**

**PLANNING AND MANAGEMENT OF WATER RESOURCES  
(501605) (2008 Course) (Semester - I) (Elective - II)**

*Time : 3Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat sketches wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of calculators allowed.*
- 5) *All questions are compulsory.*
- 6) *Answers to the two sections must be written separately.*

**SECTION - I**

- Q1) a)** What are the objectives of planning and management of water resources and Explain how national development is related with this planning and management of water resources project. **[10]**
- b) How does Planning and management of water resources play role in achieving societal goals? **[8]**

OR

- Q2) a)** What is the importance of integrated water resource management and state the challenges to be faced while managing water resources for developing country. **[10]**
- b) What are needs and opportunities in planning and management of water resources? **[8]**

- Q3) a)** Comment on spatial and temporal characteristics of water resources. How does it affect management of water resources in our country. **[8]**
- b) Explain the constraints for water resources development. **[8]**

OR

**P.T.O.**

- Q4)** a) Why is statewide water resources planning of water resources needed?[8]  
b) How does state legislation and data gathering play important role in water resources management. [8]

- Q5)** a) How the demand for irrigation water supply purposes is decided? Comment on the current status of demands of your state with respect to demand for drinking water; irrigation, hydropower; navigation. [8]  
b) Explain the different uncertainties in water resources systems. [8]

OR

- Q6)** a) New equipment is available for Rs. 200000/- and will have an expected salvage value of Rs. 70,000/- at the end of its useful life 12 years. The OMR costs are expected to be Rs. 9000/-. A used but reconditioned piece of the same equipment having OMR costs Rs. 11000/-yr, an estimated life of 7 years, and salvage value of Rs. 10000/- is available for Rs. 110000/-. If the prevailing interest rate is 10 percent and expected average inflation rate over next 10 yr is 5 percent, compare the two alternatives: [6]  
i) Considering the inflation and  
ii) neglecting the effect of inflation.  
b) Write the PCB Strategies for protection of water resources. Explain tangible and intangible benefits in detail. [10]

### **SECTION - II**

- Q7)** a) How reservoir sedimentation measured. What are methods to control sedimentation? What are the methods of removing sediments from the reservoir? [10]  
b) What are the characteristics and functions of reservoir? State conflict among uses of reservoir water. [8]

OR

- Q8)** a) The estimated annual demand of water of a town is 900 ML with a standard deviation of 200 ML. The town's water supply system has an estimated mean capacity of 1200 ML with a standard deviation of 100 ML. Assuming that both the supply and demand are independent random normal variables, find the reliability or the probability of supply exceeding the demand; the risk; i.e. the probability of the system not meeting the demand; safety margin; and safety factor. Use following table of random normal variables for 'z'. [8]

| $z$ | $\alpha$ | $z$ | $\alpha$ |
|-----|----------|-----|----------|
| 1.1 | 0.8643   | 1.3 | 0.9032   |
| 1.2 | 0.8849   | 1.4 | 0.9192   |

- b) How do you carry out reservoir operation studies? Explain the effect on river regime. [10]

**Q9) a)** What are effects of other users, other water bodies and environment on the aquifer. [8]

- b) Explain pumping out test and recuperation test. [8]

OR

**Q10) a)** Explain in detail how the conjunctive use of surface and ground water affects on the planning and management of water resources. [8]

- b) Enlist methods to improve the Ground water content to develop the ground water resources in Maharashtra state. [8]

**Q11) a)** Explain discounting of benefits and costs to present values. [8]

- b) What are the basic steps in the benefit-cost analysis process and how measuring costs and benefits is carried out. [8]

OR

**Q12) a)** What are the limitations of benefit-cost analysis. [8]

- b) What is 'Inter Basin Water Transfer'. enumerate it with suitable example. What is the importance of inter basin water transfer in managing floods and water challenges in drought prone areas. [8]



Total No. of Questions : 12]

SEAT No. :

P3775

[Total No. of Pages : 5

[4760]-85

M.E. (Civil)

**WATER RESOURCES AND ENVIRONMENTAL ENGG.**

**Optimization Techniques**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**SECTION - I**

- Q1)** a) Distinguish between convex and concave sets and local maxima, global maxima. **[8]**
- b) Write the applications of system approach in civil engineering? Explain the 'need' implementation of system approach in civil engineering field? Explain with suitable example. **[8]**

OR

- Q2)** a) Explain the terms: key decision, objective, alternatives and constraints in the context of linear optimization model by assuming a suitable industrial example. **[8]**
- b) Solve the problem by simplex method to Maximize. **[8]**

$$Z = 6x_1 + 4x_2,$$

subject to :

$$2x_1 + 3x_2 \leq 30$$

$$3x_1 + 2x_2 \leq 24$$

$$x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0$$

**P.T.O.**

**Q3)** a) What is dual? When is the solution of it preferred to that of primal? Distinguish between Big M method and Two phase method. [8]

b) Use Big M technique to Maximize  $Z = 2X_1 + 4X_2$ , [8]  
Subject to :

$$\begin{aligned}2X_1 + X_2 &\leq 18 \\3X_1 + 2X_2 &\geq 30 \\X_1 + 2X_2 &= 26 \\X_1, X_2 &\geq 0\end{aligned}$$

OR

**Q4)** a) Maximize [10]

$$Z = 6x_1 + 10x_2 + 2x_3$$

Subject to :

$$\begin{aligned}2x_1 + 4x_2 + 3x_3 &\leq 40 \\x_1 + x_2 &\leq 10 \\2x_2 + x_3 &\leq 12 \text{ and} \\x_1, x_2, x_3 &\geq 0\end{aligned}$$

b) Explain sensitivity analysis in L.P. [6]

**Q5)** a) Use the steepest descent to Minimize  $Z = 2(x_1 - 1)^2 + (x_2 - x_1)^2$  taking starting point as  $(-1, 2)$ . Carry out only two iterations. [10]

b) Maximize  $Z = 60x - x^2$  in the interval  $(0, 100)$  with an accuracy of 0.1% by using Dichotomous method. [8]

OR

**Q6)** a) Use the steepest gradient technique to Maximize

$$f(x) = 3x_1 + x_1x_2 - x_1^2 - x_2^2$$

Take initial point as  $(0, 0)$  and Carry out first two iterations. [8]

b) Use Fibonacci method to minimize the function,  $Z = x^3 - 12x$   
Within a range of 0 to 5 and an accuracy of 0.1%. Carry out first four iterations only. [10]

