

[5060]-590

M.E. (Mechanical - Design Engineering)
OPTIMIZATION TECHNIQUES
(2013 Pattern) (Semester - III) (Credit System)

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 table is allowed.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data if necessary.

Q1) a) Define engineering optimization? What are engineering applications of optimization? [5]

- b) In a two-stage compressor, the working gas leaving the first stage of compression is cooled (by passing it through a heat exchanger) before it enters the second stage of compression to increase the efficiency. The total work input to a compressor (W) for an ideal gas, for isentropic compression, is given by

$$W = C_p T_1 \left[\left[\frac{p_2}{p_1} \right]^{\frac{k-1}{k}} + \left[\frac{p_3}{p_2} \right]^{\frac{k-1}{k}} - 2 \right] \frac{k}{k-1}$$

where C_p , is the specific heat of the gas at constant pressure, k is the ratio of specific heat at constant pressure to that at constant volume of the gas, and T_1 is the temperature at which the gas enters the compressor. Find the pressure, p_2 at which inter-cooling should be done to minimize the work input to the compressor. Also determine the minimum work done on the compressor. [5]

OR

- c) Explain necessary condition for single variable optimization. [5]

P.T.O.

Q2) There grades of coal A, B and C contain phosphorus and ash as impurities. In a particular industrial process, fuel up to 100 ton (maximum) is required which should contain ash not more than 3% and phosphorus not more than 0.03%. It is desired to maximize the profit while satisfying these conditions. There is unlimited supply of each grade. The percentage of impurities and the profits of the grades are given below.

Coal	Phosphorus (%)	Ash (%)	Profit in rupees per ton
A	0.02	3.0	12.00
B	0.04	2.0	15.00
C	0.03	5.0	14.00

Find the proportions in which the three grades be used. [10]

Q3) a) Write a short note on Exhaustive search method. [4]

b) Minimize the function

$$f(x) = 4x^3 + x^2 - 7x + 14$$

Using Golden Section Method, in the interval of [0, 1] with n = 5. [5]

Q4) a) Explain any two in details. [6]

i) Fuzzy optimization

ii) Simulated Annealing

iii) Genetic algorithms

b) Minimize the function

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\lambda \tan^{-1}\left(\frac{1}{\lambda}\right)$$

Using quasi-Newton method with the starting point $\lambda_1 = 0.1$ and the step size $\Delta\lambda = 0.01$ in central difference formulas. Use $\varepsilon = 0.01$ for checking the convergence. [5]

- Q5)** a) List the different solution methods in topology optimization and explain two of them in details. [5]
- b) Write a short note on combining topology and shape design. [5]
- Q6)** a) Write a short note on Topology optimization as design tool. [5]
- b) Write a short note on Bi-directional Evolutionary optimization method. [5]



Total No. of Questions : 10]

SEAT No. :

P558

[Total No. of Pages : 2

[5063] - 330

T.Y. B.Com. (Vocational)
COMPUTER APPLICATIONS
(2013 Pattern) (Paper - V)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *Answer Any Eight questions.*
- 2) *All questions carry equal marks.*

Q1) Explain any five factors influencing the web site design. **[5]**

Q2) What is Information System? Explain any two dimensions of Information System. **[5]**

Q3) Explain B2B and B2C models of E-Commerce. **[5]**

Q4) Explain following HTML tags: **[5]**

- a) List.
- b) Table.

Q5) Write a note on Debit Card. **[5]**

Q6) Explain Web Development Process Model with suitable diagram. **[5]**

P.T.O.

Q7) Explain the need of Transaction Processing System. **[5]**

Q8) Explain various types of CSS. **[5]**

Q9) Write a note on Digital Signature. **[5]**

Q10) Write HTML Script to display the class timetable of T.Y. B.Com. **[5]**



Total No. of Questions : 8]

SEAT No. :

P5103

[Total No. of Pages : 3

[5060]-501

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

APPLICATIONS OF STATISTICAL METHODS IN CONSTRUCTIONS

(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 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) If 3 blocks out of 20 are defective and 4 of them are randomly chosen for inspection (i.e. each block has the same chance of being selected), then what is probability that only one of the defective block will be included? **[4]**

b) Explain different rules of probability with examples. **[6]**

Q2) a) In an item of excavation at the contractor's cost for particular strata and for a particular quantity of work, following costs have occurred on 10 previous projects.

Sr. No.	1	2	3	4	5	6	7	8	9	10
Cost (Rs.)	15005	11250	27288	14807	33650	17500	26000	39210	83470	22525

Determine Mean, Standard Deviation, Variance, Coefficient variance, Range, Coefficient of Range for above data. **[6]**

b) Explain discrete probability distributions with construction examples. **[4]**

Q3) The table below gives the number of major and minor accidents that occurred on construction site in various months for particular year.

Monts	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
No.of Accidents	6	4	5	9	7	8	10	12	5	7	8	9

Use χ^2 - test to assess the correctness of the hypothesis that accidents were distributed in equal numbers over the different months. Value of χ^2 for 11 degree of freedom at 5% level is 19.68. **[10]**

Q4) a) Following readings were recorded while testing concrete cubes:

Comp Strength N/mm ²	30	32	34	31	36	29	28	33	35	27
W/C Ratio	0.365	0.355	0.340	0.360	0.32	0.370	0.380	0.350	0.330	0.400

Determine the coefficient of correlation and coefficient of determination
Also interpret the same. [7]

b) Explain Griffi's Model with construction example. [3]

Q5) Find the lines of Regression for the following data: [10]

x	10	14	19	26	30	34	39	38	26	25
y	12	16	18	26	29	35	38	30	35	28

And estimate y for x = 14.5 and x for y = 29.5

Q6) a) Explain regression analysis and its types with construction examples. [5]

b) Explain EOQ model with its derivation. [5]

Q7) A contractor has kept the data of penalty which he had to pay due to delay in project on 7 of his previous executed construction projects. Using Monte Carlo Simulation, simulate the mean penalty which contractor should consider for his 10 future works. [10]

Project No.	Penalty in (Rs.)
1	5,00,000
2	2,50,000
3	4,50,000
4	3,50,000
5	10,00,000

Use following random numbers.

39 73 72 75 37 02 87 98 10 17 93 21 95 97 69

Q8) a) Perform Sensitivity Analysis for the **[5]**

$S = 2,50,000$ bags, $Co = Rs. 4,000$, $Cu = Rs. 320$, $I = 22\%$

During execution, it was observed that the Cu reduced to Rs. 300, 'S' increased by 7%, Co reduced by 4% and I remained same, Determine percentage change in cost?

b) Explain ABC analysis with graph. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4723

[Total No. of Pages : 2

[5060]-502

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

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) *Attempt any five question out of eight.*
- 2) *All questions carry 10 marks each.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Figure to the right indicate full marks.*
- 6) *Use of electronic calculator is allowed.*

Q1) a) Explain in brief Fayol's 14 principles of management. **[5]**

b) Discuss in details various functions of management. **[5]**

Q2) a) Explain project life cycle phases in construction of express highway. **[5]**

b) Write short note on: Role & Responsibilities of project manager. **[5]**

Q3) a) Write short note on: Line of balance technique. **[5]**

b) Define work break down structure. Draw work break down structure for dam construction. **[5]**

P.T.O.

Q4) Following table gives the cost duration data for various activities of a construction project. The overhead cost is Rs. 3000/- per day. Carry out step by step crashing and find out optimum project duration and optimum cost of the project. **[10]**

Activity	Normal Duration (Days)	Cost(Rs)	Crash Duration (Days)	Cost (Rs)
1-2	5	2000	4	2400
1-3	7	4200	5	4600
2-4	3	3000	2	3400
3-4	2	2600	2	2600
3-5	6	2400	4	2800
4-6	5	4000	4	6000
5-6	3	3000	2	4400

Q5) a) Elaborate on the site mobilization techniques required for Commercial Mall construction project in the heart of the city. **[5]**

b) Write short note on: Reporting Technique **[5]**

Q6) a) Explain in detail with example procedure involved in method study. **[5]**

b) Write short note on: Recording techniques of Motion study. **[5]**

Q7) a) Discuss in detail the various causes of accidents on construction site. **[5]**

b) Write short note on: Personal Protective equipment. **[5]**

Q8) a) Discuss the significance of merit rating in construction industry. **[5]**

b) Define the term Job evaluation. Discuss any two methods of job evaluation. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4724

[Total No. of Pages : 2

[5060]-503

**M.E. (Civil Engineering) Construction and Management
CONSTRUCTION TECHNOLOGY
(2013 Pattern)**

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

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

- Q1)** a) With the help of neat labeled sketches explain the function of bentonite installation plan required for bored piling work. [5]
- b) State the Marsh cone value and other technical specifications for bentonite slurry required in [5]
- i) Silty sand and sandy clay
 - ii) Shale, gravel and boulders
- Q2)** a) State and discuss the various tolerance criteria for cement, water, aggregates and admixtures for concrete mixing and batching plants. [5]
- b) Discuss the parameters and design steps adopted in micropile construction. [5]
- Q3)** a) Enlist different types of coffer dams used for marine construction works. explain any one in detail with neat lebeled sketch. [5]
- b) Discuss in detail critical factors influencing the efficiency of shotcreting in tunnels. [5]
- Q4)** a) Discuss the merits and demerits of Drill and Blast Techniques for tunnel construction over other methods. [5]

P.T.O.

- b) With the help of neat labeled sketches enlist the sequence of construction of coffer dam constructed with MS sheet piles for a bridge pier construction. [5]

Q5) With the help of neat labeled sketches explain the condition of recharge of ground water using the well point method for dewatering to be adopted for expansion work near an existing structure. [10]

Q6) a) Design a check list for efficient operation of a concrete batching and mixing plant. Explain any two parameters in detail. [5]

- b) Discuss the classification of micro-piles commonly adopted for foundation construction. Explain any one of them in detail. [5]

Q7) Design the tremie pipe set requirement for a diaphragm wall construction with M200 grade concrete having 150mm slump. Panel size is 4.5m length, 800mm thickness and 10m deep below GL. Enlist the step by step procedure as well. [10]

Q8) Write short notes on:

- a) Jet grouting technique [4]
b) Chemical grout [3]
c) Bitumen grout [3]



Total No. of Questions : 8]

SEAT No. :

P4725

[Total No. of Pages : 2

[5060]-504

**M.E. Construction Management
RESEARCH METHODOLOGY
(2013 Pattern)**

Time : 3 Hours]

[Maximum Marks : 50

Instruction to the candidates:

Solve any 5 full questions.

- Q1)** a) Explain the errors in selecting a research problem. [5]
b) Explain the basic principles of experimental design. [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 graphic rating scale. [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 'Centroid method of factor analysis'. [5]
- Q6)** a) Write a note on "Two way ANOVA". [5]
b) Explain Important Non-Parametric tests for Hypothesis testing. [5]

P.T.O.

Q7) a) Discuss the steps involved in patenting a research idea. **[5]**

b) Enlist various types of reports and explain any one in details. **[5]**

Q8) Write a research proposal for a suitable research problem (any problem related to civil engineering can be considered) to a funding agency with reference to the following terms: Title, Introduction, origin of the problem, expected outcome, literature review, significance of the study in the context of current status, objectives, methodology, year wise plan. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4726

[Total No. of Pages : 2

[5060]-506

M.E. (Civil) (Construction & Management)
Construction Contracts Administration and Management
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

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

Q1) Explain following clauses which are given in Indian Contract Act. **[10]**

- a) Complete communication
- b) Undue influence
- c) Breach of contract
- d) Absolute acceptance
- e) Free consent

Q2) What are the conditions responsible for cases of claims? **[10]**

Q3) What are the different causes of disputes on construction field? **[10]**

Q4) a) Write a note on any one of the following **[4]**

- i) EPC agreement
- ii) FIDIC red book

b) Discuss the clause of 'Subcontracting' included in conditions of contract. **[6]**

Q5) a) What is the importance of pre-bid meeting? **[4]**

b) Explain 'Submission of tenders in three envelopes'. **[6]**

P.T.O

- Q6)** a) What are the benefits of arbitration? [3]
b) Explain the procedure of arbitration in detail. [7]
- Q7)** a) What are the circumstances in which court can interfere arbitral awards?[5]
b) How conciliation differs from Arbitration? [5]
- Q8)** a) What is the definition of Injunction? What are the types of injunction? Explain in brief, each of them [6]
b) Explain following terms [4]
i) Bailment
ii) Bailee and bailer



Total No. of Questions : 8]

SEAT No. :

P5132

[Total No. of Pages : 2

[5060]-507
M.E. Civil (Construction & Management)
PROJECT ECONOMICS AND FINANCIAL
MANAGEMENT
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Solve any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Each question carries 10 marks.*
- 4) *Assume suitable data whenever necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

Q1) a) Discuss in detail revenue of a company is depending on the company's cost and expense? **[8]**

b) What are the objectives of business firms in India? **[2]**

Q2) a) Explain of need of working capital? **[5]**

b) What are the different method of credit management and cash management? **[5]**

Q3) XYZ Pvt Ltd cement company having a cost of Rs. 50Cr. and life of a 5 years. Tax rate for the company is 37% and it follows S.L.M. of depreciation. The cash flow before tax (CFBT) are as follows: **[10]**

Year	1	2	3	4	5
CFBT Cr.	10	12	18	24	40

Compute the following Payback period?

P.T.O.

- Q4)** a) Explain principles of economics period? [5]
b) Define micro financing in the construction industry? [5]
- Q5)** a) Explain types of budget and discuss in detail the "Cash Budget" in details? [6]
b) Discuss the role of budget in the construction industry? [4]
- Q6)** a) Discuss the CIDC-IRA grading in construction entities? [5]
b) Explain SABI role and responsibility in Infra structure company? [5]
- Q7)** a) What is mean by dividend policy and its features in a company's growth? [5]
b) As a site in charge of the metro construction site how you prepare daily report format in a construction site? [5]
- Q8)** Discuss in brief one of the one case study of Mass Transit System also discuss different challenges and it's in future development? [10]



Total No. of Questions : 8]

SEAT No. :

P4727

[Total No. of Pages : 3

[5060]-508

M.E. Civil (Construction & Management)
OPERATION RESEARCH
(2013 Pattern)

Time : 3 Hours]

[Maximum 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, Moiller charts, electronics Pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data information wherever necessary.*

- Q1)** a) Explain the terms feasible solution, Basis and Duality [5]
b) Draw a flow chart for the computational procedure of simplex Method to solve LPP. [5]
- Q2)** a) Compare the contrast transportation model and assignment model. [5]
b) Discuss the Monte-Carlo simulation process. Enlist merits and demerits of simulation process. [5]
- Q3)** Five dump trucks are to be assigned to five operators. the cost of operation of each machine is given below. determine the appropriate allocation of the dump truck so as to minimize the operation cost. [10]

Operator	Dump Truck				
	1	2	3	4	5
A	1	3	2	3	6
B	2	4	3	1	5
C	5	6	3	4	6
D	3	1	4	2	2
E	1	5	6	5	4

P.T.O

- Q4)** a) Discuss the basic characteristics of Queuing theory [5]
 b) Discuss the importance of Poisson and exponential distribution in Queuing Model [5]

Q5) a) Enlist the steps involved in the solution of $(2 \times n)$ and $(m \times 2)$ games. [5]

b) Solve the following (4×2) game. [5]

		B	
		1	2
A	1	2	4
	2	2	3
	3	3	2
	4	-2	-6

Q6) A construction equipment service station can handle one construction equipment at a time. the service station has a waiting area capacity to accommodate two equipments at a time. the equipment arrive at an average rate of 6 per hour and service station can handle an average of 12 per hour. assuming Poisson arrivals and exponential service distribution, find the steady state probabilities of number of equipments in the service station. Also estimate the average waiting time period for the new equipment arriving at the service station. [10]

- Q7)** a) Explain the terms local and global optimum. [5]
 b) With examples explain convex and concave functions. [5]

Q8) a) Differentiate between Gradient technique and the Lagrange Multiplier technique [5]

b) Using Lagrange Multiplier technique, [5]
Minimize $2x_1^2 + 2x_1x_2 + x_2^2 - 10x_1 - 10x_2$

Subject to:

$$x_1^2 + x_2^2 \leq 5$$

$$3x_1 + x_2 \leq 6$$



Total No. of Questions : 8]

SEAT No. :

P4728

[Total No. of Pages : 2

[5060]-510
M.E. (Civil) (CM)
Energy and Environment for Sustainable Construction
(2013 Pattern)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) *Attempt any 5 questions.*
- 2) *Neat diagrams must be drawn whenever 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 concepts of sustainable construction. [5]
b) Explain in detail EIA for a mega water resource project [5]
- Q2)** a) Explain in detail how to convert existing building into a Green Building. [5]
b) Discuss the energy sector scenario in India with special reference to solar energy. [5]
- Q3)** a) Explain the importance of participatory approach and community involvement in making a village self sufficient in its energy requirements. [5]
b) Explain importance of automation in civil engineering with special reference to use of energy requirement. [5]
- Q4)** a) Discuss in detail how a civil engineer can achieve carbon credits by sustainable wastewater management. [5]
b) Discuss in detail the UNFCCC protocols for carbon trading. [5]

P.T.O.

- Q5)** a) Explain in detail the need of use of day time solar radiation in educational institutes. [5]
- b) Explain what you understand by socio-environmental impact assessment with an example of construction of a dam. [5]
- Q6)** a) Explain in detail the smart materials available in civil engineering industry. Support your answer with suitable example. [5]
- b) Discuss the performance factors of conventional energy sources with non conventional energy sources with merits and limitations. [5]
- Q7)** a) Explain the role of pollution control boards wrt sanctioning of mega civil engineering projects. [5]
- b) Enlist various agencies in India responsible for Green Buildings certification. Explain requirements and features of any one system in detail. [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. :

P5127

[Total No. of Pages : 2

[5060] - 511

M. E. Civil (Construction & Management)

TQM IN CONSTRUCTION

(2013 pattern) (Semester - III)

Time : 3Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions carry 10 mark Each.*
- 2) *Attempt any five questions out of eight.*
- 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 electronic calculator is allowed.*

Q1) a) Explain various dimensions of quality. **[5]**

b) Discuss in detail need of TQM in construction sector. **[5]**

Q2) Explain in detail quality control tools used for quality improvement. **[10]**

Q3) Write short note on following. **[5 + 5]**

- i) PRRT
- ii) Role of human resource in TQM

Q4) a) What do you mean by quality circle? Discuss the role & responsibilities of quality circle. **[5]**

b) What do you mean by feedback. What is the importance of quality feedback system in organization. **[5]**

Q5) What do you mean by ISO standards? Discuss in detail eight principles of it. **[10]**

P.T.O.

- Q6)** a) Classify the construction defects and explain with example [5]
b) What are the obstacles associated with TQM implementation. [5]
- Q7)** a) Discuss in detail various definitions of SIX sigma given by researchers.[5]
b) How will you implement six sigma rating in construction projects. [5]
- Q8)** a) What is benchmarking. Elaborate its importance. [5]
b) Discuss in detail various aspects of CIDC CQRA quality rating system.[5]



Total No. of Questions : 8]

SEAT No. :

P5104

[Total No. of Pages : 2

[5060]-513

M.E. (Civil) (Environmental Engineering)

ENVIRONMENTAL LEGISLATION AND MANAGEMENT SYSTEMS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the students :

- 1) Attempt any five questions.*
- 2) Figures to the right indicate full marks.*
- 3) Draw neat figures whenever necessary.*
- 4) Assume suitable data, if necessary.*
- 5) Use of scientific calculator is allowed.*

Q1) Discuss multilateral Environmental Agreements and protocols. **[10]**

Q2) Discuss important provisions under Water (P & CP) Act, 1974 for violation of consent conditions. **[10]**

Q3) Discuss important provisions under Air (P & Cp) Act, 1981 for violation of consent conditions. **[10]**

Q4) Discuss the latest EIA notification under Environmental (Protection) Act 1986. **[10]**

Q5) Discuss the background and development of ISO 14000 series. **[10]**

Q6) Discuss the role of Judiciary and NGO in Environmental Protection with Supreme Court Judgement in Landmark cases. **[10]**

P.T.O.

Q7) Discuss the powers and functions of the MPCB under both water and air Act. **[10]**

Q8) Explain the procedure of conducting public hearing for obtaining the Environmental Clearance. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4729

[Total No. of Pages : 2

[5060]-514

**M.E. Civil (Environmental Engineering) (Semester - I)
ENVIRONMENTAL CHEMISTRY and MICROBIOLOGY
(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) State various methods of analysis in Environmental Engineering. **[10]**

Q2) Explain the physical processes of formation pollutants in atmosphere. **[10]**

Q3) What is mean by surfactant, Give classification of detergents and explain each in detail. **[10]**

Q4) Explain the pollution problems caused by pesticides, Discuss the problems due to DDT. **[10]**

Q5) Explain difference between Gas Chromatography and liquid Chromatography. **[10]**

Q6) Explain microbial cell structure with sketch. **[10]**

P.T.O

Q7) Write a note on staining techniques.

[10]

Q8) What is 'Bioremediation of contaminated soil' and explain its principle and microbiology.

[10]



Total No. of Questions : 8]

SEAT No. :

P4730

[Total No. of Pages : 2

[5060]-515

M.E. (Civil) (Environmental Engineering)
PHYSICO CHEMICAL PROCESSES FOR WATER & WASTE
WATER TREATMENT
(2013 Pattern)

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) Assume suitable data if necessary clearly mentioning the same.*
- 5) Solve any five questions.*

Q1) What is Reactor? Draw neat sketches with usual mathematical notations of continuous flow complete mix reactor, Plug flow reactor, fluidized bed reactor and packed bed reactor. **[10]**

Q2) Design horizontal flow type grit chamber for a sewage treatment plant, to treat maximum flow of 60000 m³/day. The estimated average and minimum sewage flows are 45000 m³/day and 15000 m³/day respectively. The flow through velocity of 0.3 m/s is to be controlled by a proportional weir. Assume suitable data if required. **[10]**

Q3) Design a continuous flow completely mix type activated sludge process plant to treat 20 MLD domestic wastewater. BOD₅ of settled wastewater to the reactor is 200 mg/l and desired BOD₅ of treated effluent is 30 mg/l. **[10]**

Plant operates at following conditions:

- i) Peak flow is 2.5 times daily average flow
- ii) MLVSS in the reactor, X = 3500 mg/l
- iii) Concentration of recycled sludge = 10000 mg/l
- iv) MLVSS is 80% of MLSS
- v) MCRT = 10 day
- vi) Effluent contains 25 mg/l of biological solids of which 65% is biodegradable
- vii) BOD₅ is 68% of ultimate BOD and BOD rate constant k = 0.1.

P.T.O.

Q4) a) A flat bottom trough is to receive the wash water from a section of the filter which is 2m wide and 3 m long. The wash water rate is 700lit/min/ m^2 . If the water is to have a depth of 25cm at the upper end of the trough, what should be the dimensions of the trough? [5]

b) Explain various mechanisms by which filtration of water takes place.[5]

Q5) Discuss the thought of Destabilization in Water and Wastewater Treatment by $Al(III)$ and $Fe(III)$. [10]

Q6) Discuss the mechanisms of disinfectants. Also describe the factors influencing the action of disinfectants. [10]

Q7) Discuss the fundamental concept of Chemical Oxidation by considering oxidation reduction reactions and half reaction potentials. [10]

Q8) Determine the reaction order of the reactant removal process for the data given below. [10]

Conc. of reactant(mg/l)	235	150	100	55	30	20
Time(minutes)	0	7	15	25	35	40

Note: Use graph paper to solve the numerical.



[5060] - 515

Total No. of Questions : 8]

SEAT No. :

P4731

[Total No. of Pages : 1

[5060]-518

**M.E. (Civil Environmental Engineering)
INDUSTRIAL WASTE WATER MANAGEMENT
(2013 Pattern)**

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) Answer any 5 questions.*
- 2) Each question carries equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Yours answer will be valued as a whole.*
- 5) Assume Suitable data, if necessary.*
- 6) Use of electronic pocket calculator and steam table is allowed.*

- Q1)* Explain in detail about Waste audit and Evaluation of pollution prevention options. **[10]**
- Q2)* Explain in details about flotation and precipitation. **[10]**
- Q3)* With suitable example discuss the membrane separation process. **[10]**
- Q4)* Explain with suitable methodology for safe disposal of treated waste. **[10]**
- Q5)* Explain manufacturing process of food processing industry and give the characteristics of effluent. **[10]**
- Q6)* Discuss characteristics and composition of effluent from mineral processing industry. **[10]**
- Q7)* Discuss in details about zero effluent discharge systems. **[10]**
- Q8)* Discuss in detail about treatment with polymer coagulation. **[10]**



Total No. of Questions :8]

SEAT No. :

P5062

[Total No. of Pages :2

[5060] - 519

M.E. (Civil - Environmental Engineering)

AIR POLLUTION AND CONTROL

(2013 Course) (501067) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

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

Q1) a) Explain the effect of NO_x and CO on human beings with specific concentration of gases. **[5]**

b) Explain global effects of air pollution. **[5]**

Q2) a) Explain need of air pollution modelling and explain any one method in detail. **[5]**

b) Write and explain the formulas to determine the stack height. **[5]**

Q3) a) Write the equation used to estimate plume rise. **[5]**

b) Write a note on dispersion of air pollutants. **[5]**

Q4) a) Write a technical comparison between fabric filter and ESP. **[5]**

b) Write principle and design parameters to control air pollution through wet scrubbers. **[5]**

Q5) a) Write a short note on desulfurization of flue gas emissions. **[5]**

d) Write principle, working mechanism and application of combustion process to control gaseous air pollutants. **[5]**

P.T.O.

- Q6)** a) Write a short note on EMP. [5]
b) Explain the procedure and significance of ambient air quality survey. [5]
- Q7)** a) Write short note on automobile emission control. [5]
b) Enlist sources of odour and explain its need to control. [5]
- Q8)** a) Write short note on changes in indoor air quality. [5]
b) Write causes and sources of indoor air pollution. [5]



Total No. of Questions : 9]

SEAT No. :

P4732

[Total No. of Pages : 1

[5060]-520

**M.E. (Civil-Environmental Engineering)
SOLID WASTE & HAZARDOUS WASTE MANAGEMENT
(2013 Pattern)**

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) Answer any 5 questions.*
- 2) Each question carries equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Yours answer will be valued as a whole.*
- 5) Assume Suitable data, if necessary.*
- 6) Use of electronic pocket calculator and steam table is allowed.*

Q1) Discuss the Environmental impact of mismanagement of solid waste. [10]

Q2) Discuss the General considerations for waste storage at source. [10]

Q3) Discuss the stages of sorting, sorting operations. [10]

Q4) Discuss typical material recovery facility for a commingled solid waste.[10]

Q5) Give the landfill design consideration in details. [10]

Q6) Discuss in details stagewise about Biomethanation. [10]

Q7) Discuss the present scenario and measures to improve system SWM in India. [10]

Q8) Discuss about Economy and financial aspects of solid waste management.[10]

Q9) Discuss about toxicology and risk assessment. [10]



Total No. of Questions : 8]

SEAT No. :

P4733

[Total No. of Pages : 2

[5060]-522

M.E. (Civil) (Environmental Engineering) (Semester - III)
ENVIRONMENTAL SANITATION
(2013 Pattern)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) Answer any 5 questions.*
- 2) Each question carries equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Your answer will be valued as a whole.*
- 5) Assume Suitable data, if necessary.*
- 6) Use of electronic pocket calculator and steam table is allowed.*

Q1) Discuss the following in details **[10]**

- a) Communicable diseases
- b) Role of Micro-organisms

Q2) Explain in details about how fly control methods are effective in prevention of fly breeding? **[10]**

Q3) Discuss the sanitation system separately for Schools, public buildings, Hospital by giving advantage of each sanitation system. **[10]**

Q4) Explain in details about the Occupational Hazards and industrial poisons. **[10]**

Q5) Discuss with suitable example about low cost excreta disposal systems. **[10]**

P.T.O

Q6) What is Rural sanitation improvement schemes? Explain in details. **[10]**

Q7) Explain the following terms of in details. **[10]**

- a) Principles of plumbing
- b) System of plumbing
- c) Building (House) drain
- d) Systems of drainage

Q8) Discuss with labeled sketch of following. **[10]**

- a) Washdown water closet
- b) Single stack system
- c) One piece urinal



Total No. of Questions : 8]

SEAT No. :

P5126

[Total No. of Pages : 2

[5060] - 523

M. E. (Civil) (Environmental Engineering)
ENVIRONMENTAL IMPACT ASSESSMENT
(2013 pattern)

Time : 3Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answers any five questions.*
- 2) Figures to the right indicate full marks.*
- 3) Draw neat figures whenever necessary.*
- 4) Assume suitable data, if necessary.*
- 5) Use of scientific calculator is allowed.*

Q1) Discuss the public participation and review of EIS. **[10]**

Q2) Discuss the environmental indices and indicators for describing affected environment, Also explain the Life cycle assessment. **[10]**

Q3) Discuss the Impact prediction, assessment and mitigation measures for air environment. **[10]**

Q4) Discuss the Impact prediction, assessment and mitigation measures for water environment. **[10]**

Q5) Discuss the Impact prediction, assessment and mitigation measures for noise and soil environment. **[10]**

P.T.O.

Q6) Discuss the importance of public participation in environmental decision making. **10]**

Q7) Explain the procedure for obtaining the environmental clearance. **[10]**

Q8) Discuss the procedure for obtaining environmental clearance for construction projects. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4734

[Total No. of Pages : 2

[5060]-525
M.E. (Civil - Hydraulics)
FLUID MECHANICS
(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 3-D continuity equation in Cartesian coordinate system. **[5]**

b) Write a short note on relaxation technique. **[5]**

Q2) a) Derive Bernoulli's equation by integrating Euler's equation along a streamline. **[5]**

b) Describe graphical method to draw flow net. Illustrate your answer by sketches. **[5]**

Q3) a) Derive equation for stream function and potential function of doublet. Determine the shape of streamlines. **[4]**

b) Working from fundamentals, show that for laminar flow between two parallel plates, moving in opposite directions (lower one moving with velocity V and upper one with velocity U). **[6]**

$$q = \frac{a}{2}(U - V) - \frac{1}{12\mu}a^3\left(\frac{\partial p}{\partial x}\right)$$

Let a be the distance between the two plates

P.T.O.

- Q4)** a) Evaluate the stream function and velocity potential for source at $Z = a$. [4]
 b) Derive equation for velocity distribution of laminar flow for suddenly accelerated plate. [6]
- Q5)** a) Air ($\nu = 1.44 \times 10^{-5} \text{ m}^2/\text{s}$) flows over a 0.5 m long and 1 m wide flat plate at a velocity of 10m/s. Determine [6]
 i) Boundary layer thickness at the end of the plate
 ii) Shear stress 0.25 m from the leading edge.
 iii) Total drag force on 2 sides of the plate
 Take $\rho = 1.208 \text{ kg/m}^3$
 b) Define nominal thickness, momentum thickness, displacement thickness of boundary layer and laminar sub-layer. [4]
- Q6)** a) Given that the velocity distribution in a laminar boundary layer due to flow over flat plate is $\frac{u}{U} = \frac{3}{2}\eta - \frac{1}{2}\eta^2$. Calculate the displacement and momentum thickness in terms nominal boundary layer thickness. [4]
 b) Derive equation for development of boundary layer over a flat plate. [6]
- Q7)** a) Discuss typical solution of Reynolds equation of motion for turbulent flow between parallel plates. [5]
 b) Derive equation for stagnation temperature in compressible flow. [5]
- Q8)** a) Derive Reynolds equation of motion. [5]
 b) Derive equation for work done during an adiabatic process. [5]



Total No. of Questions : 8]

SEAT No. :

P4735

[Total No. of Pages : 2

[5060]-526
M.E. (Civil) (Hydraulics)
IRRIGATION AND DRAINAGE
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Maximum 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.*

SECTION - I

Q1) a) Explain flow of water in saturated and unsaturated soil. **[5]**

b) Calculate the frequency of irrigation, if **[5]**

- i) Field capacity of soil = 29%
- ii) Permanent wilting point = 11%
- iii) Density of soil = 1300 kg/m³
- iv) Effective depth of root zone = 700mm
- v) Daily consumptive use of water = 12mm

The moisture content must not fall below 25% of the water holding capacity between field capacity and permanent wilting point.

Q2) What major problems do salinity and alkalinity cause in irrigated soil? **[10]**

Q3) Explain the design concepts of Drip irrigation and field suitability conditions for drip irrigation. **[10]**

P.T.O

Q4) Draw a neat sketch of lift irrigation scheme and state various components of lift irrigation scheme. **[10]**

Q5) Compare Sprinkler irrigation system with drip irrigation system and explain the suitability of Sprinkler irrigation system. **[10]**

Q6) Write short notes on **[10]**

- a) Command area development
- b) Onfarm structures

Q7) What do you mean by canal outlets? Explain the following outlets **[10]**

- a) Non-Modular outlets
- b) Modular outlets
- c) Semi-modular outlets

Q8) Explain drainage of irrigated lands considering following points **[10]**

- a) Need and purpose of drainage
- b) Design and construction of drainage systems.



Total No. of Questions : 8]

SEAT No. :

P5141

[Total No. of Pages : 2

[5060] - 527

M.E. (Civil - Hydraulics)

PLANNING AND MANAGEMENT OF WATER RESOURCES

(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) Assume suitable data if necessary.
- 5) Use of calculator is allowed.

- Q1) a) Explain objectives and necessity of water resources planning and management. [5]
- b) Explain characteristics and functions of reservoir. Also explain conflicts in multipurpose reservoir. [5]

- Q2) a) Three flood control projects have been proposed for a river. Each of the projects has a useful life of 25 years and the interest rate is 5% per year. The benefits and costs of the projects are listed in Table 1. Compare the alternatives using the benefit-cost ratio method. [5]

Table 1 : Benefits and Costs of Three Flood Control Alternatives (Rs. Million)

Benefits and Costs	Project A	Project B	Project C
Capital investment	8	9.5	11
Annual operation and maintenance costs	0.7	0.65	0.63
Annual expected reduction in flood damage (benefits)	1.5	1.6	1.75

- b) Describe operation of an impounding reservoir in drought condition. [5]
- Q3) a) Explain how benefits for different purposes are estimated in water resources. Also explain tangible and intangible benefits. [5]
- b) Explain time - oriented, space - oriented and relation oriented water resources data. [5]

P.T.O.

- Q4)** a) Explain in brief different methods of sediment yield determination. [5]
b) What do you mean by an integrated approach to manage water resources? List out its salient features. [5]
- Q5)** a) Explain aspects of planning and management of water resources. [5]
b) Explain in brief conjunctive use of surface and ground water. [5]
- Q6)** a) Two reservoirs A and B are planned to be constructed at the cost of Rs. 45 million and 75 million respectively. Annual maintenance and operation costs of these projects are Rs. 10 lakh and Rs. 25 lakh. The annual benefits from the projects are Rs. 7 million and Rs. 12 million respectively. Which of the two projects is more economical if the rate of interest is 10 % and useful life of the project A is 50 years and that of project B is 75 years? [5]
b) Explain Socio-economic and Agriculture Data required for water resources planning and management. [5]
- Q7)** a) Write a note on - demand and utility of water. [5]
b) Explain the role of water users cooperative societies in water distribution. [5]
- Q8)** a) Write a note on - inter basin transfer of water. [5]
b) Explain the role of different bodies in water resources planning. [5]



Total No. of Questions : 8]

SEAT No. :

P4736

[Total No. of Pages : 2

[5060]-528

**M.E. (Hydraulics) (Semester - I)
RESEARCH METHODOLOGY
(2013 Pattern)**

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

Solve any five full questions.

- 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 objectives of literature Survey. [5]
b) 'What are the criteria's for a good research. [5]
- Q3)** a) Write a short note on Need of pilot study. [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 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]

P.T.O

Q6) a) Explain the centroid method of factor analysis. [5]

b) Explain the conditions for the application of Chi-Square test. [5]

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

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

Q8) Write a research proposal for a suitable research problem (any problem related to civil engineering can be considered) to a funding agency with reference to the following terms.

Title, introduction, origin of the problem, expected outcome, literature review, significance of the study in the context of current status, objectives, methodology, year wise plan. [10]



Total No. of Questions : 8]

SEAT No. :

P4737

[Total No. of Pages : 2

[5060]-530
M.E. (Civil) (Hydraulics)
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) Define - Most efficient channel section and derive the formula for most efficient triangular section. **[4]**
- b) A 3.6m wide rectangular channel 9 m³/s of water with a velocity of 6m/s
i) is there a condition for hydraulic jump to occur? if so calculate the height, and length of the jump? ii) what is the loss of energy per kg of water? **[6]**
- Q2)** a) Derive the most Economic trapezoidal channel section having one side vertical and other side with side slope of 1.5H: 1V to carry the discharge of 10 m³/s. the manning's 'n' is taken as 0.015 and the bed slope is 1:3500 **[4]**
- b) Derived equation for sequent depths of hydraulic jump in a sloping channel **[6]**
- Q3)** a) Explain the characteristics of S₂ profile and state one example of its occurrence **[2]**
- b) A rectangular channel is 7.5m wide and carries a discharge of 15m³/s. The depth at certain section is 1.8m, determine how far from this section the depth will be 2.5m. take the bed slope as 1 in 7500 and manning's n=0.016 **[8]**

P.T.O

- Q4) a)** Write GVF equation in various forms [2]
- b) A rectangular channel 6m wide carries water at a uniform depth of 1.5m, on a bed slope of 1 : 8100 and $n = 0.015$, the channel ends in an abrupt drop. find how far upstream of the fall the depth of flow would be 1.4m. use step method and take two steps. sketch the profile and classify it. [8]

- Q5) a)** Route the following flood through a reach of $K = 25$ h and $x = 0.25$. at $t = 0$ the outflow discharge is $50 \text{ m}^3/\text{s}$. [6]

Time (h)	0	12	24	36	48	60	72	84	96	108	120	132	144
Inflow m^3/s	45	70	168	250	235	205	180	122	111	79	67	64	56

- b) Derive dynamic equation for spatially varied flow with increasing discharge write short note on types of surges [4]
- Q6) a)** Describe explicit method of channel flood routing [4]
- b) Classify the SVF profiles on aside weir [6]
- Q7) a)** Derive dynamic equation for rapidly varied unsteady flow [6]
- b) Derive equation for solitary wave. [4]
- Q8) a)** Derive differential form of monoclinal rising wave [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]



Total No. of Questions : 8]

SEAT No. :

P4738

[Total No. of Pages : 2

[5060] - 531

M.E. (Civil) (Hydraulics)

SEDIMENT TRANSPORT & 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) a) Briefly explain concept of fall velocity. [5]

b) What are the fundamental properties of individual sedimentary particles. [5]

Q2) a) Write short note on Shields analysis. [5]

b) Explain resistance analysis related to Regimes of flow. [5]

Q3) a) Using Meyer-Peter and Müller method, estimate the bed load transport of sediment in an alluvial channel, 110 wide and 4.5 m deep carrying a discharge of 260 m³/s. The channel bed slope is 1 in 3000 and the mean size of the sediment is 0.3 mm. [7]

b) What are the different Modes of sediment transport. [3]

Q4) a) Write a short note on “DuBoys equation”. [5]

b) Explain “Saltation mechanis”. [5]

Q5) 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 [10]

- a) Full supply discharge 80 m³/sec
- b) Lacey’s silt factor – 0.9
- c) Channel side slope 0.5H: 1V

P.T.O.

- Q6)** a) Write a short note on : [5]
i) Bed load measurement.
ii) Suspended load measurement.
- b) Explain “Continuity Equation for sediment”. [5]
- Q7)** a) What are the objective of river training and bank protection? [5]
b) Explain “Guiding the flow”. [5]
- Q8)** a) Explain different river models with respect to its need & importance. [5]
b) Explain Sediment transport through pipes, considering the following points [5]
i) Critical velocity.
ii) Head Losses.



Total No. of Questions : 8]

SEAT No. :

P4739

[Total No. of Pages : 2

[5060] - 532
M.E. (Civil) (Hydraulics)
HYDROLOGY
(2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answer any 5 of the following questions.*
- 2) *Neat diagram should be drawn wherever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) What are the basic data required for hydrological studies? Explain the role of Hydrologic engineer in the water resources management of a nation. **[5]**

b) What is the utility of depth area duration curve .Explain the procedure for constructing the depth area duration Curve and how is maximized depth area duration developed. **[5]**

Q2) a) A 6 hr storm produces a rainfall excess of 160mm. The direct surface run off produced is tabulated below. Find the ordinate of 6hr unit hydrograph which produce a volume equal to 80 mm. **[5]**

Time (hrs)	6.00	12.00	18.00	24.00	6.00	12.00	18.00	24.00	6.00	12.00	18.00	24.00
DSRO (m ³ /s)	10	520	1700	3500	6000	4800	2000	750	320	0	0	0

b) What are the different analytical methods to estimate the evaporation and explain any one method. **[5]**

Q3) a) The hydrologic process are Stochastic in nature, explain with necessary examples. Explain i) Ergodicity, ii) Stationarity **[6]**

b) Explain the method of moments for fixing distribution for fitting distribution for a set of hydrologic data. **[4]**

P.T.O.