**SECTION - II**

**Q7)** a) State Bellman's Principal of optimality and give at least two examples of dynamic programming. [6]

b) Six units of power (1 unit = 100 MW) are to be distributed among three regions designated as 1, 2 and 3. The return functions are given below. Where P is the power supplied in units,  $R_i(p)$  is the return function from the region I when  $i = 1, 2$  and 3. Using dynamic programming allocate the power optimally. (12) [10]

|          |   |   |    |    |    |    |    |
|----------|---|---|----|----|----|----|----|
| P        | 0 | 1 | 2  | 3  | 4  | 5  | 6  |
| $R_i(p)$ |   |   |    |    |    |    |    |
| $R_1$    | 0 | 8 | 11 | 30 | 70 | 82 | 90 |
| $R_2$    | 0 | 6 | 12 | 40 | 50 | 69 | 75 |
| $R_3$    | 0 | 9 | 25 | 43 | 53 | 60 | 68 |

OR

**Q8)** a) It is proposed to develop the hydropower by building dams on 3 possible river sites. The total Financial resource available is 3 units. This is to be allocated optimally to these possible developments. The return functions of this investment are given below. Use dynamic programming and determine the maximum return and the allocation to various sites. [10]

| Resource allocated | Return Form |        |        |
|--------------------|-------------|--------|--------|
|                    | Site 1      | Site 2 | Site 3 |
| 0                  | 0           | 0      | 0      |
| 1                  | 3           | 2      | 4      |
| 2                  | 5           | 6      | 6      |
| 3                  | 7           | 7      | 8      |

b) What are the applications of dynamic programming in Water resource and environmental engineering? [6]

**Q9)** a) In a queuing system a study of interarrival times and service times indicated the following frequency distribution for 100 such arrivals. [10]

|                         |    |    |    |    |
|-------------------------|----|----|----|----|
| Interarrival Time (min) | 2  | 6  | 10 | 14 |
| Frequency               | 40 | 30 | 20 | 10 |

|                    |    |    |    |
|--------------------|----|----|----|
| Service Time (min) | 1  | 3  | 5  |
| Frequency          | 40 | 40 | 20 |

Estimate the average percentage waiting time of the units, average percentage idle time of the server and the average length of the queue by simulating 10 arrivals. Use the following random numbers.

|         |    |    |    |    |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|----|----|----|----|
| Arrival | 33 | 90 | 32 | 21 | 02 | 20 | 38 | 11 | 80 | 44 |
| Service | 61 | 48 | 05 | 61 | 58 | 77 | 05 | 85 | 31 | 20 |

b) What is simulation? Explain MONTE CARLO simulation in detail. [8]

OR

**Q10)** a) A manufacturing firm has to carry out processing of 5 jobs in 3 different departments A, B and C in that order. The time required by each job in each department is as follows. [10]

| Jobs | Time in hours |         |         |
|------|---------------|---------|---------|
|      | Dept. A       | Dept. B | Dept. C |
| 1    | 15            | 8       | 20      |
| 2    | 12            | 10      | 24      |
| 3    | 13            | 14      | 18      |
| 4    | 19            | 11      | 14      |
| 5    | 16            | 13      | 10      |

Determine the sequence in which the jobs are to be processed when no-bye passing is allowed, so that the total elapsed time is minimum. Also determine the idle time of the department if any.

b) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 to 204 mopeds, whose probability distribution is as given below. The finished mopeds are transported in a specially designed three storeyed lorry that can accommodate only 200 mopeds. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54 and 10 simulate the process to find out :

- i) what will be the average number of mopeds waiting in the factory?
- ii) what will be the number of empty spaces in the lorry?

|                |      |      |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|------|------|
| Production/day | 196  | 197  | 198  | 199  | 200  | 201  | 202  | 203  | 204  |
| Probability    | 0.05 | 0.09 | 0.12 | 0.14 | 0.20 | 0.15 | 0.11 | 0.08 | 0.06 |

[8]

**Q11) a)** Explain the following : **[6]**

- i) Minimax and maxmin principles.
- ii) Pure and mixed strategies.
- iii) Two person zero sum game.

**b)** Solve the following game : **[10]**

|        | Player B |   |    |     |    |
|--------|----------|---|----|-----|----|
| Player |          | I | II | III | IV |
| A      | 1        | 6 | 4  | 8   | 0  |
|        | 2        | 6 | 8  | 4   | 8  |
|        | 3        | 8 | 4  | 8   | 0  |
|        | 4        | 0 | 8  | 0   | 16 |

OR

**Q12) a)** Solve the following  $2 \times 5$  game by graphical method. **[8]**

|        | Player B |    |    |    |    |    |
|--------|----------|----|----|----|----|----|
| Player |          | -5 | 5  | 0  | -1 | 8  |
| A      |          | 8  | -4 | -1 | 6  | -5 |

**b)** Solve the following game by dominance method. **[8]**

|        | Player B |   |    |     |
|--------|----------|---|----|-----|
| Player |          | I | II | III |
| A      | I        | 7 | 1  | 7   |
|        | II       | 9 | -1 | 1   |
|        | III      | 5 | 7  | 6   |



Total No. of Questions : 8]

SEAT No. :

**P3776**

[4760] - 86

[Total No. of Pages : 2

**M.E. (Civil - W.R.E.E.) (Semester -II)**

**OPEN CHANNEL HYDRAULICS**

**(2012 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer booklet.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Your answer will be valued as a whole.*
- 6) *Use of electronic pocket calculator is allowed.*
- 7) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** A trapezoidal channel 5 m wide and having side slope of 1.5 horizontal: 1 vertical is laid on a slope of 0.00035. The roughness coefficient  $n = 0.015$ . Find the normal depth for a discharge of  $20 \text{ m}^3/\text{s}$  through this channel. **[8]**
- b) Derive Chezy's formula. Derive relation between Chezy's 'C' and Manning's 'n'. **[8]**
- Q2) a)** Write in detail about control of jump by baffle walls. **[8]**
- b) Derive relation between conjugate depths for a hydraulic jump on sloping floor. **[8]**
- Q3) a)** Derive dynamic equation of gradually varied flow. **[8]**
- b) A river 100 m wide and 3 m deep has an average bed slope of 0.0005. Estimate the length of GVF profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Assume  $n=0.035$ . Use direct step method. **[8]**

**P.T.O.**

**Q4)** Write short notes on (any three) **[18]**

- a) Standard step method of GVF computation
- b) Hydraulic jump in expanding channels
- c) Classification of open channel flows
- d) Types of open channels.