- Q4)** a) Differentiate between continuous and discrete random variables with examples for each [4]
- b) The annual rainfall in mm for a period of 15 years from 1980 to 1995 are given below.
480,550,250,300,350,680,570,310,490,545,380,495,400,350,270
Draw a frequency curve and find 75% & 50% dependable rainfall. Also find the probability of occurrence of a rainfall of 700mm or more in any year. [6]
- Q5)** a) Distinguish between i) Return period and Exceedence probability and ii) Maximum probable flood and design flood. [4]
- b) Explain the method of estimating T_r year flood using log-Pearson type III distribution. [6]
- Q6)** a) What are the factors that affect the permeability of formation? What are the different method of determining the permeability of soil and explain any one laboratory method of determining the permeability of soil formation. [5]
- b) Show that the Darcy equation for specific discharge is given by $V = -Kdh/dl$. Explain how this equation is modified for anisotropic formation. [5]
- Q7)** a) Derive the condition for steady flow into an unconfined aquifer. [5]
- b) Pumping test was conducted on a 450 cm diameter well which penetrate to 25m below static water table. After 24 hours of pumping at a rate of 5000lpm, the water level in test well if lowered by 60cm and in well 35 m away by 1.15m. Find [5]
- i) Transmissibility of aquifer
- ii) Drawdown in pumping well
- Q8)** a) What are the favourable conditions for salt water to intrusion? Explain the how the depth of interface is determined. [5]
- b) What are the different methods of groundwater exploration and explain the geophysical method of groundwater exploration? [5]



Total No. of Questions : 10]

SEAT No :

P5063

[5060]-534

[Total No. of Pages : 3

M.E. Civil (Hydraulics)

DAM ENGINEERING

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

Time :3 Hours]

[Max. Marks : 50

Instruction to the candidates:

- 1) *Attempt any 5 questions.*
- 2) *All question are carry equal marks.*

Q1) a) Compare Elementry profile and practical profile of gravity dam. **[5]**

b) Explain in detail R.C.C. Dam. **[5]**

Q2) a) Explain seismic force analysis in Gravity Dam. **[5]**

b) A concrete dam can be assumed to be trapezoidal in section having a top width of 2 m and bottom width of 10m. Its height is 12m and U/S face has a batter of 1:10. Give Analysis of stability of dam for base section for overfarning and sliding in fall reservoir condition assuming no F.B. but allowing for uplift pressures Assume uplift pressure coefficient as 100% Assume weight of concrete 2.4 tonne / m³, unit shear strength of concrete to be 140 tonne/m² and coefficient of friction to be 0.7 **[5]**

Q3) a) Explain thin cylinder theory of Arch dam design. **[5]**

b) Explain with a sketch types of buttress dam. **[5]**

Q4) a) Explain with suitable sketch types of Arch dam & their suitability. **[5]**

b) Explain significant design parameters of Rockfill dam. **[5]**

P.T.O.

Q5) a) Determine FOS of D/S slope of earthen dam (homogenous section) drawn to scale of 1:500 with following data: [5]

- i) length of slip circle arc = 15cm
- ii) Total area of 'N' Rectangle = 16.50 cm²
- iii) Total area of 'T' Rectangle = 7.00 cm²
- iv) Total area of 'U' Rectangle = 5.00 cm²
- v) Angle of repose in degrees = 26
- vi) Cohesion of soil = 0.2 kg/cm²
- vii) Unit weight of soil = 1.8 gm/cm³

b) Explain methods of controlling seepage through earthen dam. [5]

Q6) a) Explain Swedish slip circle method of stability analysis of earthen dam. [5]

b) A homogenous earthen dam of 20m high with top width 6m, U/S slope of 4:1 and D/S slope of 3:1, retains water to a depth of 15m. An inerted filter provided extends to 30 from toe. Locate the phreatic line from dam section and estimate the seepage through. Assume coefficient of permeability $K=5 \times 10^{-4}$ an/sec. [5]

Q7) a) Design of an agee spillway with the following data. [5]

- i) Height of spillway crest above river bed = 100m
 - ii) Design discharge = 12,000 m³/sec
 - iii) Number of spans = 6
 - iv) Clear distance between piers = 15m
 - v) Thickness of piers = 3m
 - vi) Slope of d/s face of over flow section = 0.8:1
- Assume any other data if required.

b) Explain in brief with sketch instruments in earthen dam. [5]

Q8) a) Explain the classification of spillway crest gates. **[5]**

b) Explain the functions of instruments **[5]**

i) Vibrating wire piezometer,

ii) 'V' notch weir,

iii) Extensometer,

iv) Tilt meter

v) Earth pressure cells.

vi) Accelerometers.



Total No. of Questions : 8]

SEAT No. :

P4740

[Total No. of Pages : 4

[5060]-535
M.E. (Civil - Hydraulics)
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) *Assume suitable data, if necessary.*
- 5) *Use of calculator is allowed.*

Q1) a) Solve the following LP problem using Simplex method: **[7]**

Maximize $Z = 20X_1 + 80X_2$

St $4X_1 + 6X_2 \leq 90$

$$8X_1 + 6X_2 \leq 100$$

$$X_1 \text{ and } X_2 \geq 0$$

If the following new constraint is added to this model, find the solution on the new problem.

- b) Define dynamic programming problem. List and explain the terminologies of dynamic programming problem. What are the application area of dynamic programming? **[3]**

Q2) a) Apply Newton's method, with $\epsilon = 0.001$ and $x_1 = 1$ to solve following problem: **[5]**

Maximize : $f(x) = x^3 + 30x - x^6 - 2x^4 - 3x^2$.

- b) Use Fibonacci method to maximize $Z = 20x - 0.1x^2$ in the range (10 to 110) to an accuracy of 0.05%. Carry out computations for the first four stages only. **[5]**

P.T.O.

- Q3) a)** An organization is planning to diversify its business with maximum outlay of Rs. 4 crores. It has identified three different locations to install plants. The organization can invest in one or more of these plants subject to availability of the fund. The different possible alternatives and their investment (in crores of rupees) and present worth of returns during the useful life (in crores of rupees) of each of these plants are summarized in the following table. The first row of the table has zero cost and zero return for all plants. Hence, it is known as *do-nothing* alternative. Find the optimal allocation of the capital to different plants which will maximize the corresponding sum of the present worth of return. [5]

Alternatives	Plant 1		Plant 2		Plant 3	
	Cost	Return	Cost	Return	Cost	Return
1	0	0	0	0	0	0
2	1	12	2	16	2	9
3	2	15	3	20	3	12
4	3	19	4	25	-	-

- b) Find the minimum of the function $f = 2\lambda^5 - 6\lambda^3 - 19\lambda + 4$ Golden section method in the interval (0, 5). [5]

- Q4) a)** Use Lagrange Multiplier Technique to maximize

$$Z = X_1^2 + 2X_2^2 + 4X_1X_2 + X_1 + 3X_2$$

$$\text{Subject to } 2X_2 - X_1 = 2,$$

$$\text{And } X_1, X_2 \geq 0.$$

[5]

- b) Solve the following LP problem using Big-M method: [5]

$$\text{Maximize } Z = 5X_1 + 3X_2 + 7X_3$$

$$\text{ST } X_1 + X_2 + 2X_3 \leq 22$$

$$3X_1 + 2X_2 + X_3 \leq 26$$

$$X_1 + X_2 + X_3 \leq 18$$

$$X_1, X_2, X_3 \geq 0.$$

Q5) a) The arrivals at a telephone booth are considered to be following Poisson law of distribution with an average time of 10 minutes between one arrival and the next. Length of the phone call is assumed to be distributed exponentially with a mean of 3 minutes. **[6]**

- i) What is the probability that a person arriving at the booth will have to wait?
- ii) What is the average length of queue that forms from time to time?
- iii) The telephone department will install a second booth when convinced that an arrival would expect to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth?

b) Define the term Decision theory. Describe decision models based on the criterion of degree of certainty. **[4]**

Q6) a) The following matrix gives the payoff of different strategies (alternatives) S_1, S_2, S_3 against conditions N_1, N_2, N_3 and N_4 (in Rs.) **[5]**

	N_1	N_2	N_3	N_4
S_1	4000	-100	6000	18000
S_2	20000	5000	400	0
S_3	20000	15000	-2000	1000

Indicate the decision taken under the following approach.

- i) Pessimistic
- ii) Optimistic
- iii) Regret and
- iv) Equal Probability

b) Explain with suitable examples about poisson arrival pattern and exponential service pattern. **[5]**

Q7) a) Solve the game whose payoff matrix is: **[6]**

		B		
		I	II	III
A	I	1	7	2
	II	6	2	7
	III	5	1	6

b) Explain how you can apply Monte Carlo simulation technique for queuing problem. **[4]**

Q8) a) The occurrence of rain in a city on a day is dependent upon whether or not it rained on the previous day. If it rained on the previous day, the rain distribution is given by **[6]**

Event	Probability
No rain	0.50
1 cm. rain	0.27
2 cm. rain	0.13
3 cm. rain	0.06
4 cm. rain	0.04

If it did not rain the previous day, the rain distribution is given by

Event	Probability
No rain	0.75
1 cm. rain	0.20
2 cm. rain	0.03
3 cm. rain	0.02

Simulate the city's weather for 10 days and determine by simulation the total days without rain as well as the total rainfall during period. Use the following random numbers

62	55	25	60	75	35	64	08	73	70
----	----	----	----	----	----	----	----	----	----

For simulation. Assume that the first day of the simulation it had not rained the day before.

b) Explain Graphical method to solve game. **[4]**



Total No. of Questions : 8]

SEAT No. :

P5064

[Total No. of Pages : 2

[5060]-537

M.E. (Civil - Structures)

ADVANCED MECHANICS OF SOLIDS

(2013 Credit Course) (Semester - I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Attempt any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

Q1) a) Obtain Naviers equation of equilibrium. **[5]**

b) Define strain compatibility. In general states of stress, assuming the strain displacement relation, obtain the necessary strain compatibility relation.**[5]**

Q2) a) State and explain generalized Hook's law. Express the stress strain relations for an elastic and isotropic body in term of engineering constant E and ν . **[6]**

b) Define with an example, a plane strain problem. For such case obtain the stress equation of equilibrium, the strain relation and the strain compatibility. **[4]**

Q3) a) What is Airry stress function ϕ . Neglecting body forces, obtain governing equation for the stress functions $\phi(r,\theta)$ in plane elasticity problem $\nabla^4\phi = 0$. **[7]**

b) Write the basic equations for a plane stress 2D problem in polar coordinates. **[3]**

Q4) a) Derive component of stress due to circular hole in a stressed plate (Kirsch's problem). **[6]**

b) What is axisymmetric problem. Show that for such a problem, the stress function $\phi = A \log r + Br^2 \log r + Cr^2 + D$. **[4]**

P.T.O.

- Q5)** a) Determine deflection at cantilever end for a quarter circle beam of radius R. It is loaded with a concentrated load P at its free end. [5]
- b) A semicircular beam ABC of radius 3 m, is loaded with uniformly distributed load 20kN/m. It is simply supported at A & C and continuous over B. Determine reaction at supports A, B and C. [5]
- Q6)** a) Derive expression for stress by using Winkler - Bach theory. [5]
- b) Determine the ratio of $\sigma_{\max}/\sigma_{\min}$ for a curved beam in elevation of rectangular section in pure bending. The radius of curvature is 200 mm and height of cross section is 100 mm. [5]
- Q7)** a) Obtain the expression for torsion of elliptical cross section bar. [5]
- b) Derive Poisson's equation for torsion of prismatic bars of non circular section in terms of stress function ϕ . Neglect body force. [5]
- Q8)** a) Explain briefly the classification of beams on elastic foundation. What is a Winklers foundation. [5]
- b) A timber of length 4m and cross section 80 mm \times 150 mm is attached to rubber foundation for which $k = 32\text{MPa}$. A clockwise couple of 6 kNm is applied at one end. Determine maximum deflection. Take $E = 156\text{ Pa}$. [5]



[5060]-538
M.E. (Civil - Structures)
STRUCTURAL DYNAMICS
(2013 Pattern) (Semester - I)

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) If necessary, assume suitable data and indicate clearly
- 4) Use of electronic pocket calculator is allowed.

Q1) Write a note on hysteretic damping.

[10]

Q2) For the two cantilever beams whose free ends are connected to springs as shown in Fig.1 write the expressions for the spring constants k_1 and k_2 and determine the equivalent spring constant k_e for the system.

[10]

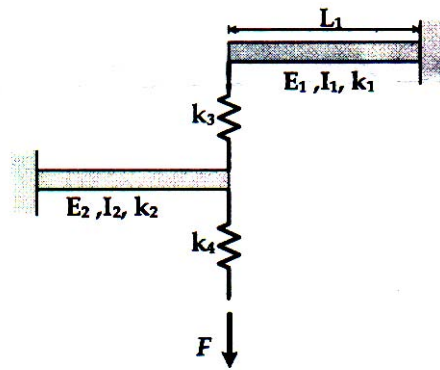


Fig. 1

Q3) Derive the solution for a system subjected to a state of resonance.

[10]

P.T.O.

Q4) Determine the response for the force F_0 as shown in Fig. 2 for **[10]**

- a) $t < t_0$ and
- b) $t > t_0$.

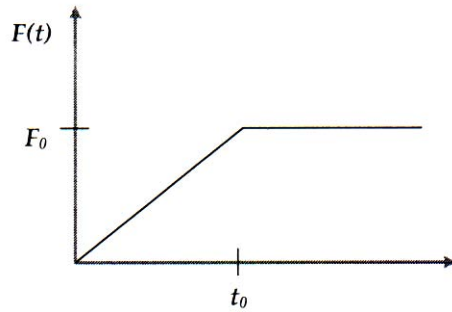


Fig. 2

Q5) A 40 m gantry crane shown in Fig. 3 has a moment of inertia of 0.02 m^4 and modulus of elasticity of $2.06 \times 10^{11} \text{ N/m}^2$. The crane truck has a mass $m_1 = 1000 \text{ kg}$, the load being lifted has a mass $m_2 = 500 \text{ kg}$, and the cable through which the mass m_2 is lifted has a stiffness of $k = 3 \times 10^5 \text{ N/m}$. Determine the natural frequencies and mode shapes of the system. **[10]**

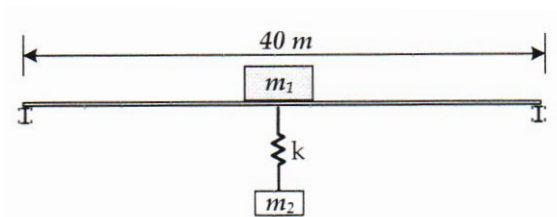


Fig. 3

Q6) Write a note on **[10]**

- a) Modal analysis and
- b) Explain what are coupled equations?

Q7) What is non-linear analysis? Explain any one method of analysis. [10]

Q8) The deflected shape of a non-uniform cantilever beam shown in Fig.4 is defined

by $W(x) = \left(1 - \frac{x}{l}\right)^2$. Find the fundamental frequency of transverse vibration using the Rayleigh - Ritz method. [10]

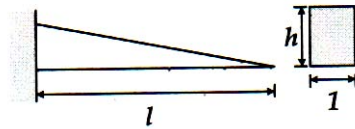


Fig. 4



Total No. of Questions : 8]

SEAT No. :

P4742

[Total No. of Pages : 4

[5060]-539

M.E. (Civil Engg. - Structures)

ADVANCED DESIGN OF STEEL STRUCTURES (ADSS)
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer any five from eight questions.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Use IS - IS: 800-2007, IS:800-1984, IS:801. IS:802, IS:811, SP-34 and Nonprogrammable calculator.*
- 4) *Neat diagram must be drawn wherever necessary.*
- 5) *More reproduction from IS code as answer, will not be given full marks.*
- 6) *Assume suitable data, if necessary.*

Q1) a) Enlist the various components of hoarding. **[3]**

- b) The hoarding structure is to be installed on the top of the building (2.5m height). The hoarding carries display board 5m × 5m. Suggest the suitable hoarding structure to carry this board. Calculate all the loads acting on the hoarding structure. Draw FBD of the suggested structures, showing calculated forces on it. **[7]**

Q2) a) Write down the guideline for web opening and stiffeners for castellated beams. **[3]**

- b) Design a castellated beam in grade Fe 410 steel to carry an imposed load of 4kN/m and dead load of 4 kN/m over a simply supported span of 16m. Assume that the compression flange is fully restrained. **[7]**

Q3) a) What is mean by microwave tower, explain with examples. **[3]**

P.T.O.

- b) A 65 m 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 hemispherical antenna disc, fixed at the top is 3m. The width of the tower at the top is 3.5m. Select a suitable configuration for the tower and determines maximum compressive force and tension in the tower legs and also the maximum shear at the base, for the following data. [7]

Weight of antenna disc and fixtures : 9 kN

Weight of platform at the top : 0.82 kN/m²

Weight of railing at top : 0.30 kN/m²

Weight of ladder and the cage : 0.65 kN/m

Weight of miscellaneous item : 2.5 kN

- Q4) a)** Draw figures and explain XBX-bracing, K-bracing, W-bracing. [3]

- b) Determine the various forces (lateral forces due to wind, longitudinal forces, if any, torsional forces, if any and dead load) acting on the tower under the following conditions: [7]

- i) Normal operating conditions.
- ii) Top-most power conductor in broken condition.
- iii) Ground wire in broken condition. Refer figure -1.

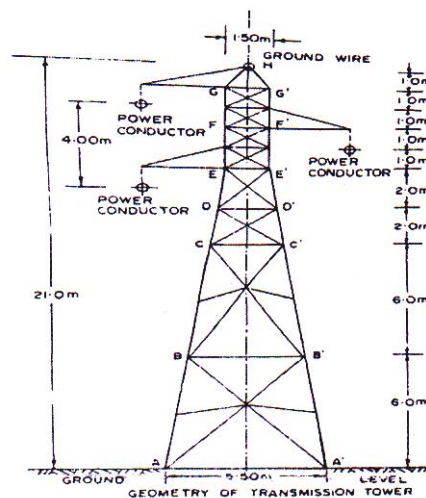


Figure 1

Q5) a) What are tubular structures? Write down its various purpose and its important advantages. [3]

b) Design a member of a tubular truss. A tension member of a truss, carrying tensile forces of 25 kN, meets the principal rafter, carrying a compressive force of 100 kN, at right angle. The panel length along the principal rafter is 2.5 m. Design both the members, using IS: 1161 grade, Yst 240 tubes. Also, design the welded joint for the members, Taking the allowable stress in fillet weld as 110 N/mm². [7]

Q6) a) Explain light-gauge section and draw different forms of light-gauge sections. [3]

b) Find the column section properties and allowable load for the column section shown in figure 2. The effective length of column is 3.2m. Take $f_y = 235$ MPa. [7]

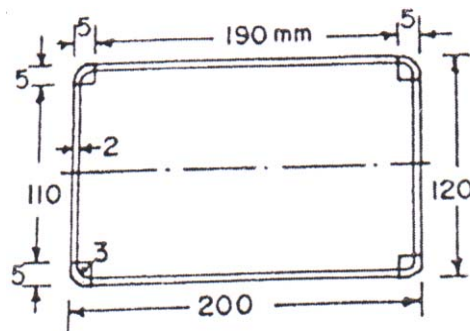


Figure - 2

Q7) a) What are the types of chimneys? State the factor influencing the design of chimney. [3]

b) Find thickness of the supporting lined chimney to the following particulars. [7]

Height of the chimney = 72m.

Diameter of the chimney = 3.0m.

Thickness of the lining = 100 mm.

Wind Pressure = 1300 N/mm² on flat vertical surface.

Take safe tensile stress = 120 N/mm².

The foundation has to rest on medium soil having bearing capacity = 200 kN/m².

- Q8)** a) State the difference between bolted and welded connections. [3]
- b) A column section ISHB250@ 907.4 N/m is subjected to following factored loads. [7]

Axial compressive load, $P = 500 \text{ kN}$

Moment, $M = 45 \text{ kN.m}$

Assuming M25 grade of concrete for the pedestal and a square base plate, design the following.

- i) Thickness of base plate
- ii) Anchor bolts



Total No. of Questions : 8]

SEAT No. :

P4743

[Total No. of Pages : 2

[5060] - 540
M.E. (Structures)
RESEARCH METHODOLOGY
(2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

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

- Q1)* a) Write in detail about the various errors in selecting a research problem. [5]
b) Discuss the general objectives of research funding agency. [5]
- Q2)* a) Discuss in brief the general format for a research proposal. [5]
b) Identify the ethical issues related to interpretation and reporting a research problem. [5]
- Q3)* a) Explain in detail the objectives of literature review. [5]
b) Explain characteristics of hypothesis. [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) Explain any one method of 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) Enlist different clustering methods and explain any one in detail. [5]

P.T.O.

- Q7)** a) Discuss the importance of research report writing. [5]
b) What does it mean to “license a patent” and why is it done? [5]
- Q8)** Write a research proposal for a suitable research problem (any problem related to Civil engineering can be considered) to a funding agency with reference to the following terms: Title, Introduction, origin of the problem, expected outcome, literature review, Significance of the study in the context of current status, objectives, methodology, year wise plan. [10]



Total No. of Questions : 8]

SEAT No. :

P4744

[Total No. of Pages : 2

[5060] - 542
M.E. (Civil-Structural Engineering)
FINITE ELEMENT ANALYSIS
(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 non-programmable electronic calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Write a note on weighted residual method. Explain collocation method and Galerkin method in detail. [5]
- b) Derive elemental stiffness matrix for a beam element using variational approach. [5]

- Q2)** Explain the process of discretization in finite element analysis and explain the following terms: Aspect ratio, material and geometric discontinuities, numbering of nodes, refining mesh in context of discretization. [10]

- Q3)** The end A of beam is clamped and end C of the beam can translate vertically without rotation as shown in Figure 1. The beam carries distributed load of 60kN/m over entire length. The flexural rigidities for portion AB and BC are 2EI and EI respectively. Analyse the beam using direct approach of FEM using standard stiffness and load vector formulation considering two elements. [10]

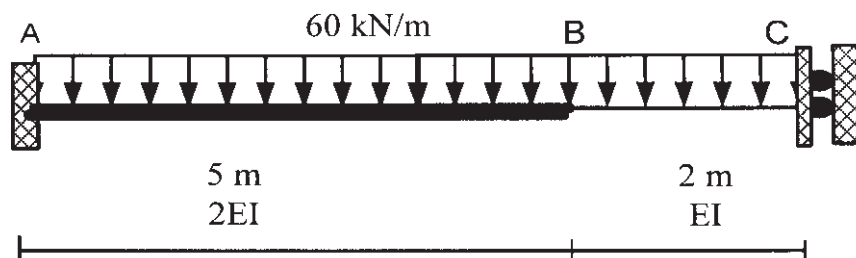


Figure 1

P.T.O.