**SECTION - II**

**Q5)** a) Derive equation for spatially varied flow with decreasing discharge. **[8]**

b) What is bottom rack? Draw possible flow profiles in a bottom racks. **[8]**

**Q6)** a) What is flood routing? Describe categories of flood routing. List hydraulic and hydrologic flood routing methods. **[8]**

b) Describe explicit method of channel flood routing. **[8]**

**Q7)** a) Derive dynamic equation of Gradually varied unsteady flow. **[8]**

b) Derive differential form of monoclinal rising wave. **[8]**

**Q8)** Write short notes on (any three) **[18]**

- a) Types of surges
- b) Classification of Spatially varied flow
- c) Method of characteristics
- d) Muskingum method.



Total No. of Questions : 8]

SEAT No. :

**P4560**

**[4760]-87**

[Total No. of Pages : 3

**M.E. (Civil-Water Resource and Environmental Engineering)**

**ADVANCE WASTE WATER TREATMENT**

**(2012 Course) (Semester - II) (501610)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Figures to the right indicate full marks.*
- 3) Assume suitable data, if necessary clearly mentioning the same.*
- 4) Use of non-programmable scientific calculator is allowed.*

**SECTION - I**

- Q1)** a) Draw and explain different flow charts for wastewater treatment by physical, chemical and biological process. **[10]**
- b) Explain basic principle of grit and sedimentation tank. **[6]**
- Q2)** a) Explain the various factors considered in the design of reactor. **[6]**
- b) Explain mechanism of flocculation and explain different types of coagulants. **[10]**
- Q3)** a) Write note on equalization and neutralization. **[10]**
- b) Design a primary settling tank of rectangular shape for a town having a population of 25000 with a WS of 135 lpcd. Assume 80% of water supplied is converted into a w/w. Assume: **[8]**
- i)  $SOR = 30 \text{ m}^3/\text{m}^2/\text{d}$ ,
  - ii)  $L:B = 1:4$
  - iii)  $DT = 2.5 \text{ Hrs.}$

***P.T.O.***

- Q4)** a) Write the kinetics of aerobic and anaerobic process. [10]
- b) Explain working mechanism of grit chamber and write different types of grit chamber. [6]

**SECTION - II**

- Q5)** a) Write note fluidized bed reactor treatment. [6]
- b) Average operating data for ASP plant is as follows [10]
- i) Waste water flow = 25000 cum/d
  - ii) Volume of aeration tank = 15500 cum
  - iii) Influent BOD = 200mg/l
  - iv) Effluent BOD = 25 mg/l
  - v) MLSS = 3000 mg/l
  - vi) Effluent suspended solid = 40 mg/l
  - vii) Waste sludge suspended solids = 1200 mg/l
  - viii) Quantity of waste sludge = 250 cum/d

Determine:

- 1) Aeration period
- 2) F/M ratio
- 3) Efficiency of BOD removal
- 4) Sludge age

- Q6)** a) Write note RBC. [6]
- b) Design high rate single stage TF for population of 4000 persons. [10]

**Q7) a)** Explain with a neat sketch: working of a 2-stage digester. Explain empirical formulae used to find the volume of the 2-stage digester. **[10]**

b) Explain different methods of sludge disposal. **[6]**

**Q8) a)** Write note on **[10]**

i) Desalination

ii) Ultra filtration

b) Write different methods of dissolved solids and explain any one in detail. **[8]**

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P3777**

**[4760]-89**

[Total No. of Pages : 2

**M.E. (Civil) (Water Resource and Environmental Engg.)**

**NOISE POLLUTION AND CONTROL TECHNIQUE**

**(2012 Course) (Semester - II) (Elective - III)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in a separate answer books.*
- 2) *Attempt three questions from each section.*
- 3) *Figure to the right indicates full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**SECTION - I**

**Q1)** Explain sound propagation characteristics with neat sketch. Clarify how sound is absorbed in air. **[16]**

**Q2)** Define intensity of noise? How it can be measured? Also discuss equal Loudness counters with neat sketch. **[16]**

**Q3)** Discuss with sketches sound/noise signal and its power spectrum. **[16]**

**Q4)** Write note on: **[18]**

- a) Sources of noise.
- b) Protective equipment's and basic principles of noise control.
- c) Sound level meter.

**SECTION - II**

**Q5)** Enlighten the effect of noise on task performance and Cardio-vascular system. Explain with case studies. **[16]**

**P.T.O.**

**Q6)** a) Enlist various sources of noise pollution specially related to civil Engineering works. How they are controlled at source. [8]

b) Discuss various sources of Noise from industry and its control measures. [8]

**Q7)** Explain in detail traffic noise? Also discuss any one case study of traffic noise due to various vehicles. [16]

**Q8)** Write note on: [18]

a) Existing legal provisions for controlling noise and noise level standards.

b) Air craft and Airport noise any case study.

c) Noise pollution control measures.

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4549**

[4760] - 9

[Total No. of Pages :2

**M.E. (Civil - Construction & Management)**  
**TQM IN CONSTRUCTION**  
**(2008 Course) (Elective - II) (Semester - I)**

*Time : 4 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any 3 questions from section I and any 3 questions from section II.*
- 2) Answer to the 2 sections must be written separately.*
- 3) Figures to the right indicate full marks.*
- 4) Make suitable assumptions as necessary and take suitable data wherever required.*
- 5) Use of calculators is allowed.*

**SECTION - I**

**Q1)** With any case study elaborate the various causes of failure of construction projects in the context of **[18]**

- a) Quality
- b) Speed
- c) Cost
- d) Functional aspects

**Q2)** Explain with examples the following terms:-

**[16]**

- a) Conformance
- b) Requirements
- c) Specifications
- d) Adherence
- e) Quality
- f) Quality Control
- g) Quality Plan
- h) Defect

**P.T.O.**

**Q3)** Explain the major provisions made in the following international standards. **[16]**

- a) ISO 9004
- b) ISO 14000
- c) ISO 18000
- d) ISO 22000

**Q4)** Discuss the following: **[16]**

- a) PDCA cycle
- b) Quality circles
- c) Kaizen
- d) DMAIC

### **SECTION - II**

**Q5)** Classify the construction defects and explain the methodology to arrive at the total cost of these defects. How these can be prevented. **[18]**

**Q6)** TQM barriers need to be overcome. What are these barriers and how they can be overcome by a committed approach of the top management? Explain in detail. **[16]**

**Q7)** What is six sigma? How does it facilitate the TQM process in the construction organisations as well as on the construction projects? What type of certifications are associated with the six sigma trainings? Elaborate. **[16]**

**Q8)** Discuss the following: **[16]**

- a) Importance of Benchmarking in TQM.
- b) Quality Manual.
- c) Quality Documentation.
- d) Total Quality Control on a construction project.