- Q4)** a) Derive the shape functions using Lagrangian function for a one dimensional three noded bar element. Extend the same to obtain the shape function for nine noded rectangular element in Cartesian or natural coordinate system. Plot the variation of the same. [5]
- b) Explain the following terms with reference to finite element analysis [5]
- i) Global coordinates
 - ii) Local coordinates
 - iii) Natural coordinates.
- Q5)** a) Using polar coordinates for the displacement function, derive the stiffness matrix for a typical triangular axisymmetric element starting from assuming the displacement function. [5]
- b) Explain the term 'Axi-symmetric problems' and give constitutive law for such problems. [5]
- Q6)** Explain the isoparametric mapping and derive the Jacobian matrix for 1 - D, 2 - D and 3 - D isoparametric formulation. [10]
- Q7)** Explain rectangular plate element with 12 degrees of freedom and 16 degrees of freedom. Comment on conformity of the displacement function. [10]
- Q8)** a) Explain the analysis of shells by finite element analysis. Explain commonly used elements for shell analysis. [5]
- b) Write a note on Ahmad's degenerated solid element or Pawsey's eight noded shell element. [5]



Total No. of Questions : 8]

SEAT No. :

P5065

[5060]-543

[Total No. of Pages : 2

M.E.(Civil - Structures)
THEORY OF PLATES AND SHELLS
(2013 Credit Course) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions from the following.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Differentiate thin and thick plates. [2]
b) Derive Governing differential equation in cartesian co-ordinates with usual notation. [8]

- Q2)** a) Derive an expression of flexural rigidity for thin plate. [2]
b) A rectangular plate of size $a \times b$ with four edges simply supported carries a patch load on $(u \times v)$ of intensity q_0/m^2 . Derive an expression for the deflection of the plate using Navier's method. [8]

- Q3)** a) Derive an expression for maximum deflection of the rectangular plate with two opposite edges simply supported subjected to uniformly distributed load by Levy's method. [8]
b) Explain in brief Reissener-Mindlin Theory. [2]

- Q4)** a) Develop from first principle, governing differential equation for a circular plate under axisymmetric loading. [8]
b) State the boundary condition for the analysis of circular plate. [2]

- Q5)** a) State and explain in brief assumption of thin plate with small deflection. [4]
b) Derive an expression of equilibrium equations for cylindrical shell using bending theory. [6]

P.T.O.

- Q6)** a) Explain membrane theory and derive equilibrium equation for circular cylindrical shell. [6]
b) State and explain boundary conditions for circular cylindrical shells. [4]
- Q7)** a) Explain in brief application bending theory to pipes and pressure vessels. [5]
b) Explain the needs of bending theory for the analysis of cylindrical shells and expression for strains. [5]
- Q8)** a) State and explain beam theory of cylindrical shells and principle of Lundgren's beam theory. [5]
b) Explain in brief application of beam theory to arch analysis. [5]



Total No. of Questions : 8]

SEAT No. :

P5066

[5060]-544

[Total No. of Pages : 2

M.E. (Civil - Structures)
Advanced Design of Concrete Structures
(2013 Credit Course) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator IS:456 are allowed.*

Q1) a) Explain assumptions in yield line theory. **[5]**

b) Draw yield line for the Rectangular slab with fixed at supports on three sides with shorter side simply supported. **[5]**

Q2) Design the slab, $3.5\text{m} \times 4.5\text{m}$, to carry superimposed service load of 3kN/m^2 . Slab is to be orthotropically reinforced. Use M20 concrete and Fe 415 steel. **[10]**

Q3) Design a grid slab for a floor of hall $11.5\text{m} \times 13.5\text{m}$ c/c having square grid of 1.5m . Use M25 and Fe 500. Take FF= 1.2kN/m^2 and live load 5.5kN/m^2 . Draw reinforcement details. **[10]**

Q4) Design an interior panel of flat slab $5.75\text{m} \times 5.75\text{m}$ for a live load of 5.5kN/m^2 and F.F. 1.1kN/m^2 . Use M20 and Fe415 steel. Size of column is $520\text{mm} \times 520\text{mm}$. **[10]**

Q5) Design circumferential and radial reinforcement in the slab of elevated water tank if capacity of water tank is 1000m^3 . Diameter of tank as 15m . Assume total circumferential load on periphery as 2100 kN (including wall load and roof slab) **[10]**

P.T.O.

Q6) Design a square bunker to store 60kN of coal. The unit weight and angle of repose may be taken as 8kN/m^3 and 27° respectively. **[10]**

Q7) The foundation of a structure is to consists of 16 piles to carry a total load of 10400kN. The piles are $300\text{mm} \times 300\text{mm}$ and are 9m long. They are spaced at 1.5m c/c. Design one of the pile. Use M20 and Fe415. **[10]**

Q8) Design the formwork for column $275\text{mm} \times 275\text{mm}$ having a height of 2.8m. It is proposed to deposit concrete in one stage. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4745

[Total No. of Pages : 2

[5060] - 546

M.E. (Civil-Structures)

EARTHQUAKE ENGINEERING & DISASTER MANAGEMENT

(2013 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

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

Q1) Write a note on disasters. Explain how they affect the structural components of a building. [10]

Q2) What are post-disaster activities? Explain how various agencies co-ordinate these activities. [10]

Q3) An illustrative building is shown in Fig. 1. Perform dynamic analysis and show the distribution of lateral forces. Consider $W_1 = W_2 = 4,500$ kN.[10]

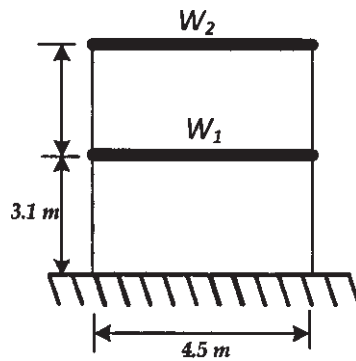


Fig. 1

Q4) Explain capacity based design. How is it different from conventional design. [10]

Q5) What is ductile detailing? Explain with a suitable example. [10]

P.T.O.

Q6) What are the functions of shear walls? Explain the design steps. [10]

Q7) Why is fire analysis performed? Explain the provisions of IS : 800. [10]

Q8) Explain conventional and non-conventional methods of retrofitting with suitable examples. [10]



Total No. of Questions : 8]

SEAT No. :

P4746

[Total No. of Pages : 3

[5060]-547

M.E. Civil (Structures)

**STRUCTURAL DESIGN OF RCC AND PRESTRESSED
BRIDGES
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *All answers should be written in same book.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of IRC- 5,6,18,27,45,78 & 83 codes, IS 1343, IS 456-2000 is allowed.*
- 5) *Mere reproduction of theory from IS or IRC codes as answer will not get full credit.*
- 6) *Neat diagrams must be drawn wherever necessary.*
- 7) *Assume any other data if necessary.*

Q1) a) Write short note on structural forms of bridge decks. **[5]**

b) What are the factors affecting the span of bridge. **[5]**

Q2) a) Write short note IRC 70R loading. **[5]**

b) Explain loading standards for railway bridges. **[5]**

Q3) Design only slab the slab culvert with the data: **[10]**

Clear span of the culvert = 6.1 m Clear carriage way width = 7.5m

Size of kerb = 200mm x 600 mm

Average thickness of wearing coat 80 mm

Use material M25 ,Fe 415

Loading class AA

Draw the cross section showing details of reinforcement at mid-span and at junction of the slab are kerb.

P.T.O.

Q4) Design the deck slab only and calculate the maximum bending moment and shear force intermediate post tensioned prestressed concrete bridge girder for the following. Effective span=20 m, width of carriageway=7.5m, No. of beams 3, equally spaced along the carriageway width, Spacing of cross girders=4m c/c, width of footpath on either side of carriageway=1m loading class=IRC class AA, kerb size = 200 X 600mm, Material M25 & TMT for deck slab. **[10]**

Q5) a) Differentiate between rigid frame bridges and simply supported bridges. **[5]**

b) Explain with sketches, how rigid frame bridges are classified. **[5]**

Q6) Design a reinforced elastomeric bearing at a pinned end of a plate girder of a bridge with following data. **[10]**

Maximum vertical load = 600 kN

Dynamic vertical load = 50 kN

Transverse lateral load = 60 kN

Longitudinal load = 50 KN

Longitudinal total translation =10 mm

Rotation at support = 0.003°

Shear modulus of elastomeric bearing = 1.2 N/mm²

Allowable comp. stress for concrete = 8 N/mm²

Allowable comp. stress for elastomer = 10 N/mm²

Q7) a) Explain the forces acting on wing wall for bridges. **[5]**

b) Explain with sketches, the type's wing walls. **[5]**

Q8) Design open well type foundation for a pier in sandy soil for following: **[10]**

Diameter of pier at bottom = 1.8 m

Height of bearing above the maximum scour level = 30 m

Permissible horizontal displacement at bearing level = 10mm

Total vertical load including self-weight of pier = 10000 kN

Total lateral force at scour level = 180 kN

Submerged unit weight of soil = 10 kN/m³

Material of pier and footing = M30 & Fe500

Design the RCC well and check the stresses at the staining



Total No. of Questions : 8]

SEAT No. :

P4747

[Total No. of Pages : 2

[5060]-549

M.E. (Civil)

(WATER RESOURCES AND ENVIRONMENTAL ENGG)

Planning and Management of Water Resources

(2013 Pattern)

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 side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

Q1) a) State the objectives of water resource planning and management. Justify need of planning and management of water resources. [6]

b) Explain the system components of water resources planning and management and state various approaches of planning and management of water resources. [4]

Q2) a) Comment on spatial and temporal characteristics of water resources.[5]

b) Explain constraints like non reversibility for development of water resources. [5]

Q3) a) Explain various cost benefit study methods for single and multipurpose projects. [6]

b) Comment on repayment of cost in multipurpose project. [4]

Q4) a) How the priority is fixed as per Maharashtra water act for various purposes. [6]

b) What are various plans implanted for controlling flood. [4]

P.T.O.

- Q5)** a) How reservoir sedimentation control is playing important role in water management. [4]
b) Explain any one water doctrine to avoid conflict amongst users. [6]
- Q6)** a) How is the impact of climate change on river flow regimes related to the impact on mean annual runoff. [4]
b) Explain vulnerability assessment of water supply in agricultural reservoir utilizing probability distribution and reliability analysis methods. [6]
- Q7)** a) Write a note on center for ground water evaluation and management. [4]
b) Explain how conjunctive use of surface and ground water play Important role in water management. [6]
- Q8)** a) State discounting techniques and explain any one. [4]
b) Explain the importance of river basin planning and management. [6]



Total No. of Questions : 8]

SEAT No. :

P4748

[Total No. of Pages : 2

[5060]-550

**M.E. (CIVIL) Water Res. & Env. Engg.
ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY
(2013 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) *Use of electronic calculator is allowed.*

- Q1)** a) Explain Radiation and types of radiation. **[4]**
- b) Calculate the PH of a buffer solution containing 0.01 M acetic acid & 0.01 M solution acetate. Then Calculate the pH after enough HCl is added to give a concentration of 0.001M **[6]**
- Q2)** a) Explain effects of air pollution on materials. Discuss the mechanism of these effects. **[6]**
- b) Discuss the sampling and monitoring technique of air pollution. **[4]**
- Q3)** a) Explain Gaussian plume model & its behaviour. **[6]**
- b) Differentiate between absorption & adsorption process. **[4]**
- Q4)** a) Convert 0.55 PPM NO_2 to mg/m^3 at 290k & 100.00 KPa pressure. **[4]**
- b) Discuss the methods of concentration determination of. air pollutants. **[6]**
- Q5)** a) Explain how environment is polluted by natural contaminants & particulate matter. **[4]**
- b) Design a floatation thickener without pressurized recycle to thicken the solids in activated - sludge mixed liquor from 0.3-4% **[6]**

P.T.O.

Assume that the following conditions apply:

- i) Optimum A/S ratio = 0.008 ML/mg
- ii) Temperature = 20°C
- iii) Air solubility = 18.7 ML/L
- iv) Recycle - System pressure = 275 Kpa
- v) Fraction of saturation = 0.5
- vi) Surface - loading rate = 8L/m².min
- vii) Sludge flowrate = 400 m³/d

Q6) a) Write a short note on filter packing for trickling filters. **[4]**

b) Write a short note on substrate utilization in biological waste treatment. Give significance of F/M ratio. **[6]**

Q7) a) Explain AAS. with sketch. **[5]**

b) Explain Gas Chromatograph (G.C) **[5]**

Q8) a) Explain one method for recycling of waste water for non potable use it's design parameters. & principle. **[5]**

b) Explain air quality models. Which are widely used & its applications. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4749

[Total No. of Pages : 2

[5060]-551

M.E. (Civil) (Water Resources and Environmental 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) Prove that circulation per unit area is equal to twice the rotation about axis perpendicular to the plane of the area. **[5]**
b) Define nominal thickness, displacement thickness, momentum thickness, energy thickness of boundary layer and laminar sub-layer. **[5]**
- Q2)** a) Derive continuity equation for steady flow of incompressible fluid passing through a stream tube. **[4]**
b) The velocity distribution in the turbulent boundary layer over a flat plate is given as $\frac{u}{U_\infty} = 2\frac{y}{\delta} - \left(\frac{y}{\delta}\right)^2$. Obtain an expression for the displacement thickness, momentum thickness and energy thickness. **[6]**
- Q3)** a) Derive differential form of continuity equation in cylindrical polar coordinate system. **[6]**
b) Oil of viscosity 18 poise flows between two parallel plates which are kept at a distance 150 mm apart. The maximum velocity of flow is 1.5 m/s. Find (i) The pressure gradient (ii) Shear stress at the wall. **[4]**
- Q4)** a) What is conformal mapping? Give complex potential for (i) source at $Z=a$ and (ii) source and sink. For uniform flow find velocity potential and stream function for Uniform flow using complex potential as $w = AZ$ with A as real. **[5]**
b) Derive equation for velocity distribution for flow between parallel plates with one plate moving and the other at rest starting with Navier-Stokes equations. **[5]**

P.T.O.

- Q5)** a) What is boundary layer separation? What are its effects and how to control it? [5]
b) Derive Reynolds' equation of motion. [5]
- Q6)** a) Derive equation for boundary layer starting from Navier-Stokes equation. [6]
b) Write a short note on types of turbulent flow. [4]
- Q7)** a) Derive energy equation for adiabatic process. [5]
b) Discuss the analogy between the normal shock wave and the hydraulic jump. [5]
- Q8)** a) Derive equation for stagnation density. [5]
b) What is the effect of compressibility on drag. [5]



Total No. of Questions : 8

SEAT No. :

P4750

[Total No. of Pages : 1

[5060] - 552
M.E. (Civil) (WREE)
RESEARCH METHODOLOGY TREATMENT
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any FIVE questions.*
 - 2) *Figures to the right side indicate full marks.*
- Q1)** a) With suitable example explain Ex post facto research. [5]
b) "Selecting an appropriate research problem is the key to successful research", Discuss. [5]
- Q2)** a) Explain the technique involved in defining a research problem. [5]
b) Explain the basic principles of experimental designs. [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 Interview. [5]
b) Write the advantages and disadvantages of itemized rating scale [5]
- Q5)** a) Differentiate between Null hypothesis and Alternative hypothesis. [5]
b) Explain the steps involved in procedure for hypothesis testing. [5]
- Q6)** a) What is a Z-test? When it is used and for what purpose? Explain with examples. [5]
b) Explain the steps involved in writing report. [5]
- Q7)** a) Write down the good characteristics of good Abstract. [5]
b) Write a note on Multicollinearity. [5]
- Q8)** Write a research proposal for a suitable research problem (any problem related to Civil engineering can be considered) to a funding agency with reference to the following terms: Title, Introduction, origin of the problem, expected outcome, literature review, Significance of the study in the context of current status, objectives, methodology, year wise plan. [10]



Total No. of Questions : 8

SEAT No. :

P4751

[Total No. of Pages : 2

[5060] - 554

M.E. (Civil) (Water Resources and Environmental Engg.)
ENVIRONMENTAL HYDRAULICS AND ENVIRONMENTAL
STRUCTURES
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any 5 questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed.*

Q1) Explain and compare the performance of reciprocating compressor and screw pump. **[10]**

Q2) a) A centrifugal compressor having inside diameter of 40mm and outside diameter of 82mm width of blade is 35mm. Temperature of air at inlet is 30°C, inlet and outlet angle of blade are 8° and 20°. Temperature in the pipe is 38°C and pressure ratio is 2. Determine power required to drive compressor. **[5]**

b) Write short note on strain gauges. **[5]**

Q3) a) What is PTFE? What is its common commercial name? State its advantages. **[5]**

b) Explain working of RTD with sketch. **[5]**

Q4) a) Discuss in detail the effectiveness no. of transfer units(NTU) with respect to heat exchanger. **[5]**

b) Explain crystallization process. **[5]**

P.T.O.

- Q5)** a) Double acting cylinder is hooked in the regenerative circuit. The relief valve setting is 110 bars and the pump flow is $0.0018 \text{ cm}^3/\text{sec}$. If the regenerative and retracting speed are equal to 0.30 m/s . Find the piston and rod dia. area and also load carrying capacity for the [5]
- i) Extending stroke
 - ii) Retracting stroke
- b) Derive equation for pure bending of plate. [5]
- Q6)** a) Design an underground water tank $4.5 \text{ m} \times 11.5 \text{ m} \times 3.5 \text{ m}$ deep. The subsoil consists of sand having angle of repose of 30° & saturated unit weight of 18 kN/m^3 . The water table is likely to rise up to ground level. Use M20 concrete and HYSD bars. Take unit weight of water as 9.81 kN/m^3 . [6]
- b) Determine only forces acting on circular water tank resting ground having capacity of 6000 cum . Height of tank is 5 meter. Use M30 concrete and Fe250 steel. [4]
- Q7)** a) Discuss in detail the nozzles & openings in pressure vessels. [5]
- b) What is LVDT? Explain its working. [5]
- Q8)** a) Derive expressions for principal stresses of thick cylinders. [6]
- b) Determine arc and depth of foundation required for square column carrying load of 550 kN vertical. The SBC of soil is 230 kN/m^2 . Density of soil 30 kN/m^3 , Angle of repose is 20° . [4]



Total No. of Questions : 8

SEAT No. :

P4752

[Total No. of Pages : 2

[5060] - 555

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

HYDROLOGY

(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 instrumental, empirical, combined energy balance and mass transfer and water balance method to measure evaporation [8]
b) Explain Horton's infiltration curve and state the equation for infiltration capacity. [2]
- Q2)** a) Draw a flow chart for mathematical methods in hydrology and explain stochastic hydrology applications [7]
b) Explain normal distribution (statistical) [3]
- Q3)** a) What is design flood. How it is calculated for various hydraulic structures [4]
b) Explain log-normal distribution method [6]
- Q4)** a) How inflow and outflow relation is useful to determine reservoir surplus water and capacity of reservoir [5]
b) Explain the Goodrich method of flood routing [5]
- Q5)** a) Explain step by step design of tube well [5]
b) Design a tubewell to be sunk in confined aquifer of 20 m thicknessfully. The yield required is 2400 m³/day. Coefficient of permeability of aquifer was found to be 40 m/day. The drawdown in the well was taken to be 4 m. [5]

P.T.O.

- Q6)** a) What affects the quality of ground water in India [6]
b) Explain cavity type and slotted type tube well [4]
- Q7)** a) Explain any one widely used method of ground water recharge [4]
b) State various methods to conserve ground water and explain any two [6]
- Q8)** a) Explain sand tank model and transparent model for ground water modeling [6]
b) Explain electric analog model for ground water modeling [4]



Total No. of Questions : 8]

SEAT No. :

P4753

[Total No. of Pages : 2

[5060] - 556

M.E. (Civil) (Water resources and Environmental Engg)

OPEN CHANNEL HYDRAULICS

Water resources and Environmental Engg

(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 for a trapezoidal channel section of most economical section
(i) half the top width = length of the sloping side (ii) hydraulic radius = $\frac{1}{2}$
the depth of flow [4]

b) Explain the characteristics of M_1 profile and state one example of its occurrence [6]

Q2) a) Describe constriction in width of channel for upstream flow subcritical [6]

b) Starting from basic principles derive an expression for GVF for a wide rectangular channel in the form [4]

$$\frac{dy}{dx} = S_o \frac{1 - \left(\frac{y_n}{y}\right)^{10/3}}{1 - \left(\frac{y_c}{y}\right)^3}$$

P.T.O

- Q3)** a) Write a short note on control of hydraulic jump by jump at an abrupt drop [6]
 b) Write a short note solution of GVF equation using Chow's method [4]
- Q4)** a) At a certain section M in a rectangular channel of bed width 2 m, depth of flow is 1.2 m. When the rate of flow is 6 m³/s estimate the distance from M to another section N where the depth is 1.4 m. The bed slope is 0.002 and Manning's n = 0.015. Take two steps. Sketch and classify the profile [8]
 b) Enumerate types of hydraulic jump [2]
- Q5)** a) Explain any two SVF profiles on bottom racks with sketches [6]
 b) Derive dynamic equation of gradual varied unsteady flow [4]
- Q6)** a) Derive dynamic equation of spatially varied flow with decreasing discharge [5]
 b) Derive equation for celerity of a solitary wave [5]
- Q7)** a) Define condition of incipient motion? Write in brief of Shields' analysis [5]
 b) What is flood routing? Distinguish between reservoir routing and channel routing [5]
- Q8)** a) Define bed load, saltation load, suspended load, total load [4]
 b) For the following flood hydrograph through a river reach for which K = 12 h and x = 0.20 find the discharge for first two time steps. At the start of the inflow flood the outflow discharge is 10 m³/s [6]

Time (h)	0	6	12	18	24	30	36	42	48	54
Inflow m ³ /s	10	20	50	60	55	45	35	27	20	15



Total No. of Questions : 8]

SEAT No. :

P4754

[Total No. of Pages : 2

[5060] - 558

M.E. (Civil) (Water Resource & Environmental Engg.)

ADVANCED WATER & WASTE WATER TREATMENT

(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 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 in detail the principle and working of reverse osmosis and ion exchange for water and waste water treatment. [10]

Q2) Discuss the principle, concept and necessity of aeration. Explain various methods of aeration with neat sketches. [10]

Q3) What is the theory of disinfection? State the factors affecting disinfection. Explain different methods of chlorination. [10]

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. [10]

Q5) Design an activated sludge process for municipal wastewater flow rate of $9000 \text{ m}^3/\text{day}$, BOD of settled effluent = 2100 mg/l , expected BOD of treated effluent = 17 mg/l , yield coefficient = 0.5 kg/kg , $K_d = 0.05/\text{day}$, MLSS = 3000 mg/l , return sludge solids concentration = $10,000 \text{ mg/l}$, and mean cell residence time is 10 days. [10]

P.T.O

Determine :

- i) Volume of reactor,
- ii) F/M ratio,
- iii) VLR,
- iv) Oxygen requirement,
- v) Recycle ratio &
- vi) BOD removal efficiency.

Q6) Design a high rate trickling filter using NRC equations for **[10]**

- i) Sewage flow = 10 MLD,
- ii) Recirculation ratio = 1.5,
- iii) BOD of raw sewage = 1900 mg/l,
- iv) BOB removal in PST = 35%,
- v) Final effluent BOD desired = 20 mg/L.

Q7) State the design parameters, principle, advantages and disadvantages of UASBR. Draw a neat sketch of the reactor. **[10]**

Q8) State the sources of waste water from manufacturing process, characteristics of effluent for distillery and automobile industry. Draw the treatment flow charts. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4755

[Total No. of Pages : 2

[5060] - 559

M.E. (Civil) (WREE)

DAM ENGINEERING

Water Resources and 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 side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Discuss reservoir operation [4]
b) Draw a neat sketch of foundation for Gravity dam and suggest treatment for durability [6]
- Q2)** a) How earthquake load is taken in to consideration for design of earthen dam [7]
b) Discuss causes of seepage in earthen dam [3]
- Q3)** a) Explain any one theory for design of arch dam [7]
b) How arch differs from other type of dams. [3]
- Q4)** a) Explain design concept for buttress dam [6]
b) What is buttress dam? Explain the classification of buttress dam [4]

P.T.O

- Q5)** a) Explain side channel and syphon spillway [6]
b) Calculate the discharge over an ogee shaped weir whose coefficient of discharge is equal to 2.5 at a head of 4 m. The length of the spillway is 40 m. The weir crest is 6 m above the bottom of the approach channel which has the same width as that of the spillway. [4]
- Q6)** a) Explain determination of settlement and lateral movements in dam [6]
b) What are the objectives of dam safety organization (DSO) [4]
- Q7)** a) State common objectives of CWC and ICID. [4]
b) Explain functioning of global water partnership (GWP). [6]
- Q8)** a) Comment on dams and climate. [6]
b) What is the impact due to construction of dam on displacement and rehabilitation? [4]



Total No. of Questions : 8]

SEAT No. :

P4756

[Total No. of Pages : 2

[5060]-561

M.E.(Civil) (Geotechnical Engineering)

ADVANCE SOIL MECHANICS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to candidates :

- 1) Answer any 5 questions.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate marks.*
- 4) All questions carry equal marks.*
- 5) Your answers will be valued as a whole.*
- 6) Assume suitable data, if necessary.*

Q1) Derive the strain tensor matrix using strain components for two-dimensional case. **[10]**

Q2) Derive an equation for vertical pressure, under a uniformly loaded circular area: state the necessary assumptions in the boussinesgs theory. **[10]**

Q3) Explain the effective stress principle proposed by terzaghi for location of the failure plane.

Also, explain how the location of failure plane can be directly derived from mohr's circle. **[10]**

Q4) Explain the culmann's graphical method for estimation of active earth pressure with a suitable sketch. **[10]**

Q5) Explain the active and passive states of plastic equilibrium in a soil mass. Also, derive the equations for active and passive earth pressure using mohr's circle. **[10]**

Q6) Write a short notes on **[10]**

- a) Stability of braced cuts
- b) Soil messure on structted excavations

Q7) Explain the effect of peripheral smear in the process of consolidation. How effect of smear can be minimised? **[10]**

Q8) What is flow net? Explain the properties of flow net. Elaborate the procedure for construction of flow net in an anisotropic soil media. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4757

[Total No. of Pages : 1

[5060]-562

**M.E. (Civil) (Geotechnical Engg.)
GROUND IMPROVEMENT TECHNIQUES
(2013 Pattern)**

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 5 questions.*
- 5) *Assume suitable data if necessary clearly mentioning the same.*

- Q1)** a) Describe the atomic bonds in clay minerals. [5]
b) Explain the electrical effects in clay minerals. [5]
- Q2)** a) Write short note on granular stabilisation. [5]
b) Discuss the behaviour of chemically stabilised soils. [5]
- Q3)** Explain the mechanism of cement stabilisation. [10]
- Q4)** Explain the process of bituminous stabilisation. [10]
- Q5)** Describe electro osmosis and electro kinetic stabilisation. [10]
- Q6)** a) Write note on granular trench stabilisation. [5]
b) Describe process and design criteria for sand drains. [5]
- Q7)** a) What is dynamic consolidation? [5]
b) Describe the technique of preloading. [5]
- Q8)** a) State the different grouting techniques and describe permeation grouting [5]
b) Write note on jet grouting. [5]



Total No. of Questions : 8]

SEAT No. :

P5122

[Total No. of Pages : 2

[5060]-563

M.E. (Civil) (Geotechnical Engineering)

ROCK MECHANICS

(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the students :

- 1) *Answer any five questions from 8 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 diagram must be drawn wherever necessary.*

Q1) a) Enlist the some areas of rock mechanics application activity involving substantial rock mechanics inputs. Explain any one in detail. **[6]**

b) Enlist the physical and mechanical characteristics of rock material. Discuss the slaking and durability of rock. **[4]**

Q2) a) Explain the rock grouting with reference to following aspects: **[6]**

i) Types of treatment

ii) Grouting material

iii) Grouting methods

b) Write a detailed note on rock anchoring. **[4]**

Q3) a) Discuss with neat sketch the various methods of in situ stress determination on rock. **[6]**

b) Explain the effect of principle stress ratio on rock failure. **[4]**

P.T.O.

- Q4)** a) Enlist the common laboratory tests for characterizing rock strength? Explain any one in detail. [4]
- b) With help of sketch explain the tensile cracking failure of rock. [3]
- c) Write a note on anisotropic rocks. [3]
- Q5)** a) Explain the phenomenon of fracturing rock masses in compression. [6]
- b) Explain the Griffith's theory of fracture initiation in rock masses. [4]
- Q6)** a) Explain the approximate methods for two dimensional limit equilibrium analyses of rocks systems. [6]
- b) What is the rock parameters required for the analysis of underground structures. [4]
- Q7)** a) With help of neat sketch discuss the methods for gaining joint samples of rock. [6]
- b) Explain the various modes of failure of footing on rock. [4]
- Q8)** a) Discuss the phenomenon of plastic behaviour around tunnel. [6]
- b) Explain the rock slopes with reference to modes of failure and factors affecting on rock slope. [4]



Total No. of Questions : 8]

SEAT No. :

P5067

[5060]-564

[Total No. of Pages :1

M.E. (Civil-Geotech.)
RESEARCH METHODOLOGY
(2013 Pattern) (Semester-I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any five questions out of eight questions.*
- 2) Each question carries ten marks.*

- Q1)** a) State and explain the various steps of research process.
b) Differentiate between null and alternate hypotheses.
- Q2)** a) Which are the elements of research proposal?
b) What is the need of literature survey?
- Q3)** a) Elaborate the styles and strategies of literature review.
b) Describe various factors affecting choice of data collection methods.
- Q4)** a) What are the various types of scales? Describe their significance.
b) Differentiate between qualitative and quantitative data analysis.
- Q5)** a) What is ANOVA (analysis of variance) test ? In which situation is it useful?
b) Differentiate between qualitative and quantitative data analysis.
- Q6)** a) What is regression analysis? What for is it used?
b) Explain the concept of factor analysis.
- Q7)** a) Explain various steps involved in report writing.
b) Write a note on plagiarism.
- Q8)** a) Describe various elements of effective presentation.
b) What is patenting ? Explain the process for obtaining patent.



Total No. of Questions : 8]

SEAT No. :

P5105

[Total No. of Pages : 3

[5060] - 566

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 5 questions from 8 questions.*
- 2) *Figure to the right side indicate full marks.*
- 3) *Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator and steam tables is allowed.*
- 4) *Assume additional data, if necessary.*
- 5) *Neat diagrams must be drawn whenever necessary.*

Q1) a) A thin-wall tube sampler was pushed into soft clay at the bottom of a bore hole at a distance of 600mm. When the tube was recovered, a measurement down inside the tube indicated a recovered sample length of 585mm. What is the recovery ratio and what happened to the sample? If the another with 76.2mm outside diameter, 73mm inside diameter, 610mm length tube was used, what is the probable sample quality. [4]

- b) Discuss the process of undisturbed sampling in cohesive soil with reference to following aspects : [6]
- i) Equipments used
 - ii) Difficulties faced
 - iii) Sample recovery

Q2) a) A vane shear test was conducted in saturated clay. The height and diameter of the vanes were 101.6mm and 50.80mm, respectively. During the test the angle of twist observed was 95.6 and $K = 8 \text{ N/m}$. Compute the undrained shear strength of the clay. [4]

- b) In a clay layer, the GWT is located below 4.5m below the ground surface. The unit weight of soil above and below the GWT are 17.0 kN/m^3 and 19.2 kN/m^3 respectively. The cone penetration resistance below the ground surface is 0.8 MN/m^2 . Determine the undrained cohesion, C_u . Also find the over consolidation ratio, OCR. [6]

P.T.O.

Q3) a) A footing of size $1.5\text{m} \times 1.5\text{m}$ is laid at a depth of 0.7m below ground level. The footing is laid in a sandy layer having $\gamma = 18 \text{ kN/m}^3$, $\phi = 30^\circ$, $C = 0$. Assume that the one - way load eccentricity $e = 0.15\text{m}$. Determine the ultimate load, Q_{ult} . **[4]**

Take $N_q = 18.4$, $N_\gamma = 22.4$

b) A footing of size $1.5\text{m} \times 1.0\text{m}$ is located at a depth of 1.0m in stronger clay. A softer clay layer is located at a depth of 1m , measured from the bottom of the foundation.

For top layer Undrained Cohesion $C_1 = 120\text{kN/m}^2$ and $\gamma = 16.8 \text{ kN/m}^3$
For bottom layer Undrained Cohesion $C_2 = 48\text{kN/m}^2$ and $\gamma = 16.2 \text{ kN/m}^3$
Calculate the gross allowable load for the footing with an FOS of 4.**[6]**

Q4) a) Write a note on Modulus of subgrade reaction k_s for raft foundation.**[4]**

b) What will be the net allowable bearing capacity of raft foundation with dimensions of $15\text{m} \times 10\text{m}$ constructed over a sand deposit? Here, $D_f = 2\text{m}$, the allowable settlement is 25mm and the corrected average penetration number $N_{60} = 10$. **[6]**

Q5) a) Discuss with help of neat sketch the construction sequence for backfilled structure and dredged structure sheet pile. **[4]**

b) Draw an illustrative diagram showing variation of deflection and moment for anchored sheet pile with free earth support and fixed earth support method. Assume suitable data if required. **[6]**

Q6) a) Write a note on Brooms method of pile design. **[4]**

b) A square concrete pile of $400 \text{ mm} \times 400 \text{ mm}$ in cross section is placed in a sandy soil for which $\gamma = 16.5 \text{ kN/m}^3$, $\phi = 30^\circ$. Determine the ultimate point load carried by the pile bu using Meyerhof's method.**[6]**

Take $N_q = 55.0$

- Q7)** a) What are the practical considerations in cellular cofferdam design? **[4]**
- b) How will you determine bearing capacity for a cofferdam founded on soil? Enlist only the steps to be followed. **[6]**
- Q8)** a) Enlist and explain the factors that influence the depth of well foundation. **[4]**
- b) With reference to well foundation explain the aspect of sinking well and difficulties encountered during the activity. **[6]**



Total No. of Questions : 8]

SEAT No. :

P4758

[Total No. of Pages : 2

[5060]-567

M.E. (Civil) (Geotechnical Engg.)

**CONSTRUCTION METHODS IN GEOTECHNICAL
ENGINEERING
(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 Calculator is allowed.*
- 5) Assume suitable data if necessary clearly mentioning the same.*

Q1) Explain the construction of raft foundation and write short note on dewatering. **[10]**

Q2) Describe predredging and excavation methods for cofferdams with sketches. **[10]**

Q3) Write note on Dewatering methods for cofferdams. **[10]**

Q4) Describe tremie concreting procedure and difficulties faced with tremie box. **[10]**

P.T.O.

- Q5)** a) Describe the fabrication of caissons with neat sketches. [5]
b) How is site and foundation preparation for caissons done? [5]
- Q6)** Compare the construction procedure of open and pneumatic caissons. [10]
- Q7)** a) Describe the drilling equipment for rock excavation with sketches. [5]
b) How is evaluation and planning for rock excavation carried out? [5]
- Q8)** Explain shield tunnelling and tunnelling by TBM. [10]



Total No. of Questions : 8]

SEAT No. :

P4759

[Total No. of Pages : 2

[5060]-568

M.E. (Civil) (Geotechnical Engineering)

STABILITY OF SLOPES AND EARTH DAMS

(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) Your answer will be valued as a whole.*
- 6) Assume suitable data, if necessary.*

Q1) Explain Taylor's stability number in detail. Also explain using Taylors stability charts, how long term stability of slopes is evaluated. **[10]**

Q2) What are the measures to control seepage through an earth dam. Explain the installation of relief wells with a suitable sketch. **[10]**

Q3) What is flow net? Explain the various applications of flow net. Also derive an equation for determination of seepage discharge using flow nets. **[10]**

Q4) Explain the following modes of failure in an earth dam with suitable sketches: **[10]**

- a) Hydraulic failure
- b) Seepage failure
- c) Structural failure
- d) Earthquake failure

P.T.O.

- Q5)** Write short notes on : **[10]**
- a) Inclometers.
 - b) Vibrating wire settlement cells.
- Q6)** Explain the IS code provisions for the construction of road embankments. Draw a typical cross-section of road embankment and explain the functions of various components. **[10]**
- Q7)** Explain the typical application of Geotextile in : **[10]**
- a) Earth dam with geotextile filter.
 - b) Cross-section of Tunnel with geotextile.
- Q8)** What the various causes of land slides. Also, explain the remedial measures in detail. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4760

[Total No. of Pages : 2

[5060]-570

M.E. (Civil) (Geotechnical Engineering)

GEOTECHNICAL EARTHQUAKE ENGINEERING

(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) All questions carry equal marks.*
- 4) Your answer will be valued as a whole.*
- 5) Use of electronic pocket calculator is allowed.*
- 6) Assume suitable data, if necessary.*

- Q1)** a) Differentiate between 'Continental Drift' & 'Plate Tectonics'. [5]
b) Explain 'DSHA'. [5]
- Q2)** a) Explain 'Elastic Rebound Theory'. [5]
b) Discuss 'Love Waves'. [5]
- Q3)** a) How will you measure Dynamic soil properties? [5]
b) Explain, effects of local site conditions on ground motion. [5]
- Q4)** a) Explain 'Seismic Reflection Test'. [5]
b) Discuss 'Development of design parameters' for ground motion. [5]

P.T.O.

- Q5)** a) Discuss 'Effects of liquefaction'. [5]
b) Explain 'Goodman & Seed Approach'. [5]
- Q6)** a) Explain 'Seismic slope stability Analysis. [5]
b) Explain 'Jai-Krishna Approach. [5]
- Q7)** a) Discuss various soil improvement techniques for remediation. [5]
b) Explain EQ induced settlement. [5]
- Q8)** a) Explain the steps for seismic design of retaining wall. [5]
b) Discuss the method for mitigation of EQ effects. [5]



Total No. of Questions : 8]

SEAT No. :

P4761

[Total No. of Pages : 2

[5060]-571

M.E. (Civil) (Geotechnical Engineering)

GEOENVIRONMENTAL ENGINEERING

(2013 Pattern) (Semester - III) (Credit System)

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 tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) Assume suitable data, if necessary.*

Q1) a) Write in detail about identification of hazardous waste, Non-hazardous waste and Domestic waste. **[5]**

b) Explain in detail with neat sketch 'Double liner land fills'. **[5]**

Q2) a) What are the sources and effects of sub-surfaces contamination? **[5]**

b) Write in detail note on "Geo-technical re-use of waste". **[5]**

Q3) A wastewater treatment plant produces 72,000 L/d of thickened bio solids containing 3% solids. A belt-filter press installation is to be designed based on a normal operation of 8 h/d and 5 d/wk a belt filter press loading rate of 275 kg/m-h and the following data. Compute the number and size of belt-filter presses required and the expected solids capture, in percent. **[10]**

P.T.O.

- a) Total solids in dewatered sludge = 25%
 - b) Total suspended solids concentrated in filtrate = 900 mg/l = 0.09%
 - c) Wash water flow rate = 90 l/min per m of belt width.
 - d) Specific gravity of sludge feed, dewatered cake and filtrate are 1.02, 1.07 and 1.01 respectively.
- Q4)** a) What are the different methods used for disposal of solid waste. Explain any one method in detail. [5]
- b) Write in detail detections and control of sub-surface containment”. [5]
- Q5)** a) What are the different types of landfills? Explain any one in details. [5]
- b) What are the different types of composting adopted in India? Explain in detail any one. [5]
- Q6)** a) Write the necessity of “Environmental monitoring around landfills”. [5]
- b) Explain the planning and design aspects relating to waste disposal in land fills. [5]
- Q7)** a) Write detail note on ‘Geo-synthetic application in waste disposal”. [5]
- b) Write in brief the physical, chemical and biological characteristics of solid waste. [5]
- Q8)** a) What are the application of “Geo-synthetics in waste disposal design”?[5]
- b) What are the characteristic of hazardous, non-hazardous and domestic waste? [5]



Total No. of Questions : 8]

SEAT No. :

P4762

[Total No. of Pages : 3

[5060]-581

M.E. (Mechanical) (Design Engineering) (CAD-CAM) (Automobile)

ADVANCED MATHEMATICS

(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) Neat diagrams must be drawn wherever necessary.
- 4) Use of electronic pocket calculator is allowed.
- 5) Assume suitable data if necessary.

Q1) a) Find an orthonormal basis for the Euclidean space R^3 , by applying Gram-Schmidt's method to the following vectors (1, -1, 1), (1, 0, 1) and (1, 1, 2). [5]

b) If $w = \phi + i\psi$ represents a complex potential for an electrostatic field which is analytic, if the potential function ϕ is given by $y + e^x \cos y$ find the stream function ψ . [5]

Q2) a) Evaluate $\oint_C \frac{e^{-z}}{(z-1)(z-2)^2} dz$, where C is $|z| = 3$. [5]

b) Find the Laplace transform of the periodic function, whose definition in one period is: [5]

$$f(t) = t, 0 < t < 2$$
$$= (t - 2), 2 < t < 4.$$

Q3) a) Solve the initial value problem in a mechanical system given by [5]

$$\frac{d^2 y}{dx^2} + y = t \text{ and } y(0) = 1, y'(0) = -2.$$

b) Solve the following differential equation by series method

$$(1 - x^2) \frac{d^2 y}{dx^2} - 9y = 0. [5]$$

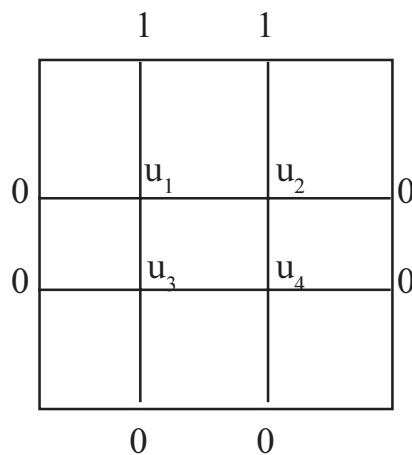
P.T.O.

Q4) a) Find the largest eigen value and corresponding eigen vector of the matrix **[5]**

$$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix} \text{ with } X_0 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

b) Given the values of $u(x, y)$ on the boundary of the square as in the figure

below, solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$. **[5]**



Q5) a) Given $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial t^2}$, $u(0, t) = 0$, $u(4, t) = 0$ and $u(x, 0) = \frac{x}{3}(16 - x^2)$.