Total No. of Questions : 8]

SEAT No. :

**P3778**

**[4760]-90**

[Total No. of Pages : 2

**M.E. (Civil) (Water Resource and Environmental Engineering)**

**GROUND WATER MODELLING**

**(2012 Course) (Elective - III) (501611)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) Answer to the two sections should be written in separate answer books.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*
- 6) All questions are compulsory.*

**SECTION - I**

- Q1)** a) Write in detail the occurrence and movement of ground water. [10]  
b) Discuss in short the aquifer system. [5]
- Q2)** a) Write a note on Unit Hydrograph. [10]  
b) Discuss in short the Darcy's law. [5]
- Q3)** a) Write an essay on seepage from surface water artificial recharge. [5]  
b) Vertical distribution of sub surface water. [5]
- Q4)** a) Write in short the Ground water budget. [5]  
b) How Pump tests are carried on field. [5]

***P.T.O.***

## SECTION - II

- Q5)** a) Write in detail the constraints on groundwater development. [10]  
b) Limitations in ground water flow modeling. [5]
- Q6)** a) Write an essay on ground water flow model. [10]  
b) Limitations of ground water modeling by FEM. [5]
- Q7)** a) Discuss in detail the Mathematical modeling of ground water system. [5]  
b) Sources of error in Modeling. [5]
- Q8)** a) Discuss the details of misuse of Models for ground water modeling. [5]  
b) Write a note on data preparation for the ground water modeling. [5]

*EEE*

Total No. of Questions : 10]

SEAT No. :

**P3779**

**[4760]-91**

[Total No. of Pages : 3

**M.E. (Civil) (Water Resources and Environmental Engg.)**

**INDUSTRIAL WASTE MANAGEMENT**

**(2012 Course) (Semester - II) (Elective - III) (501611)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Attempt any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*
- 7) *Use data sheet.*

**SECTION - I**

**Q1) a)** Explain physical, chemical & biological characteristics of industrial waste water. **[8]**

b) Explain design of CETP. **[8]**

**Q2) a)** Explain sampling technique. **[8]**

b) Explain techniques for reduction of waste. **[8]**

**Q3) a)** Plot the BOD curve and calculate Kt & Lt for the following data **[8]**

|           |    |    |    |    |    |
|-----------|----|----|----|----|----|
| Time days | 2  | 4  | 6  | 8  | 10 |
| BOD mg/L  | 10 | 20 | 23 | 25 | 30 |

b) Explain the concept of self purification of stream. **[8]**

**Q4) a)** Explain different methods for removal of TDS. **[8]**

b) Explain working of digester. **[8]**

**P.T.O.**

- Q5) a)** The BOD of industrial W.W. for 1 day at 30°C has been found to be 110 mg/L What will be the 5 day BOD at 20°C. Take  $K_D(20^\circ\text{C}) = 0.1$ . [9]
- b) Explain the concept of anaerobic sludge digestion with three phases such as hydrolysis, acidogenesis, methanogenesis and also explain conventional sludge digester with diagram. [9]

### **SECTION - II**

- Q6) a)** The treated W.W. with flow of 2000 L/min is to be treated with PAC to reduced concentration of total organic nitrogen from 5 mg/L to 1 mg/L. The removal follows Freundlich adsorption isotherm in which capacity factor and intensity parameter are  $160 \text{ mg/gm (L/mg)}^{1/n}$  & 0.5 respectively. Determine PAC dose, PAC requirement and annual cost of PAC. Assume PAC cost to be Rs. 50/- per kg. [8]
- b) Explain operation and maintenance problem of CETP. [8]
- Q7) a)** Draw a flow diagram for treating W.W. of dairy industry & show all treatment unit. [8]
- b) Draw a flow diagram for treating W.W. of textile industry and show all treatment unit. [8]
- Q8) a)** Explain the electro dialysis process and determine power required for electro dialysis process for the following data. [8]
- i)  $Q = 4000 \text{ m}^3/\text{d}$ ,
  - ii)  $\text{TDS} = 2000 \text{ mg/L}$ ,
  - iii) No of Cells = 300
  - iv) Cation and anions concentration = 0.011 Eq/L,
  - v) Salt removal Efficiency = 50%, Current efficiency = 90%.,  $R = 50 \text{ ohm}$  Use data sheet if required.
- b) Explain importance of treatability index in waste water treatment. [8]

**Q9)a)** Explain the characteristics of sugar industrial waste with value and state disposal method of industrial treated waste with flow diagram. [8]

b) Write short note on water pollution act 1978. [8]

**Q10)a)** Design CETP for following data [9]

i)  $Q = 150 \text{ m}^3/\text{d}$ ,

ii)  $\text{pH} = 11 - 12$ .

iii)  $\text{BOD at } 27^\circ\text{C} = 70 \text{ mg/L}$

iv)  $\text{TDS} = 3000 \text{ mg/L}$

v)  $\text{TS} = 6000 \text{ mg/L}$

vi)  $\text{Iron concentration} = 700 \text{ mg/L}$

vii)  $\text{COD} = 5000 \text{ mg/L at } 27^\circ\text{C}$

Find

1) Volume of sedimentation tank.

2) Acid required for neutralization if 3 lit acid required for 1  $\text{m}^3/\text{d}$  of E/F pH.

3) Quantity of lime required for removal of Iron take lime consumption as 1 mg/L of Iron required 0.5 mg/L of lime.

4) Select suitable method for removal of COD and BOD

5) F/M ratio

b) Write short note on hazardous waste management. [9]

*EEE*

Total No. of Questions : 12]

SEAT No. :

P3933

[Total No. of Pages : 4

[4760] - 92

**M.E. (Civil) (Water Resources and Environmental Engineering)**

**DAM ENGINEERING**

**(2008 Pattern) (Elective - IV) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q4, Q.5 or Q.6 from Section - I.*
- 2) *Solve Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12 from Section - II.*
- 3) *Answer any 3 questions from each section.*
- 4) *Answers to the two sections should be written in separate books.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Figures to the right indicate full marks.*
- 7) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 8) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1)* a) Enumerate various forces acting on gravity dam. Give the expression for each of them. **[4]**
- b) A gravity dam is 10 m high. It has a top width of 1m and base width 9m. the front face is vertical. Assume that the weight of concrete is 2400 kg/m<sup>3</sup> and the water is stored upto the top of the dam. Take density of water as 1000 kg/m<sup>3</sup>. **[10]**
- Find i) Stability against overturning.
- ii) Compressive stresses and principal stresses at the toe and heel of the dam.
- iii) Shear stress at the toe and heel of the dam.
- Consider only self weight of dam and water pressure.
- c) A solid gravity dam is to be constructed with concrete (1:2:4). Find out the height up to which the dam may be considered as a low dam. Draw a neat section of the low dam for this height. **[4]**

OR

*P.T.O.*

- Q2)** a) Write short note on earthquake pressure in gravity dams. Explain in detail effect of horizontal and vertical acceleration. [8]
- b) Explain elementary profile of gravity dam with neat sketch. Also discuss the stress intensities in elementary profile. [6]
- c) What are the different methods of stability analysis of gravity dam? Explain analytical method in detail. [4]

- Q3)** a) What are salient features of an arch dam and different types of arch dam? Derive an equation for best central angle of arch dam. [10]
- b) Explain the design criteria for arch dam? [6]

OR

- Q4)** a) What are the different methods of design of an arch dam? Explain thin cylinder theory in detail. [10]
- b) What are the various forces acting on arch dam? [6]

- Q5)** a) What are the various causes of failures of earthen dam? Draw neat sketches. [8]
- b) A homogeneous earth dam has a section as shown in fig. -1. It is provided with a horizontal filter 20 m long on the D/S side. Draw the base parabola and indicate the adjustments required to obtain phreatic line from it. [8]

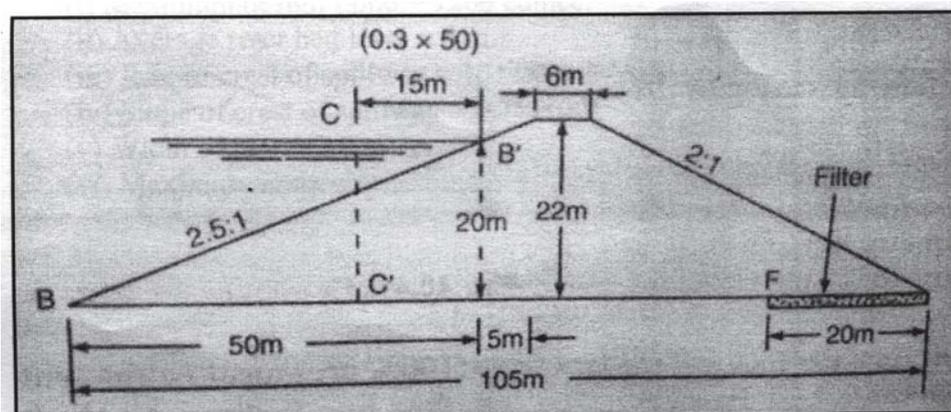
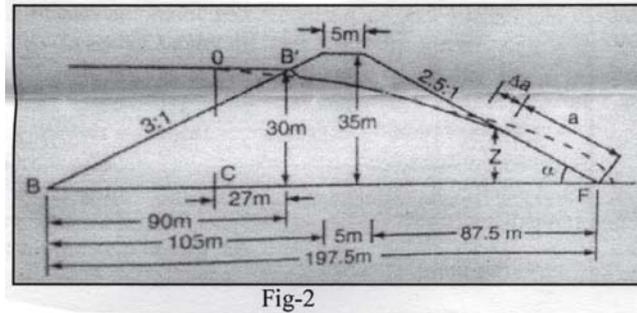


Fig-1

OR

- Q6) a) Calculate the seepage per meter length through the body of the dam section shown in fig.-2. Assume coefficient of permeability  $K = 8 \times 10^{-4}$  cm/sec. [8]



- b) Draw a cross-section of an earth dam with the following data : [8]  
 R.L. of natural surface at site = 100.00 m  
 R.L. of F.R.L. = 118.30 m  
 R.L. of H.F.L. = 121.30 m Slope of saturation line 4:1. Assume other data.

### SECTION - II

- Q7) a) Explain the various types of rockfill dams and draw the sketches for each of them. [10]  
 b) What are the various methods of construction of rockfill dams? Explain any one in detail. [8]

OR

- Q8) a) Explain the concept and design of Buttress dam. Also discuss the merits and demerits of buttress dam over gravity dam. [10]  
 b) Draw plan and an elevation of a flat slab deck type buttress dam and describe the important features of the same. [8]

- Q9) a) Design an Ogee shape gated spillway for the following data: [10]  
 i) Maximum design flood = 1200 cumec.  
 ii) Average river bed level = 0 m.  
 iii) R.L. of crest of spillway = 101.00 m.  
 iv) Slope of crest of spillway = 0.7H : IV.  
 v) Width of pier = 2.0 m  
 vi) Maximum allowable water level during flood = 105.00 m  
 Assume number of span as 7, clear way of each span as 10.0 m and  $k_a = 0.1$ ,  $K_p = 0.01$ .  
 b) Explain energy dissipation arrangement for the following two cases:[6]  
 i) T. W. C. coincides H. J. C.  
 ii) T. W. C. always above H. J. C.

OR

- Q10)**a) Describe Indian Standard practice for design of horizontal apron stilling basin for a dam spillway. [8]  
b) Describe the Creager's method of designing profile of a overflow spillway. [8]
- Q11)**a) Explain with neat sketches: [8]  
i) Remiolds automatic gate  
ii) Visvesvaraiya's gate  
b) What are the advantages of gated spillway. [8]

OR

- Q12)**a) Explain with neat sketches : [8]  
i) Drum gate  
ii) Stoney gate  
b) What are sluices? What functions they serve? Describe Dharwar and Belgam type briefly whit the help of sketches. [8]



Total No. of Questions : 8]

SEAT No. :

P3934

[Total No. of Pages : 2

[4760] - 93

**M.E. (Civil) (Water Resources and Environmental Engineering)**

**Energy and Environment**

**(2008 Pattern) (Elective - IV)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Answer any 3 questions from each section.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary clearly mentioning the same.*
- 4) *Use of non-programmable scientific calculator is allowed.*

**SECTION - I**

- Q1)** a) Discuss the pollution potential of construction projects with suitable examples. With suitable reasons justify whether infrastructure projects or real estate projects pollute more. [8]
- b) Explain in detail, the need for harnessing energy sources. Explain the importance of use of non conventional energy sources in civil engineering field. [8]
- Q2)** a) Explain in detail nuclear power as a sustainable energy source. Comment on atomic power projects in India. [8]
- b) Enlist various non conventional energy sources. Explain their advantages and disadvantages in detail. [8]
- Q3)** a) Explain the concept of green procurement and green contracts. How different is a green contract from conventional civil engineering contract? Explain the differences with suitable clauses and examples.[8]
- b) Explain in detail various mechanisms of harnessing solar energy. Also explain the importance of R&D in solar energy sector in India. [8]
- Q4)** a) Explain in detail energy requirement of India and need of finding alternative sustainable energy sources. [9]
- b) Explain what you understand by socio-environmental impact assessment with an example of hill road construction in tribal areas.[9]