Obtain u if $h = 1$ using Schmidt-bendre's method upto $t = 2$. **[5]**

b) Solve the differential equation $y'' + y + 2x(1 - x) = 0$ with boundary conditions $y(0) = 0, y(1) = 1$. Using Galerkin's method. **[5]**

Q6) a) Find the extremal of the functional

$$\int_0^1 [x y' + (y')^2] dx \quad y(0) = 0 \text{ \& } y(1) = 1. \quad \mathbf{[5]}$$

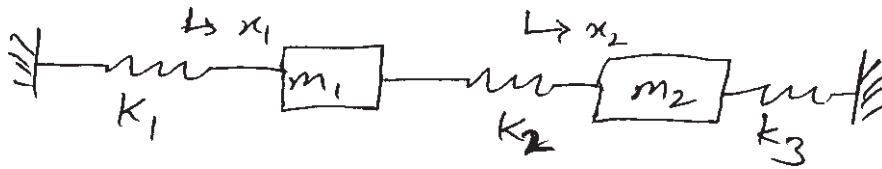
b) Solve the system of equation by least square method

$$x - 2y = 1, 2x + 4y = -1, 4x - 3y = 2. \quad \mathbf{[5]}$$

Q7) a) Find the image of the interior of the circle $C : |z - 2| = 2$ under the bilinear transformation $w = \frac{z}{2z - 8}$. [5]

b) Find the Fourier Transform of $e^{-x^2/2}, -\infty < x < \infty$. [5]

Q8) a) For the system of masses & spring in the figure below $m_1 = 1, m_2 = 1, k_1 = 1, k_2 = 3/2, k_3 = 1$, assuming there is no friction. Find natural frequencies of the system and corresponding normal modes of vibration using matrix method. [5]



b) Solve the equation $u_{tt} = 16 u_{xx}$ by taking $h = 1$ upto $t = 1.25$. The boundary conditions are $u(0, t) = u(5, t) = 0, u_t(x, 0) = 0$ and $u(x, 0) = x^2(5 - x)$. [5]



Total No. of Questions : 7]

SEAT No :

P5068

[5060]-582

[Total No. of Pages : 2

M.E. (Mechanical) (Design Engineering)
MATERIAL SCIENCE AND MECHANICAL BEHAVIOR OF
MATERIALS

(2013 Credit Pattern) (502202) (Semester - I)

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 programmable calculators not permitted.*
- 5) *Assume Suitable data if necessary.*

Q1) In a cubic unit cell, sketch the following:

[10]

- a) $[\bar{1} 1 0]$
- b) $[\bar{1} \bar{2} 1]$
- c) $[0 \bar{1} 2]$
- d) $[0 \bar{1} \bar{2}]$
- e) $[\bar{1} \bar{1} 0]$

Q2) State of stress at a point in a body is given by $\begin{bmatrix} 10 & 0 & 3 \\ 0 & 3 & 0 \\ 3 & 0 & 2 \end{bmatrix}$. Determine- **[10]**

- a) Octahedral normal stress.
- b) Octahedral shear stress.
- c) Maximum shear stress.

Q3) State of stress at a point is described by $\begin{bmatrix} 20 & -40 & 0 \\ -40 & -40 & 0 \\ 0 & 0 & 100 \end{bmatrix}$, using Mohr's

circle determine the

P.T.O.

- a) Principal stresses [10]
- b) Octahedral stresses and
- c) Maximum shearing stress

Q4) The stress -strain response in simple tension for an elastic -linear hardening plastic material is approximated by expression $\sigma = \sigma_0 + m\varepsilon^n$, for $\sigma \geq \sigma_0$. The material obeys Hook's law up to elastic limit. $\sigma_0 = 210$ MPa, $E=210$ GPa and $m = 26$ GPa. The Material sample is first stretched to a total strain $\varepsilon = 0.007$, is subsequently returned to its initial strain free state by continued compressive stressing and then is unloaded and reloaded in tension again to reach the same strain, $\varepsilon = 0.008$. Sketch the stress-strain curve for the following hardening rules: [10]

- a) Isotropic hardening
- b) Kinematic hardening

Q5) An element of J_2 - material (deformation theory of plasticity) is subjected to a proportional loading path with stress ratio $\frac{\sigma}{\tau} = 2$. The material obeys Hook's law up to elastic limit. Post-yield behavior during simple tension of the material is given by $\varepsilon = \frac{\sigma}{e} + \frac{6 - \sigma_y}{m}$ with Young's modulus $E=210$ GPa, yield stress $\sigma_y = 210$ Mpa, constant $m=26$ GPa and Poisson's ratio = 0.3. Find all the components of normal and shear strains for stress state of $\sigma = 200$ MPa and $\tau=100$ MPa. [10]

Q6) Explain Residual stresses and Residual Strain in cylinder in torsion. [10]

Q7) Explain Viscoelasticity and Maxwell model for rheological properties of viscoelastic material. [10]



Total No. of Questions : 7]

SEAT No. :

P5069

[5060]-583

[Total No. of Pages : 3

M.E. (Mechanical) (Design Engineering)
ADVANCED STRESS ANALYSIS
(2013 Credit Pattern) (Semester - I)

Time :3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions out of 7.*
- 2) *All the questions should be solved in one answer book and attach extra supplements if required.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary, but state the assumptions clearly.*

Q1) Investigate stress function $\phi = \frac{\cos^3 \theta}{r}$, is it permissible Airy's stress function.

Determine the stress components. **[10]**

Q2) A mild steel plate ($E=200\text{GPa}$, $\nu=0.29$, Yield stress = 315 MPa) has a thickness $h = 10$ mm and covers a circular opening having a diameter of 200 mm. The plate is fixed at the edges and is subjected to a uniform pressure p . **[10]**

Determine the magnitude of the yield pressure p_y and maximum deflection w_{\max} at the centre of the plate when this pressure is applied.

Derive the equation for maximum deflection you use.

Q3) Derive an expression for Equivalent modulus of Elasticity for composite rod subjected to Longitudinal loading and Transverse loading, to the direction of fibre.

State clearly the assumptions made. **[10]**

P.T.O.

Q4) A model scaled to ten times the size of a prototype is tested under a loading of 5 times greater than the actual prototype loading. The model material has a modulus of elasticity which is 10 percent less than that for the prototype material. The maximum stress and deflection of the model were found to be 8 MPa and 0.65 mm respectively. Determine the expected values for the prototype. [10]

Q5) A feed roll consists of two circular cylindrical steel rollers, each 200 mm in diameter and arranged so that their longitudinal axes are parallel. A cylindrical steel shaft of 60 mm diameter is fed between the rollers in such a manner that its longitudinal axis is perpendicular to that of the rollers. The total load between the shaft and rollers is 4.5 kN. Determine maximum principal stress and maximum shear stress in the shaft. Also determine the distance from the plane contact to the point of maximum shear stress. [10]

Take Young's modulus $E=200\text{GPa}$ and Poisson's ratio $\nu = 0.29$.

Q6) a) Stress function $\phi=(A/2)x^2 + Bxy + (C/2)y^2$ provides stress distribution on a rectangular plate, Evaluate the stress field and sketch the stress distribution on plate. [5]

b) Explain Isochromatic and Isoclinic Fringes. [5]

Q7) State of stress at a point is defined as shown in figure 1, for a part made from steel with yield strength of 350 MPa. Will it exhibit yielding? If not, Determine the factor of safety using [10]

a) Von Mises criterion and

b) Tresca's criterion.

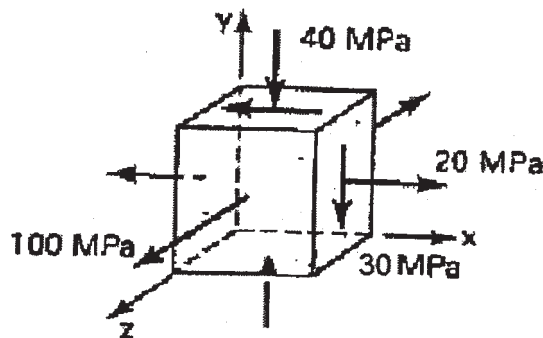
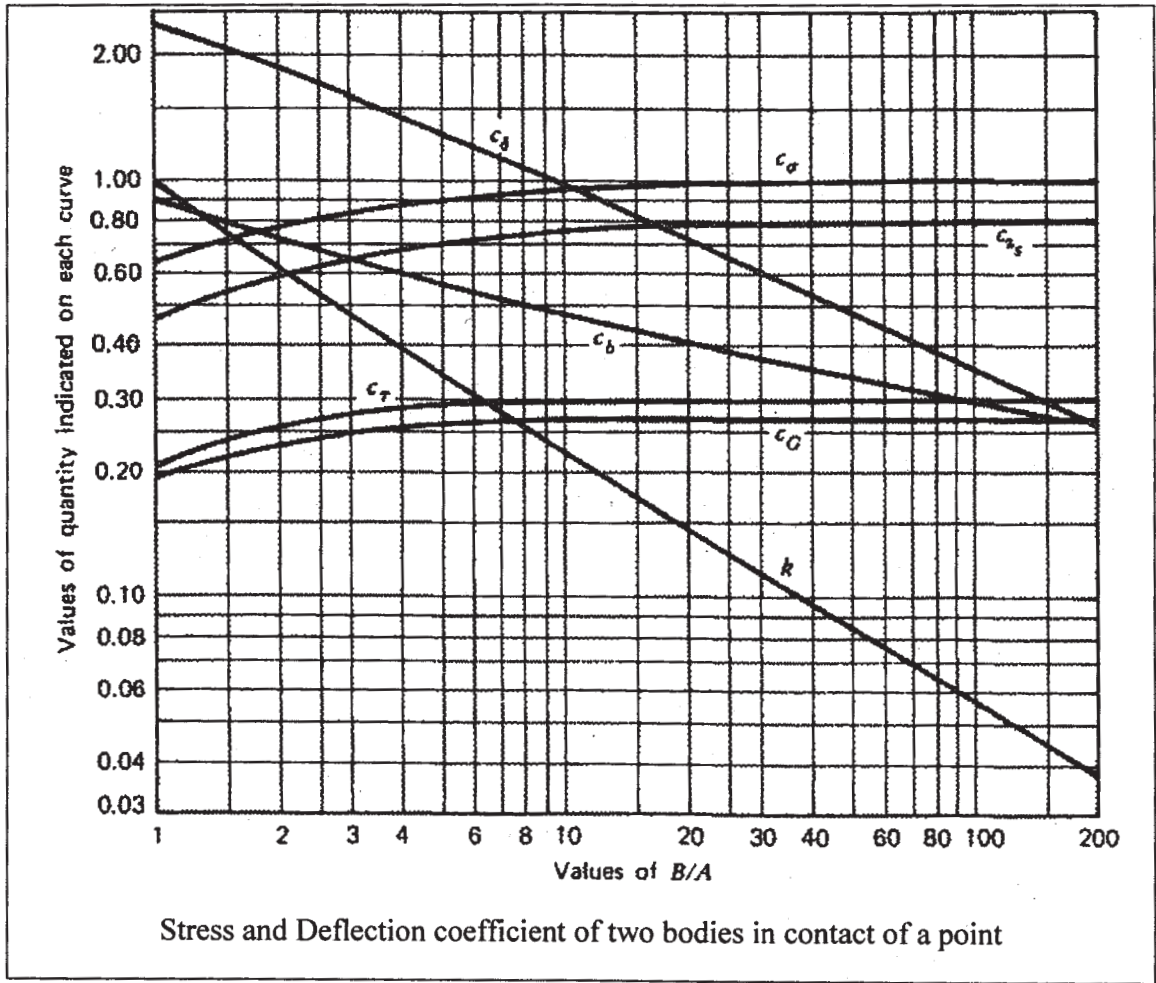


Fig. 1: State of stress at a point



Total No. of Questions : 7]

SEAT No. :

P4763

[Total No. of Pages : 2

[5060]-584

**M.E. (Mechanical) (Heat Power/Design/Mechatronics/CAD/CAM/
Energy Engineering)**

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

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five 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) Discuss the motivation for doing research. **[5]**
- b) Discuss the eight step model for Research Process starting from formulation of research problem till research report writing. **[5]**
- Q2)** a) What do you mean by Citation and Impact Factor of a Journal? Explain the significance of Peer reviewed Journal Papers for literature review/validation. Discuss the impact of referring open access Journals/websites on research process. **[5]**
- b) Discuss the significance of literature review at Research during various stages of research. **[5]**
- Q3)** a) Explain the meaning of Research Problem (RP). How a Research Problem is different an ordinary problem. **[5]**
- b) What are the Criteria's of a Good RP. **[5]**

P.T.O.

- Q4)** a) Explain the term variable used in Research? How to identify Variables for Engineering Research? [5]
- b) Explain the term Research Design (RD) and its significance in Research Process. [5]
- Q5)** a) Explain the significance of curve fitting in Engineering Research and the procedure to be followed for the same. [5]
- b) Discuss the structure of a typical Engineering Research Proposal and in short elaborate each point. [5]
- Q6)** a) Explain: Static, Dynamic and Random Characteristics of instruments.[5]
- b) Define : [5]
- i) Range
 - ii) Accuracy
 - iii) Precision
 - iv) Sensitivity
 - v) Resolution
 - vi) Threshold/Dead zone.
- Q7)** a) Explain Linear Regression Equation. [5]
- b) Explain the structure for writing a research report. [5]



Total No. of Questions : 7]

SEAT No. :

P4764

[Total No. of Pages : 2

[5060]-586

M.E. (Mechanical Design Engineering)

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 indicate full marks.*
- 4) *Use of logarithmic tables, slide rules and electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) Design a four link mechanism when the motion of the input and the output links are governed by a function $y = x^2$, and x varies from 0 to 2 with an interval of 1. Assume θ to vary from 50 to 150 degrees and ϕ from 80 to 160 degrees. Use graphical method for four positions. **[10]**

Q2) a) Explain how to convert a low degree complex mechanisms to a simple mechanism with examples? **[4]**

b) Explain auxiliary point method with neat sketches. **[6]**

Q3) a) Derive Freudenstein's equation for slider crank mechanism. **[6]**

b) For the beam element, write element and stiffness mass matrices. Explain the terms used for matrix representation. **[4]**

P.T.O.

Q4) Following data is related to a four bar mechanism where link 2 is crank and link 4 is output link. **[10]**

$$\theta_2 = 60^\circ$$

$$\Phi_4 = 90^\circ$$

$$\omega_2 = 3 \text{ rad/sec}$$

$$\alpha_2 = -1 \text{ rad/sec}^2$$

$$\omega_4 = 3 \text{ rad/sec}$$

$$\alpha_4 = -1 \text{ rad/sec}^2$$

Determine ratios of link lengths.

Q5) Find the inflection circle for the motion of coupler of slider crank mechanism as shown in **Fig. 01**. Also determine instantaneous radius of curvature of path of coupler point D $OA = 50 \text{ mm}$, $AB = 80 \text{ mm}$, $AC = 50 \text{ mm}$ and $CD = 25 \text{ mm}$. **[10]**

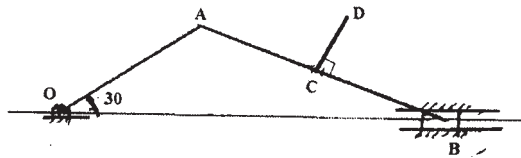


Fig. 01

Q6) a) Explain with neat sketch Denavit-Hartenberg parameters for the Hooke's Joint. **[5]**

b) What is matrix method of analysis? How it is used for analysis of spatial mechanisms? **[5]**

Q7) Explain the following with neat sketches : **[10]**

a) Dyad.

b) Center point.

c) Circle point.

d) Ground pivot specifications.

e) Cognates.



[5060]-587

M.E. (Mechanical) (Design Engineering)
ADVANCED MECHANICAL VIBRATION
(2013 Credit Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Answer any five questions.
- 2) Draw neat diagrams wherever necessary.
- 3) Use of non - programmable scientific calculator is allowed.
- 4) Assume suitable data wherever necessary.
- 5) Figures to the right indicate full marks.

Q1) Using matrix iteration technique, calculate all the natural frequencies of the system shown in figure Q.1. [10]

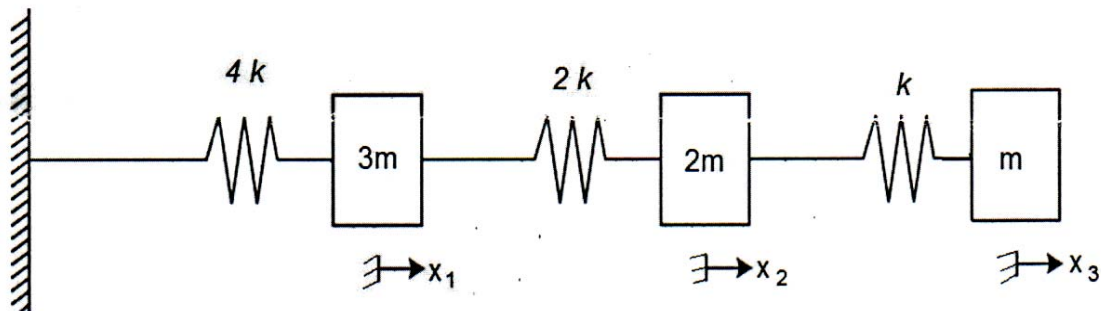


Figure: Q.1

- Q2)** a) Derive the wave equation for the string. [3]
- b) How does a continuous system differs from discrete system in the nature of equation of motion? [2]
- c) Determine the natural frequencies of vibration of a uniform beam fixed at $x = 0$ and simply supported at $x = l$. [5]

Q3) What is transient vibration? How to find response of single degree of freedom system against unit impulse? How to find the response of a single degree of freedom system to an arbitrary excitation and against arbitrary ground excitation? [10]

Q4) Analyze undamped dynamic vibration absorber and show frequency response for main system and absorber system. [10]

Q5) a) State the three types of maintenance schemes used for machinery. Explain how time domain and frequency domain techniques are used for condition monitoring. [5]

b) Explain FFT analyzer with block diagram. [5]

Q6) a) Derive an expression for spectral density of the derived process. [5]

b) Calculate the Autocorrelation function corresponding to the ideal white noise and to the unit step function. [5]

Q7) Write notes on (Any Four): [10]

a) Frequency Measuring Instruments

b) In-situ Balancing of rotors

c) Holzer Method

d) Fault Diagnosis

e) Analysis of Narrow and Wide band systems.



Total No. of Questions : 7]

SEAT No. :

P5070

[5060]-588

[Total No. of Pages : 2

M.E. (Mech. Design)
FINITE ELEMENT METHOD
(2013 Course) (Semester - II)

Time :3 Hours]

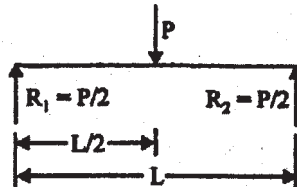
[Max. Marks : 50

Instructions to the candidates:

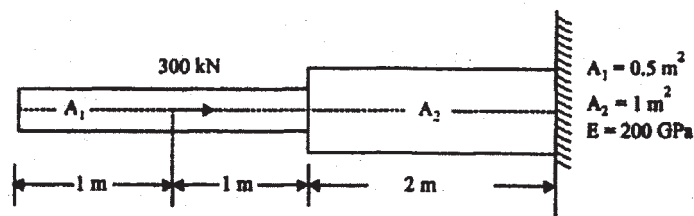
- 1) *Answer any five questions.*
- 2) *Answer to the each section should be written in separate books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if required.*

Q1) Explain Different methods of Weighted Residual Methods. **[10]**

Q2) Calculate the maximum deflection in a simply supported beam, subjected to concentrated load 'P' at the center of the beam. Use Galerkins Approach. **[10]**



Q3) Determine the nodal displacements and element stresses by finite element formulation for the following figure. Use $P=300$ k N; $A_1 = 0.5$ m²; $A_2=1$ m²; $E=200$ GPa **[10]**



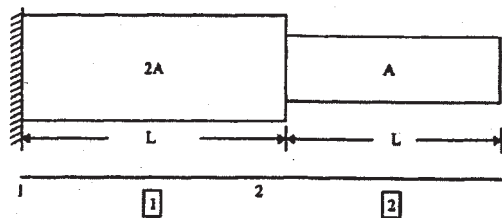
P.T.O.

Q4) Explain Iso sub and super parametric Element Formulations and write its advantages over normal element formulations. [10]

Q5) Write a note on following (Any two). [10]

- a) Kirchoffs Plate Bending theory
- b) Mindlin Plate Element
- c) Degenerated Shell Element

Q6) Find the natural frequencies of longitudinal vibrations of the constrained stepped shaft of areas A and $2A$ and of equal lengths (L), as shown below. Compare the results obtained using lumped mass matrix approach and consistent mass matrix approach. [10]



Q7) Write a Note (Any Four). [10]

- a) Geometric Nonlinearity
- b) Consistent and Lumped Mass Matrices.
- c) Jacobi Method
- d) Adaptive Finite Element Technique
- e) H & P refinements



[5060]-590

M.E. (Mechanical - Design Engineering)
OPTIMIZATION TECHNIQUES
(2013 Pattern) (Semester - III) (Credit System)

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 table is allowed.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data if necessary.