**P.T.O.**

## SECTION - II

- Q5) a)** Biogas has huge potential in India. Explain this statement in detail.[8]  
**b)** Explain in detail : environmental impacts of biomass. What are the challenges in the same? [8]
- Q6) a)** Enlist and explain the roles and responsibilities of different organizations in India related to environment and pollution control. Discuss their jurisdiction details and the procedures involved for getting clearances from these organizations. [8]  
**b)** Enlist various environment protection acts in force in India. Explain the salient features and penalty clauses involved in any two of these acts. [8]
- Q7) a)** Explain in detail use of participatory approach for efficient use of energy in India. Also explain the role played by industries in energy sector through PPP. [8]  
**b)** Explain importance of cogeneration plants in sugar industry. How industries can get benefitted from such co-gen plants? Explain with a suitable example. [8]
- Q8) a)** Write notes on (Any Two) : [10]  
a) Sustainable construction.  
b) Smart materials in Civil Engineering.  
c) Participatory approach in Environmental field.  
**b)** Explain in detail role played by industries through CSR for betterment of environment. [8]



Total No. of Questions : 12]

SEAT No. :

**P4561**

[4760]-94

[Total No. of Pages : 3

**M.E. (Civil) (Water Resources and Environmental Engineering)**

**CLOSED CONDUIT FLOW**

**(2008 Course) (Semester - II) (Elective - IV) (501612)**

*Time : 3 Hours]*

*[Max. Marks :100*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Draw neat sketches wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Use of calculators is allowed.*
- 5) *All questions are compulsory.*
- 6) *Answers to the two sections must be written separately.*

**SECTION - I**

- Q1)** a) What are pump characteristics? Explain with neat sketches applications of pump characteristics. **[8]**
- b) A pump delivers water at  $Q = 300$  l/s and a head  $D_h = 40$  m through a DN 400 discharge pipe measuring  $L = 5000$  m into an overhead tank;  $a = 1000$  m/s. The inertia moments of pump and motor are negligible. Is there a risk of liquid column separation, i.e. macro-cavitation, following pump trip? If so, what is the anticipated pressure increase? **[10]**

OR

- Q2)** a) What do you understand by static head Manometric head and total head of a centrifugal pump? Explain Manometric, Mechanical and overall efficiencies of centrifugal pumps. **[9]**
- b) Derive the expression for specific speed of centrifugal pump. **[9]**

**P.T.O.**

- Q3)** a) Explain Water hammer theory (elastic and rigid) for pipeline flow for hydroelectric project. [8]
- b) Illustrate with the help of sketch variation in hydraulic gradient in a penstock with change of load. [8]

OR

- Q4)** a) What do you understand by a surge tank? Illustrate with sketches its different types. [8]
- b) Do we need surge tanks in tailrace tunnel? Illustrate various types with suitable sketches. [8]
- Q5)** a) A rectangular power channel 20 m wide and 3 m deep supplies 120 cumecs discharge to a power plant with four turbines. Two turbines are suddenly closed. Determine magnitude and speed of surge developed. [8]
- b) A penstock 2000 m long and m in diameter has a surge tank 20 m diameter for a discharge of 30 cumecs. Friction factor is 0.018. Normal reservoir level is 500 m. Determine maximum and minimum water levels in the tank. [8]

OR

- Q6)** a) What are the functions of surge tanks? Determine the pressure rise due to sudden closure of the valve at the end of steel penstock pipe 500 m long carrying water at a velocity of 5 m/s. Assume  $\sigma = 102$ . [8]
- b) Explain in detail differential surge tanks with expanded chambers. [8]

### **SECTION - II**

- Q7)** a) What are various components of water distribution system? Explain with sketches. [8]
- b) Explain in detail method of pipe network analysis. [10]

OR

- Q8)** a) Explain use of PIPE2000(KYPIPE) for design of pipeline. [9]  
b) Explain in detail contribution of computer science in planning and management of water supply. [9]

- Q9)** a) Explain use of SURGE program. [8]  
b) State basic equations of transient flow analysis in closed conduits and explain terms involved. [8]

OR

- Q10)**a) Explain use of HEC\_RAS(HEC2) program in managing water resources. [8]

- b) Explain use of Pipe 2000-SWMM program. [8]

- Q11)**a) Explain classification of open channel flows. [8]

- b) What are gradually varied flows explain with sketches various GVF profiles. [8]

OR

- Q12)**a) What are rapidly varied flows (RVF) explain with sketches RVF. [8]

- b) Explain use of floodplain hydraulics in design of various civil engineering structures. [8]

EEE

Total No. of Questions : 8]

SEAT No. :

**P4302**

**[4760] - 96**

[Total No. of Pages : 3

**M.E. (Mech - Heat Power)**

**NUMERICAL METHODS IN THERMAL & FLUID ENGG.**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** While solving two dimensional heat conduction in a plate, the following equations are obtained: **[17]**

$$4T_1 - T_2 - T_3 = 150$$

$$- 2T_1 + 4T_2 = 210$$

$$- 2T_1 + 4T_3 = 210$$

Find temperatures  $T_1$ ,  $T_2$  &  $T_3$  at 3 different points using

- a) LU decomposition Method.
- b) Gauss-Seidel Method (Four iterations)

**Q2)** The following polynomial can be used to relate the zero pressure specific heat of dry air,  $C_p$  KJ/kg K to temperature  $T$  : **[16]**

$$C_p = 0.99403 + 1.671 \times 10^{-4} T + 9.7215 \times 10^{-8} T^2 - 9.5838 \times 10^{-11} T^3 + 1.952 \times 10^{-14} T^4$$

Determine the temperature that corresponding to a specific heat of 1.2kJ/kg k.  
Use

- a) Newton-Raphson Method.
- b) Bi-section Method.

Carry out four iterations each.

**P.T.O.**

**Q3)** Kinematic viscosity of water ( $\nu$ ) is related to temperature (T) in the following manner: **[16]**

|                                       |        |        |        |        |        |        |        |
|---------------------------------------|--------|--------|--------|--------|--------|--------|--------|
| T(°C)                                 | 0      | 4      | 8      | 12     | 16     | 20     | 24     |
| $\nu 10^{-2}$<br>cm <sup>2</sup> /sec | 1.7923 | 1.5676 | 1.3874 | 1.2396 | 1.1168 | 1.0105 | 0.9186 |

Use method of least squares to fit the parabolic equation of the form  $\nu = A.T^2 + B.T + C$  for the data.

Derive the equation you use.

**Q4)** Using Hermite Interpolation, estimate the value of  $y(1.3)$  from the following data **[17]**

|    |        |        |        |         |
|----|--------|--------|--------|---------|
| x  | 0.5    | 1.0    | 1.5    | 2.0     |
| y  | 0.4794 | 0.8415 | 0.9975 | 0.9093  |
| y' | 0.8776 | 0.5403 | 0.7074 | -0.4162 |

### SECTION - II

**Q5)** Use the order of  $h^6$  Romberg integration to evaluate  $\int_0^3 xe^{2x} dx$  **[17]**

**Q6) a)** Consider the matrix A given by  $A = \begin{bmatrix} 4 & 1 & 0 \\ 1 & 20 & 1 \\ 0 & 0 & 4 \end{bmatrix}$  and  $b = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$  **[12]**

Determine the maximum Eigen values and corresponding Eigen vector using the power method up to six iteration.

b) What are the Eigen value problems? How are the different from boundary value problems? **[4]**

**Q7)** Using Runge-Kutta 4<sup>th</sup> order method, solve for y at x = 1.2 and x = 1.4 from

the equation  $\frac{dy}{dx} = \frac{2xy + e^x}{x^2 + x.e^x}$  With  $x_0 = 1, y_0 = 0$ . **[16]**

**Q8)** Solve using Gauss-Seidel Method with relaxation,  $\nabla^2 U = -10(x^2 + y^2 + 10)$  over the square mesh with sides x = 0, y = 0, x = 3, x = 3 with U = 0 on the boundary and mesh length 1 unit. **[17]**



Total No. of Questions : 8]

SEAT No. :

P4303

[Total No. of Pages : 4

[4760]-97

**M.E. (Mechanical) (Heat Power)**  
**ADVANCED THERMODYNAMICS**  
**(2008 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**SECTION - I**

- Q1) a)** A rigid vessel of volume 0.3 m<sup>3</sup> contains 10 kg of air at 27°C. Determine the pressure exerted by the air, using :- **[10]**  
i) perfect gas equation ii) Van der Waal's equation of state. Also find the reduced temperature and pseudo reduced volume.

Given:  $T_c = 132.8\text{K}$  and Van der Waal's constants as

$$a = 1.364 \text{ bar} \left( \frac{\text{m}^3}{\text{kg.mole}} \right)^2 \text{ and } b = 0.0366 \text{ m}^3/\text{kg.mole.}$$

$$p_c = 37.7 \text{ bar}$$

- b) Write a note on Generalised compressibility chart? **[6]**

**P.T.O.**

**Q2) a)** In a steam turbine, steam at 8 bar, 250°C expands adiabatically with negligible velocities at inlet and exit, to a pressure of 0.75bar, the quality of steam being 0.95. Calculate the availability of entering and leaving steam and the maximum work output. The temperature & pressure of the surroundings are 25°C and 1 bar, respectively. [10]

b) Explain : [6]

i) Critical point

ii) Triple point

**Q3) a)** Derive the following relation where the notations carry usual meanings. [12]

Hence show that

i)  $C_p > C_v$ , and

ii) at absolute zero,  $C_p = C_v$

$$\text{Relation: } (C_p - C_v) = -T \left( \frac{\partial v}{\partial T} \right)_p^2 \cdot \left( \frac{\partial P}{\partial v} \right)_T.$$

b) Explain the law of degradation of energy. [4]

**Q4)** Write short notes on (any three): [18]

a) Helmholtz and Gibb's function.

b) Inversion curve.

c) Gibb's phase rule.

d) Maxwell relations.

### SECTION - II

**Q5) a)** In the expression given below for the equilibrium constant  $K$ , 'v' stands for a *stoichiometric coefficient* of a distinct component 'A' (i.e. number of molecules of a substance 'A' which participate in the reaction) and  $\phi$  is a function of temperature only [Molar Gibbs function:  $\bar{g} = \bar{R}T(\phi + \ln p)$ ]. Using 'Van't Hoff equilibrium box, derive for the heat of reaction ' $\Delta H$ ' at any desired temperature or within a certain temperature range.

$$\ln k = -(v_3\phi_3 + v_4\phi_4 - v_1\phi_1 - v_2\phi_2) \quad [8]$$

- b) One cu meter of He at 1 bar & 25°C is mixed with one cu meter of  $N_2$  at 1 bar & 25°C. For the mixture at same condition find. [8]
- Mole fraction.
  - Partial pressure.
  - Mass fraction of components.
  - Molar mass of mixture.
  - Gas constant of the mixture &
  - Volume of the mixture.

- Q6)** a) "For non-pure crystals there will be some energy associated with the imperfections". Explain with the help of the third law of thermodynamics. [3]
- b) What is a fugacity? Show that for an ideal gas  $dg = n\bar{R}T d \ln a$ . [5]
- c) Hydrogen is burned with air at atmospheric pressure in an adiabatic burner to produce a flame of 2000 K. Determine the percentage theoretical air required assuming complete combustion, when the hydrogen & air are supplied at 25°C. Use enthalpies given below.[8]

| Enthalpy of formation (kJ/kmol) at the standard reference state of 25°C & 1 atm | Sensible enthalpy at 2000 K (Relative to standard reference state)<br>$\Delta \bar{h} = (\bar{h}^0 - \bar{h}_{298}^0) \text{kJ/kmol}$ |
|---|---|
| $(\bar{h}_f^0)_{H_2O} = -241836$  | 72698   |
| $(\bar{h}_f^0)_{O_2} = 0$   | 59199   |
| $(\bar{h}_f^0)_{N_2} = 0$   | 56141   |

- Q7)** a) State the need of statistical Thermodynamics. [3]
- b) Define microstate & macro-state. Discuss distribution law & ensemble approaches. [5]

c) Discuss Bose-Einstein distribution law and derive for B-E distribution function. [8]

**Q8)** a) State and derive the principle of Equipartition of energy. [10]

b) Compare Bose-Einstein and Fermi-Dirac statistics when four particles are arranged in two energy levels. Three particles are at energy level  $\epsilon_1$  having degeneracy  $g_1 = 4$  and one particle at energy level  $\epsilon_2$  having degeneracy  $g_2 = 2$ . [8]



Total No. of Questions : 12]

SEAT No. :

**P3780**

**[4760]-98**

[Total No. of Pages : 4

**M.E. (Mechanical)**

**(Common to Mechanical-Heat Power, Design,**

**Automotive and Mechatronics)**

**TECHNOLOGY AND FINANCIAL MANAGEMENT**

**(2008 Course) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) Answer any three questions from each section.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of electronic pocket calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**SECTION-I**

- Q1) a)** Distinguish between 'Flexible budget' and 'Fixed Budget'? What are the main features of a budgetary control system. **[10]**
- b)** Define 'budget' and 'budgetary control'. Discuss the cardinal features and objectives of budgetary control. **[6]**

OR

- Q2)** Write short notes on the following: **[16]**
- a) Functional budget.
  - b) Forces driving global economy.
  - c) Sources of short term finance.
  - d) Functions of finance.