Q1) a) Define engineering optimization? What are engineering applications of optimization? [5]

- b) In a two-stage compressor, the working gas leaving the first stage of compression is cooled (by passing it through a heat exchanger) before it enters the second stage of compression to increase the efficiency. The total work input to a compressor (W) for an ideal gas, for isentropic compression, is given by

$$W = C_p T_1 \left[\left[\frac{p_2}{p_1} \right]^{\frac{k-1}{k}} + \left[\frac{p_3}{p_2} \right]^{\frac{k-1}{k}} - 2 \right] \frac{k}{k-1}$$

where C_p , is the specific heat of the gas at constant pressure, k is the ratio of specific heat at constant pressure to that at constant volume of the gas, and T_1 is the temperature at which the gas enters the compressor. Find the pressure, p_2 at which inter-cooling should be done to minimize the work input to the compressor. Also determine the minimum work done on the compressor. [5]

OR

- c) Explain necessary condition for single variable optimization. [5]

P.T.O.

Q2) There grades of coal A, B and C contain phosphorus and ash as impurities. In a particular industrial process, fuel up to 100 ton (maximum) is required which should contain ash not more than 3% and phosphorus not more than 0.03%. It is desired to maximize the profit while satisfying these conditions. There is unlimited supply of each grade. The percentage of impurities and the profits of the grades are given below.

Coal	Phosphorus (%)	Ash (%)	Profit in rupees per ton
A	0.02	3.0	12.00
B	0.04	2.0	15.00
C	0.03	5.0	14.00

Find the proportions in which the three grades be used. [10]

Q3) a) Write a short note on Exhaustive search method. [4]

b) Minimize the function

$$f(x) = 4x^3 + x^2 - 7x + 14$$

Using Golden Section Method, in the interval of [0, 1] with n = 5. [5]

Q4) a) Explain any two in details. [6]

i) Fuzzy optimization

ii) Simulated Annealing

iii) Genetic algorithms

b) Minimize the function

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\lambda \tan^{-1}\left(\frac{1}{\lambda}\right)$$

Using quasi-Newton method with the starting point $\lambda_1 = 0.1$ and the step size $\Delta\lambda = 0.01$ in central difference formulas. Use $\varepsilon = 0.01$ for checking the convergence. [5]

- Q5)** a) List the different solution methods in topology optimization and explain two of them in details. [5]
- b) Write a short note on combining topology and shape design. [5]
- Q6)** a) Write a short note on Topology optimization as design tool. [5]
- b) Write a short note on Bi-directional Evolutionary optimization method. [5]



Total No. of Questions : 8]

SEAT No. :

P4767

[Total No. of Pages : 3

[5060]-591

M.E. (Mechanical - Design Engineering)

MECHANICAL MEASUREMENT & 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 indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Explain following static characteristics of measuring instruments. **[5]**

- i) Sensitivity
- ii) Hysteresis
- iii) Repeatability
- iv) Drift

b) Explain following: **[5]**

- i) Mean
- ii) Median
- iii) Standard Deviation
- iv) Variance

Q2) a) Calculate standard deviation (σ) and variance (V) for following measurement sets

409 406 402 407 405 404 407 404 407 407 408 406 410 406 405 408 406
409 406 405 409 406 407. **[6]**

b) Explain properties of regression and correlation coefficient. **[4]**

P.T.O.

Q3) a) By using following data find lines of regression & Compute Karl Pearson coefficient of correlation. [6]

$$\Sigma x = 250 \quad \Sigma y = 300 \quad \Sigma xy = 7900 \quad \Sigma x^2 = 6500 \quad \Sigma y^2 = 10000 \quad n = 10.$$

b) Explain Sources of Systematic Error. [4]

Q4) a) How the temperature of metal slab can be measured? Draw setup required for that and explain working. [5]

b) For vibration measurement which parameters are measured? Explain piezoelectric accelerometer with neat sketch. [5]

Q5) a) List out various methods of level measurement. Explain any one in detail. [5]

b) List out various instruments for frequency measurement. Explain stroboscope in detail. [5]

Q6) a) Figures Q 6 (A) shows an error time graph. Sketch the PD controller output w.r.t. time $K_p = 5\%/%$, $K_D = 0.5\%/s$ and $m(0) = 30\%$. [5]

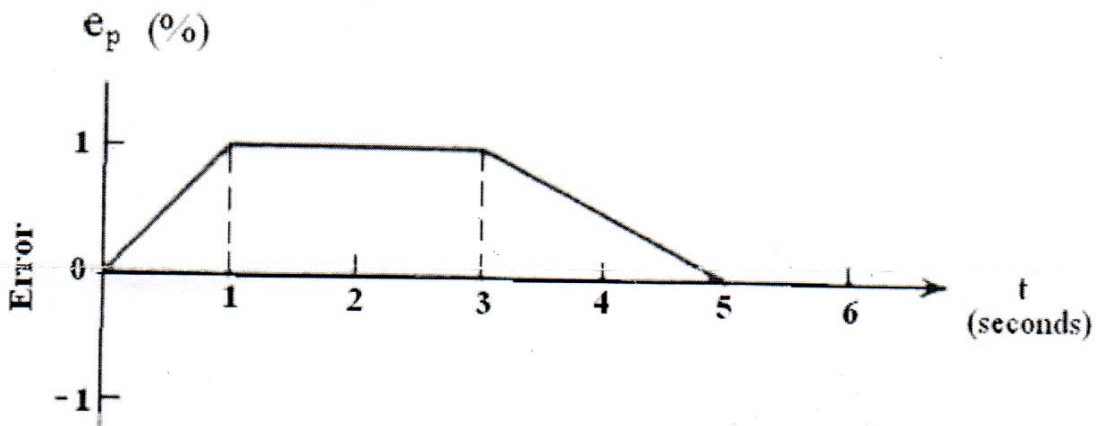


Figure Q6 (A)

b) Explain transient response specifications. [5]

Q7) a) Characteristic equation of system is given by $s^3 + 101.3s^2 + 132s + 5.093k = 0$. Find value of k , if system is stable by using Routh Hurwitz criterion. **[5]**

b) Derive the transfer function between output θ and input τ for the single DOF rotational system shown in Figure Q7 (b). **[5]**

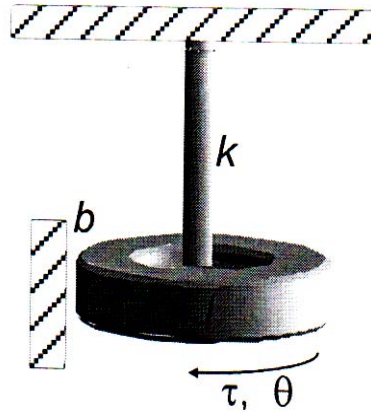


Figure Q7 (B)

Q8) a) Explain Proportional + Integral + Derivative Controller. **[6]**

b) Define Gain Margin & Phase Margin. **[4]**



Total No. of Questions : 8]

SEAT No. :

P4768

[Total No. of Pages : 3

[5060] - 593

ME (Mechanical) (Heat Power / Energy)

ADVANCED MATHEMATICS AND NUMERICAL METHODS

(2013 Pattern) (Credit System)

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) Black Figures to the right 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) a) Find the root of the equation $\cos x = x e^x$ which lies between 0 and 1 by using hallers's method. [5]

b) If P is pull required to lift a load W by means of fully block find a linear law of the form $P = M W + C$ connecting P and W using data.

P : 12 15 21 25

W : 50 70 100 120

Compute P when $W = 150$ kg. [5]

Q2) a) Solve by LU Decomposition method, the system of equations:

$$3x + 2y + 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7$$

[5]

b) Use lagrange's interpolation formula to find $f(x)$ for the data:

x	0	1	3	6
f(x)	18	10	-18	90

[5]

P.T.O.

Q3) a) Fit a cubic spline to the data. [5]

x	1	2	3
y	-6	-1	16

Also evaluate $y(1.5)$ and $y'(2)$.

b) Use Romberg's method to compute. [5]

$$\int_0^1 \frac{1}{1+x} dx$$

Q4) a) Compute the integral $I = \int_0^1 \frac{\cos x - x}{(1+x)} dx$ using gauss legendre two point formula. [5]

b) Determine the largest eigenvalue and the corresponding eigenvector of the following matrix using power method.

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix} \quad [5]$$

Q5) a) Using givens method, reduce the following matrix. A to tridiagonal form,

$$\text{where } A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix} \quad [5]$$

b) Using runge kutta method of fourth order obtain the numerical solution of

$$\frac{dy}{dx} = x^2 + y^2; y(1) = 1.5 \text{ in the interval } (1, 1.2) \text{ with } h = 0.1. \quad [5]$$

Q6) a) Using adam's Bashforth method find $y(0.4)$, given that

$$\frac{dy}{dx} = 1 + xy, y(0) = 2, y(0.1) = 2.1103, y(0.2) = 2.243, y(0.3) = 2.4011. [5]$$

- b) Solve the partial differential equation $\frac{\partial^2 y}{\partial x^2} + \frac{\partial^2 y}{\partial y^2} = 0$ for figure given below using gauss seidel method. [5]

- Q7) a)** Solve the system of linear equations by gauss seidal iteration method.
 $20x + y - 2z = 17$
 $3x + 20y - z = -18$
 $2x - 3y + 20z = 25$ [5]

- b) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5, t \geq 0$ subjected to the conditions: $u(x, 0) = 20, u(0, t) = 0, u(5, t) = 100$ by crank Nicholson method (Take $h = 1$) [5]

- Q8) a)** Find the solution of $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ for $0 \leq x \leq 1$ subjected to the condition (i) $u(x, 0) = \sin \pi x, (0 \leq x \leq 1)$ [5]
(ii) $\left(\frac{\partial u}{\partial t}\right) = 0, (0 \leq x \leq 1) \text{ at } t = 0$
(iii) $u(0, t) = 0 (t > 0)$
(iv) $u(1, t) = 0 (t > 0)$

by using explicit scheme.

- b) Solve the boundary value problem $\frac{d^2 u}{dx^2} = y(x)$ with $y(0) = 0$ and $y(1) = 1.17$ by using shooting method. [5]



Total No. of Questions : 8]

SEAT No. :

P4769

[Total No. of Pages : 3

[5060] - 594

M.E. (Mechanical) (Heat Power Engineering)

ADVANCED THERMODYNAMICS & COMBUSTION TECHNOLOGY

(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 indicate full marks.
- 4) Use of logarithmic tables, slide rule, mollier charts, electronics pocket calculators and steam tables is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) State and explain Law of corresponding states also explain generalized compressibility chart with suitable sketch. [6]
- b) Develop the following formula of Vander Waal's equation in terms of reduced parameters. [4]

$$\left\{P_r + \frac{3}{v_r^2}\right\}(3v_r - 1) = 8t_r$$

- 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) A steam boiler initially contains 5m³ of steam and 5m³ of water at 1MP. Steam is taken out at constant pressure until 4 m³ of water is left. What is the heat transferred during the process?. [5]
- Q3)** a) Derive an equation for exergy balance of a closed system. [5]
- b) Calculate the decrease in exergy when 25 kg of water at 95°C mix with 35 kg of water at 35°C, the pressure being taken as constant and the temperature of the surroundings being 15°C (C_p of water = 4.2 kJ/kg K)[5]

P.T.O.

- Q4) a)** Write a note on availability and irreversibility. [4]
- b) Air in a large building is kept warm by heating it with steam in a heat exchanger. Saturated water vapor enters this heat exchanger at 35°C at a rate of 10000 kg/h and leaves as saturated liquid at 32°C. Air-atm pressure enters this heat exchanger at 20°C and leaves at 30°C at about the same pressure. Determine the rate of entropy generation associated with this process. [6]
- Q5) a)** Write a note on Clausius – Claypeyron equation. [4]
- b) With usual notations derive the following thermodynamic relation: [6]
- $$C_p - C_v = TV\beta^2 / \alpha$$
- Q6) a)** Explain: [4]
- i) Enthalpy of formation
- ii) Enthalpy of combustion
- b) The products of combustion of a unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat apparatus: $CO_2 = 12.5\%$, $O_2 = 3.2\%$, $CO = 0.3\%$, $N_2 = 84\%$. [6]
- Determine
- i) The composition of the fuel
- ii) The air fuel ratio
- iii) The percentage of excess air used
- Q7) a)** Discuss briefly: [4]
- i) Equilibrium constant
- ii) Gibb's phase rule [4]
- b) For the chemical reaction $CO_2 + H_2 \rightleftharpoons CO + H_2O$ The equilibrium value of the degree of reaction at 1200 K is 0.56. Determine the equilibrium constant and the Gibbs function change. [6]

- Q8)** a) What is fugacity and activity? Explain. [4]
b) Write a note on: [6]
i) Thermodynamics of Nutrition and Exercise.
ii) Thermodynamics of biological cells.



[5060] - 595

M.E. (Mechanical - Heat Power)
ADVANCED FLUID MECHANICS
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:-

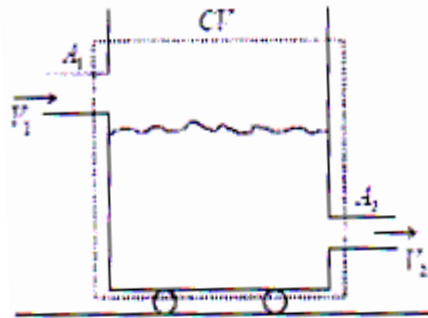
- 1) Answer five questions from following.
- 2) Draw diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data, where ever necessary.

Q1) a) Explain the term; i) vorticity ii) stream function iii) velocity potential. [5]

b) Consider flow of water from tank mounted on trolley as shown in fig. Determine i) velocity at outlet ii) force required to keep the tank stationary.

$$V_1 = 5\text{m/s}, D_1 = 25\text{ mm}, P_1 = 30\text{ kPa}, Q = 0.2\text{m}^3/\text{s}, D_2 = 20\text{mm}, P_2 = 18\text{kpa}$$

[5]



Q2) a) Derive an expression for conservation of momentum equation in following

$$\text{form; } \rho \frac{D\bar{V}}{Dt} = \bar{f} \quad [5]$$

b) The flow field of a fluid is given by: [5]

$V = xy\hat{i} + 2yz\hat{j} - (yz + z^2)\hat{k}$. Show that it represents a possible three-dimensional incompressible flow. Is the flow rotational or irrotational? If rotational, then determine at a point (2,4,6): i) angular velocity, ii) vorticity, iii) shear and linear strains

P.T.O.

- Q3)** a) Derive an expression of velocity profile for fully developed laminar flow through pipe using Navier Stokes equations. [5]
- b) The flat plate is moving at a velocity of $U = 15$ m/s on top of a 15 mm thick oil film. The density of the oil is 920 kg/m³ and dynamic viscosity, $\mu = 0.8$ kg/m.s. Also there is a favorable pressure gradient of $-3 \mu U/h^2$. Calculate the average and maximum forward velocity of the oil film, the flow rate, the force required to pull the upper plate (per m²). 'h' is the distance between moving plate and stationary plate. Assume laminar flow between the plates. [5]
- Q4)** a) Obtain an expression for stream function and velocity function for following flows. Also determine pressure distribution in sink flow [5]
 i) Source & sink flow ii) Vortex flow
- b) Derive an expression for lift on rotating cylinder. (Kutta-Joukowski theorem) [5]
- Q5)** a) Obtain momentum - integral equation for the boundary layer. [5]
- b) Air flows over as sharp edged flat plate with $L = 1$ m, a width of 3 m and $U_\infty = 2$ m/s. For one side of the plate, assume laminar flow find: [5]
 i) Boundary layer thickness, $\delta(L)$,
 ii) Skin friction coefficient, $C_f(L)$,
 iii) Surface shear stress, $\tau_w(L)$,
 iv) Drag force. F_D
- Assume, density of air = 1.23 kg/m³ and kinematic viscosity of air as = $1.46 \cdot 10^{-5}$ m²/s.
- Q6)** a) Explain different types of free turbulent flows. What is a need of turbulence modeling? [5]
- b) Derive an expression of velocity profile in a smooth pipe for turbulent flow. [5]

- Q7)** a) It is desired to expand air from $P_0 = 200$ kPa and $T_0 = 500$ K through a throat to an exit Mach number of 2.5. If the desired mass flow is 3 kg/s, compute **[5]**
- i) The throat area and the exit
 - ii) Pressure,
 - iii) Temperature,
 - iv) Velocity, and
 - v) Area, assuming isentropic flow, with $k = 1.4$
- b) Derive an expression for Fanno line & Rayleigh line for normal shock. **[5]**



Total No. of Questions : 7]

SEAT No. :

P4771

[Total No. of Pages : 5

[5060]-598

M.E. (Mechanical - Heat Power)
ADVANCED HEAT TRANSFER
(2013 Pattern) (Semester - II)

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) Explain boundary and initial conditions for heat diffusion equation. **[5]**

- b) Consider steady heat transfer between two large parallel plates at a constant temperature of $T_1 = 490$ K and $T_2 = 250$ K that are $L = 2$ cm apart. Assuming surfaces to be black, determine the rate of heat transfer between the plates per unit surface area assuming the gap between the plates is (i) filled with atmospheric air, (0.02 W/mK) (ii) evacuated (iii) filled with fiber glass insulation (0.04 W/ mK) and (iv) filled with superinsulation having an apparent thermal conductivity of 0.00015 W/m°C. **[5]**

Q2) a) Explain various dimensionless parameters associated with transient conduction. **[5]**

- b) A long 20-cm-diameter cylindrical shaft made of stainless steel 304 comes out of an oven at a uniform temperature of 600°C. The shaft is then allowed to cool slowly in an environment chamber at 200°C with an average heat transfer coefficient of $h = 80$ W/m² °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. The properties of stainless steel 304 at room temperature are $k = 14.9$ W/m °C, $\rho = 7900$ kg/m³, $C_p = 477$ J/kg°C, and $\alpha = 3.95 \times 10^{-6}$ m²/s. **[5]**

P.T.O.

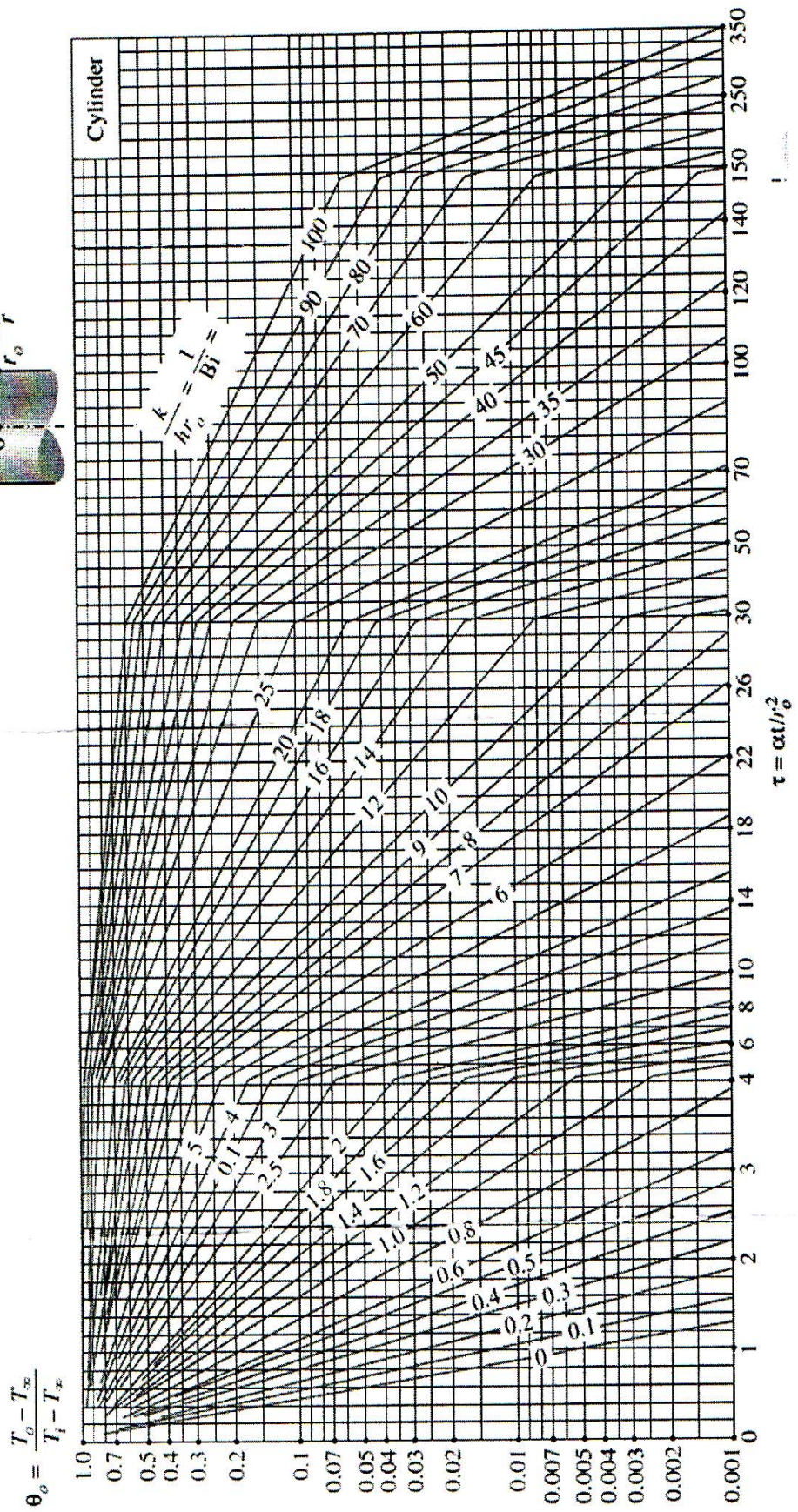
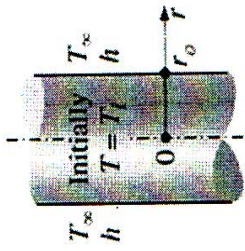
- Q3) a)** Discuss analogies between momentum and heat transfer. [5]
- b) Differentiate between velocity and thermal boundary layer. [5]
- Q4) a)** Discuss pressure, velocity and heat transfer variation for flow over cylinder. [5]
- b) Engine oil at 60° C flows over the upper surface of a 5-m long flat plate whose temperature is 20° C with a velocity of 2 m/s .Determine the total drag force and the rate of heat transfer per unit width of the entire plate. [k = 0.144 W/m-K Pr = 2870, $\nu = 242 \times 10^{-6} \text{ m}^2/\text{s}$, $\rho = 876 \text{ kg/m}^3$] [5]
- Q5) a)** Explain governing equation for natural convection for heat transfer over vertical flat surface. [5]
- b) A 12-cm-high and 20-cm-wide circuit board houses 100 closely spaced logic chips on its surface, each dissipating 0.05 W. The board is cooled by a fan that blows air over the hot surface of the board at 35°C at a velocity of 0.5 m/s. The heat transfer from the back surface of the board is negligible. Determine the average temperature on the surface of the circuit board assuming the air flows vertically upwards along the 12- cm-long side by (i) ignoring natural convection and (ii) considering the contribution of natural convection. Disregard any heat transfer by radiation. [k = 0.02717 W/m-K Pr = 0.7235, $\nu = 1.774 \times 10^{-5} \text{ m}^2/\text{s}$, $\beta = 0.00312 \text{ K}^{-1}$] [5]
- Q6) a)** Saturated steam at 1 atm condenses on a 3-m-high and 5-m-wide vertical plate that is Maintained at 90°C by circulating cooling water through the other side. Determine: [5]
- (i) the rate of heat transfer by condensation to the plate,(ii) the rate at which the condensate drips off the plate at the bottom. [$k_1 = 0.677 \text{ W/m-K}$ $C_p = 4212 \text{ J/kg-K}$, $\mu_1 = 0.297 \times 10^{-3} \text{ kg/m-s}$, $\rho_1 = 961.5 \text{ kg/m}^3$]
- b) Explain external & internal flow boiling processes. [5]