- Q3) a)** What do you mean by marginal costing? Explain with an example how do income statements prepared under the absorption costing and marginal costing concepts differ? **[8]**

***P.T.O.***

- b) A company makes plastic buckets. An analysis of their accounting reveals the following: **[10]**

|                          |   |                       |
|--------------------------|---|-----------------------|
| Variable cost per bucket | : | Rs. 20                |
| Fixed cost               | : | Rs. 50000 per year    |
| Capacity                 | : | 2000 buckets per year |
| Selling price per bucket | : | Rs. 70                |

- i) Calculate the break-even point.
- ii) Find the number of buckets to be sold to get a profit of Rs. 30000.
- iii) If the company can manufacture 600 buckets more per year with an additional fixed cost of Rs. 2000, what should be the selling price to maintain the profit per bucket as at (ii) above?

OR

- Q4)** a) Explain the different methods of computing profits on contracts, where work is not completed at the close of the accounting year? **[8]**
- b) What are the characteristics of process costing? **[5]**
- c) Explain in brief the stages and flow of costs in Activity Based Costing? **[5]**

- Q5)** a) Distinguish between micro economics and macro economics. **[6]**
- b) Explain the theory of consumer's demand with the help of indifference curve analysis. Also explain Income effect and substitution effect? **[10]**

OR

- Q6)** a) How does international trade affects domestic market? Explain in brief the methods to protect domestic trade? **[12]**
- b) Distinguish between monopoly and oligopoly types of competition. **[4]**

## SECTION-II

**Q7)** a) Define Total Quality Management (TQM). What are the elements and principles of TQM? [10]

b) Explain KAIZEN duties in different levels of management. [6]

OR

**Q8)** a) Explain the Deming's 14 point approach to Quality Management. [8]

b) What is Juran trilogy diagram? Explain its importance in quality management. [8]

**Q9)** A small engineering project consists of set of activities whose three time estimates in days are given below:

| Activity | Optimistic time | Most likely time | Pessimistic time |
|----------|-----------------|------------------|------------------|
| 1-2      | 2               | 5                | 14               |
| 1-6      | 2               | 5                | 8                |
| 2-3      | 5               | 11               | 28               |
| 2-4      | 1               | 4                | 7                |
| 3-5      | 5               | 11               | 17               |
| 4-5      | 3               | 5                | 14               |
| 6-7      | 3               | 9                | 27               |
| 5-8      | 2               | 2                | 8                |
| 7-8      | 7               | 13               | 23               |

Draw the PERT network diagram and identify the critical path and critical path duration. [7]

i) Calculate the standard deviation, variance, EST, LST, total slack for each activity. [8]

ii) Calculate the variance of critical path. [3]

OR

- Q10)a)** Explain the stages involved in project life cycle with a neat line diagram. [6]
- b) Explain the concept of BOT in brief. [6]
- c) Distinguish between PERT and CPM. [6]

- Q11)a)** Define personnel management. State the objectives and principles of personnel management. [10]
- b) Distinguish between autocratic and supportive models of organizational behavior. [6]

OR

- Q12)a)** Define merit rating. State and describe any three methods of merit rating. [10]
- b) Explain the process of Management by Objectives. [6]



Total No. of Questions : 8]

SEAT No. :

**P4562**

[4760]-99

[Total No. of Pages : 3

**M.E.(Mechanical-Heat Power Engineering)**  
**PERFORMANCE ASSESSMENT OF MECHANICAL**  
**EQUIPMENTS**  
**(502104-A) (2008 Course) (Elective-I) (Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates:*

- 1) *Answer any three questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary and mention it clearly.*

**SECTION-I**

**Q1) a)** With a neat schematic explain the various steam system components used in an industrial plant. **[8]**

b) Discuss the feed water treatment techniques in boiler system. **[8]**

**Q2)** A boiler is used for an industrial application. Determine the boiler efficiency using the following data.

Fuel consumption: 350 kg/h

Steam generation rate: 1000 kg/h

Calorific value :41500 kJ/kg

Steam generation pressure: 10 bar, saturated

Chemically correct air-fuel ratio:15:1

Excess air supplied:18%

Exhaust gas temperature & its specific heat: 300°C & 1.05 kJ/kgK

Feed water temperature:70°C

Boiler surface temperature:62°C

Boiler surface area:40m<sup>2</sup>

**P.T.O.**

Ambient temperature: 25°C

Heat transfer coefficient from outer surface of boiler: 8 W/m<sup>2</sup>K

Ultimate analysis of fuel can be taken as

C = 85%, H = 11%, S = 3%, O<sub>2</sub> = 1% .

Assume additional data if necessary. Show various losses with neat diagram. [18]

- Q3)** a) What is meant by waste heat quality? Explain various types with its applications. [8]
- b) Explain the following: [8]
- i) Steam traps and their selection.
  - ii) Cogeneration systems and its applications.

- Q4)** Write a short note on any two: [16]
- a) Heat pump as waste heat recovery device.
  - b) Gas turbine cogeneration system.
  - c) Methods of furnace testing.

### SECTION-II

- Q5)** a) Discuss the energy conservation opportunities in compressed air system. [8]
- b) Explain the various factors affecting the pump performance. [8]
- Q6)** a) Explain the step by step procedure of energy performance assessment of DG sets. [8]
- b) Classify fans used in ventilation systems. Explain its characteristics. Give its selection criteria. [8]

**Q7) a)** Explain: Heat wheel as a waste heat recovery device. **[8]**

b) Draw the block diagram of compressed air system. List industrial uses of compressed air. **[8]**

**Q8) Write a short note on the following:** **[18]**

a) Energy conservation opportunities in heat exchangers.

b) Fuel economy measures in furnaces.

c) Performance testing of heat pump.