- Q7) a) Explain the terms radiation intensity & radiocity. [5]
- b) The temperature of the filament of an incandescent light bulb is 2500 K. Assuming the filament to be a blackbody, determine the fraction of the radiant energy emitted by the filament that falls in the visible range. Also, determine the wavelength at which the emission of radiation from the filament peaks. The visible range of the electromagnetic spectrum extends from $\lambda_1=0.4 \mu\text{m}$ to $\lambda_2= 0.76\mu\text{m}$ (Refer table) [5]

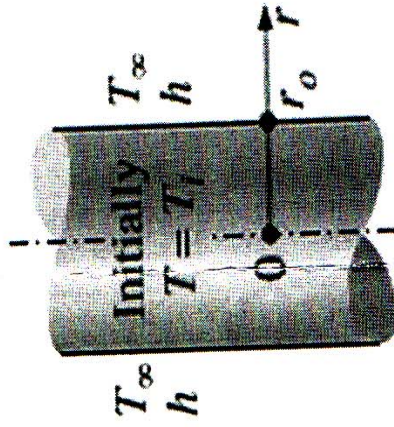
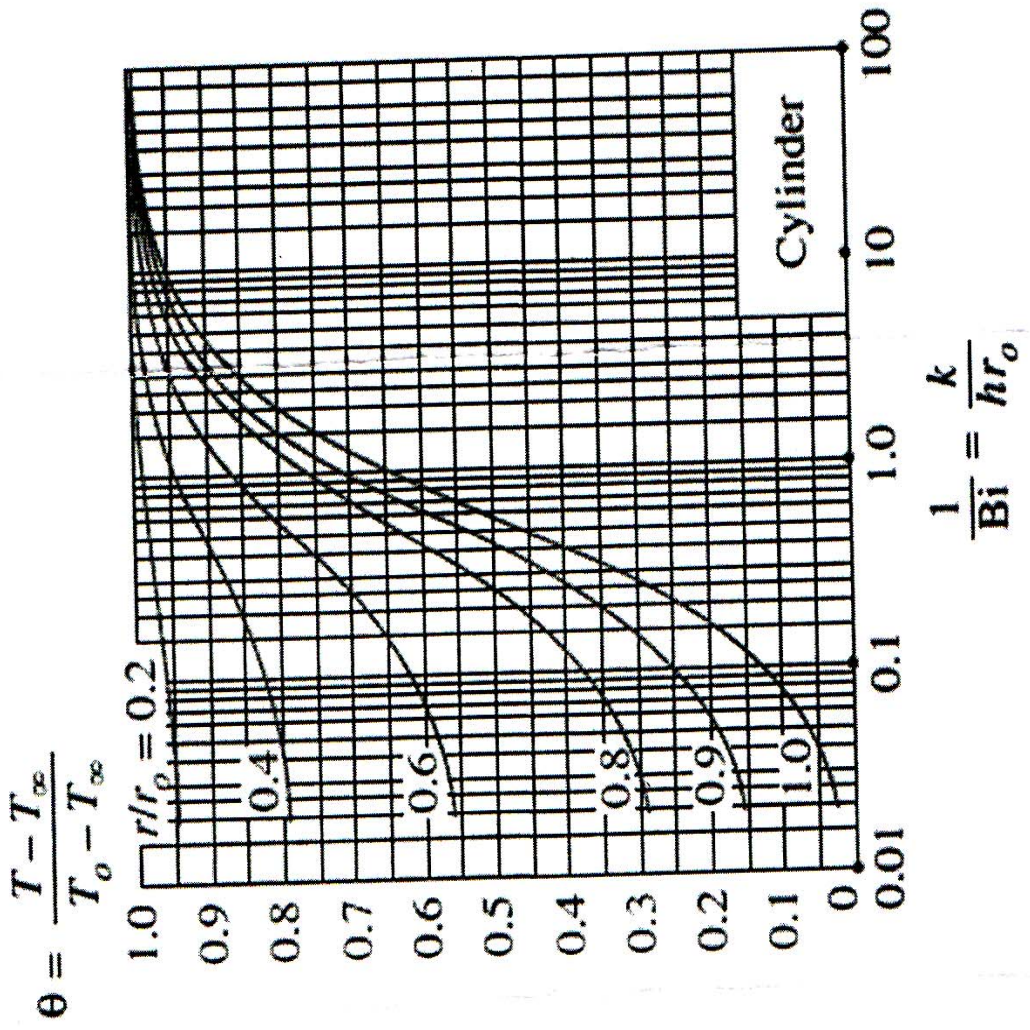
Table: Blackbody radiation functions

$\lambda T,$ $\mu\text{m} \cdot \text{K}$	f_λ	$\lambda T,$ $\mu\text{m} \cdot \text{K}$	f_λ
200	0.000000	6200	0.754140
400	0.000000	6400	0.769234
600	0.000000	6600	0.783199
800	0.000016	6800	0.796129
1000	0.000321	7000	0.808109
1200	0.002134	7200	0.819217
1400	0.007790	7400	0.829527
1600	0.019718	7600	0.839102
1800	0.039341	7800	0.848005
2000	0.066728	8000	0.856288
2200	0.100888	8500	0.874608
2400	0.140256	9000	0.890029
2600	0.183120	9500	0.903085
2800	0.227897	10,000	0.914199
3000	0.273232	10,500	0.923710
3200	0.318102	11,000	0.931890
3400	0.361735	11,500	0.939959
3600	0.403607	12,000	0.945098
3800	0.443382	13,000	0.955139
4000	0.480877	14,000	0.962898
4200	0.516014	15,000	0.969981
4400	0.548796	16,000	0.973814
4600	0.579280	18,000	0.980860
4800	0.607559	20,000	0.985602
5000	0.633747	25,000	0.992215
5200	0.658970	30,000	0.995340
5400	0.680360	40,000	0.997967
5600	0.701046	50,000	0.998953
5800	0.720158	75,000	0.999713
6000	0.737818	100,000	0.999905

Centerline temperature (from M. P. Heisler)



Temperature distribution (from M. P. Heisler)



Total No. of Questions : 7]

SEAT No. :

P5131

[Total No. of Pages : 4

[5060]-599

M.E. (Mechanical - Heat Power Engg)
AIR CONDITIONING TECHNOLOGY
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Solve any 5 questions out of 7.*
- 2) *Draw Neat diagrams wherever necessary.*
- 3) *Use of Steam tables, p-h chart, Pshychrometric chart and scientific calculator is alllowed.*
- 4) *Assume suitable data where ever necessary.*
- 5) *Figures to the right indicate full marks.*

Q1) Explain the procedure of static regain method of duct design. With a suitable example highlight the drawbacks of static regain method of duct design. [10]

Q2) a) $2 \times 4 \times 2$ m room contains air at 35°C DBT and 25°C WBT. The pressure inside at room is 2 bar. Determine. [5]

i) Specific humidity

ii) DPT

iii) RH

iv) Mass of dry air

v) Mass of water vapour

b) Explain - desiccant dehumidification systems. [5]

P.T.O.

Q3) A space is to be maintained at 27°C DBT and has a rate of sensible heat gain of 13 kW and a rate of latent heat gain of 8.5kW. The mass flow rate of air supplied to the space is 1.1 kg/s. Outdoor air at 38°C DBT and 15°C DPT is introduced into the system at a rate of 0.28kg/s. The air at the exit of the cooling coil is saturated and at a temperature of 7°C. **[10]**

- a) Clearly sketch and label all the points and process lines on Psychrometric chart.
- b) Determine DBT and RH of the air supplied to the space.
- c) RH of the air in the space.
- d) Refrigeration load.

Q4) An air conditioned space is maintained at 26°C DBT and 50% RH when outdoor conditions are 35°C DBT and 28°C WBT. The space has sensible heat gain of 17.6 kW and the air to the space is supplied at a condition of 8°C saturated. **[10]**

Determine:

- a) The mass and volume flow rate of the air supplied.
- b) Latent heat load in the room.
- c) The cooling load of the refrigeration plant if 15% of the total mass of air supplied to the space is fresh air and remaining is recirculated air.

Q5) a) Explain displacement ventilation system. List its advantages, limitations and applications. **[5]**

- b) Explain the factors taken into consideration while selecting air conditioning system for hospital application. **[5]**

Q6) An air conditioned room maintained at 25°C DBT and 50% RH has sensible load of 25kW and latent load of 5 kW. The ventilation air requirement is 20% by mass. The bypass factor of cooling coil is 0.20 and ambient conditions are 40°C DBT and 50% RH. Determine. **[10]**

- a) Mass of supply air
- b) Outside air heat load
- c) Grand total load
- d) ESHF
- e) GSHF

Q7) a) Desert air cooler is used to cool air from 46°C DBT, 23% RH to 24° C by evaporative cooling. Estimate the volume flow rate of air in m³/hr and the quantity of water required per hr for cooling capacity of 5 TR. **[5]**

- b) Explain-Fresh air calculations and considerations for IAQ. **[5]**

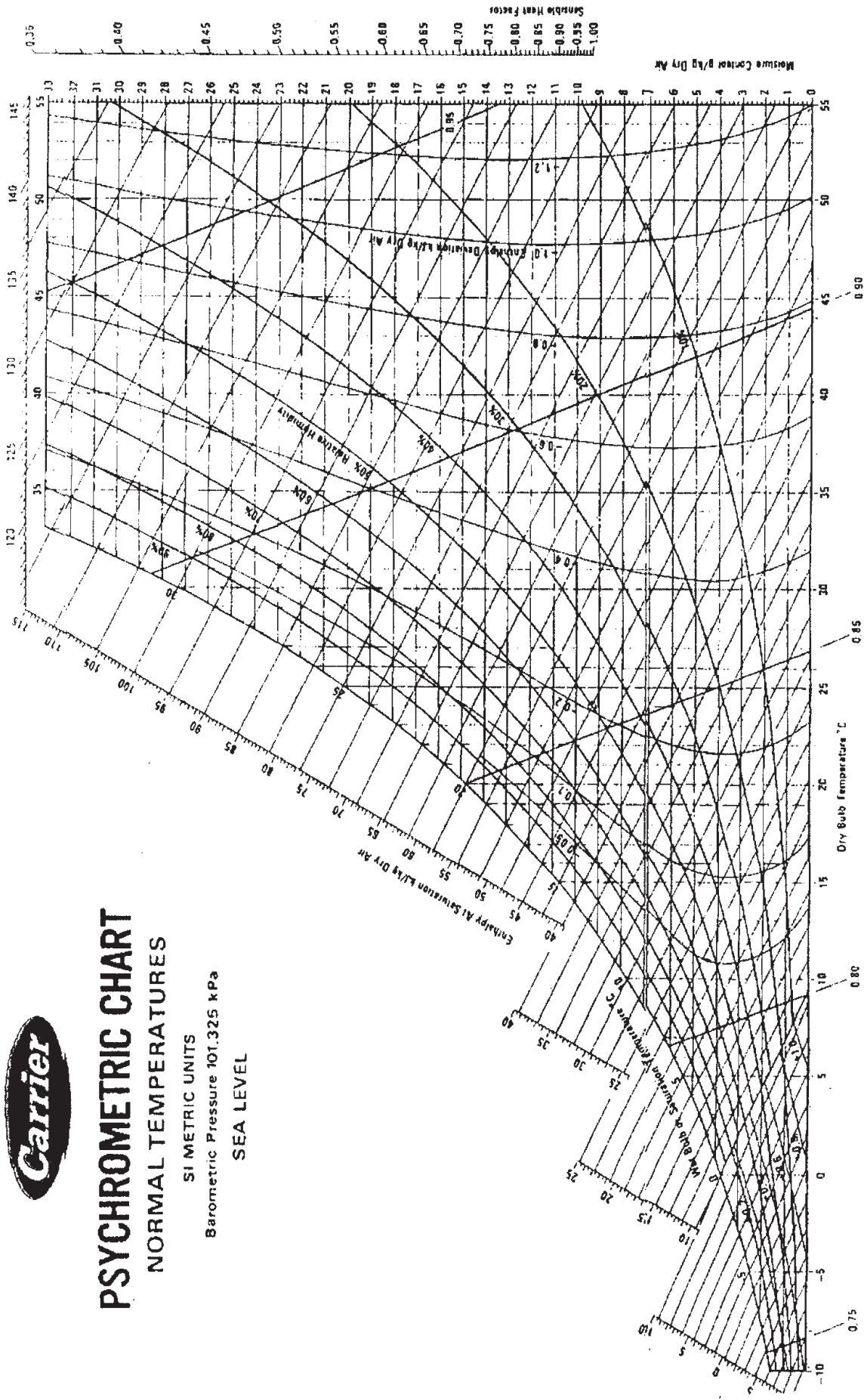




PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS
 Barometric Pressure 101.325 kPa
 SEA LEVEL



Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

Volume m³/kg Dry Air

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Total No. of Questions : 7]

SEAT No. :

P5139

[Total No. of Pages : 2

[5060]-600

M.E. Mechanical Engineering (Heat Power Engineering)
MEASUREMENTS AND CONTROLS
(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 Calculator, heat transfer data book, steam table is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1) a)** Explain any five static characteristics of instruments in detail. **[6]**
b) With suitable example explain first order instrument. **[4]**

- Q2) a)** In a student laboratory experiment a measurement is made of a certain resistance by different students. The values obtained were. **[5]**

Reading	1	2	3	4	5	6	7	8	9	10	11
Resistance, K Ω	12.0	12.1	12.5	11.8	13.6	11.9	12.2	11.9	12.0	12.3	12.1

Calculate the standard deviation, the mean reading, and the uncertainty.

- b)** Explain sources of systemic and random errors. **[5]**

- Q3) a)** In a cooling experiment the system is presumed to behave as a first-order system following a relation like $y = Ce^{-at}$ The following data points are collected: **[5]**

y	t
0.9	0.1
0.8	0.5
0.4	0.9
0.3	1.2
0.2	1.7
0.1	2.3
0.01	4.6

Then perform a least-squares analysis to obtain the best values of C and a. Calculate the correlation coefficient for the least-squares fit.

- b)** Design a control system for pressure control in boiler. **[5]**

P.T.O

- Q4)** a) When would a piezoelectric transducer be used to advantage in a seismic instrument? Explain its working. [5]
b) Explain the characteristics of various types of strain gauges. [5]
- Q5)** a) Which device is used for pressure measurement below 1 torr? Explain its working with neat diagram. [5]
b) With neat schematic explain the working principle of rotameter. [5]
- Q6)** a) Explain basic methods used for calibration of flow-measurement devices. [5]
b) Discuss the working of electronic PID controller with neat diagram. [5]
- Q7)** a) A radiant energy measurement is made to determine the temperature of a hot block of metal. The emitted energy from the surface of the metal is measured as $28 \pm 0.4 \text{ kW/m}^2$ and the surface emissivity is estimated as $\epsilon = 0.90 \pm 0.05$. Calculate the surface temperature of the metal and estimate the uncertainty. [5]
b) Explain the characteristics of P, PI, PID controller modes. [5]



Total No. of Questions : 7]

SEAT No. :

P5097

[Total No. of Pages : 3

[5060]-602

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) Classify the partial differential equations. How will you categorize following equations based on linearity? **[5]**

i) $\frac{\partial u}{\partial x} + c \frac{\partial u}{\partial y} = 0$; where $c = \text{constant}$

ii) $\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} = 0$

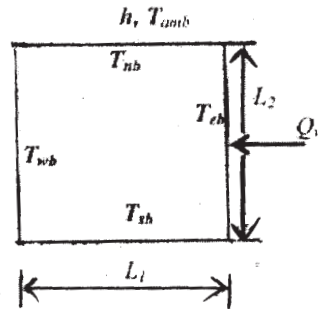
iii) $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = 1$

b) Derive governing equation based on principle of Newton's second law of motion. Simplify the viscous term in it and write it in tensor form. **[5]**

Q2) a) Consider heat conduction in a 2D metallic plate subject to following boundary conditions as shown in following figure. Write an algorithm to find temperature distribution along the plate using central difference

P.T.O.

method. Determine the resulting system of linear algebraic equation in matrix form. Use the numerical grid size of 5×5 with uniform grid size Δx & Δy , i.e. $i_{max} = j_{max} = 5$. [7]



- b) Explain in detail which discretization method is commonly used in Commercial CFD tools. Justify the same. [3]
- Q3)** a) Explain in brief structured grid generation in CFD simulations and its demerits. Write an algorithm for algebraic grid generation. [6]
- b) Give practical examples of the any two types of grid topologies used. Explain with neat sketches. [4]
- Q4)** a) Differentiate between explicit and implicit time-marching approaches? [3]
- b) Discretize the second order wave equation using MacCormack method. Comment on its order of accuracy and stability condition. [7]
- Q5)** a) What are the different convergence acceleration techniques used in CFD? Explain any one in detail. [4]
- b) Explain the CFD simulation process for flow through pipe using SIMPLE numerical technique. Write stepwise algorithm to find out the numerical simulation using SIMPLE technique. [6]

- Q6)** a) Write in detail the necessity of the turbulence modeling. Explain $k - \epsilon$ turbulent model giving its advantages and disadvantages. [6]
- b) Explain turbulence intensity or degree of turbulence or level of turbulence. Write intensity for isotropic flow. [4]
- Q7)** a) Enlist three challenges encountered in industrial CFD applications. Comment on the solution of each challenge. [5]
- b) Write in detail the CFD simulation process. Comment on the importance of the validation and verification process in CFD. [5]



Total No. of Questions : 7]

SEAT No. :

P4772

[Total No. of Pages : 2

[5060]-603

M.E. (Mechanical - Heat Power)
DESIGN OF HEAT TRANSFER EQUIPMENTS
(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 indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Elaborate the different steps in selection of heat exchanger for the application. **[5]**

b) Explain in detail any method of Rating and sizing method the heat exchanger design. **[5]**

Q2) a) Enlist the different methods for determining the heat exchanger effectiveness and explain any one in detail. **[5]**

b) Write a short notes on: **[5]**

i) Non uniform overall heat transfer coefficient.

ii) Multi pass heat exchanger.

Q3) a) Steam enters a counter flow heat exchanger, dry saturated at 10 bar and leaves at 35°C. The mass flow rate of steam is 800 kg/min. The gas enters the heat exchanger at 650°C with a mass flow rate of 1350 kg/min. if the tubes are 30 mm diameter and 3 m long, determine the number of tubes required . Neglect the resistance offered by metallic tubes. Use following data: **[5]**

for steam $t_{sat} = 180^{\circ}\text{C}$, $C_{ps} = 2.71 \text{ kJ/kg } ^{\circ}\text{C}$, $h_s = 600 \text{ W/m}^2 \text{ } ^{\circ}\text{C}$

for gas : $C_{pg} = 1 \text{ kJ/kg } ^{\circ}\text{C}$, $h_g = 1 \text{ W/m}^2 \text{ } ^{\circ}\text{C}$

b) What are the different parameters considered for presenting the non dimensional pressure drop. **[5]**

P.T.O.

Q4) a) List the methods to determine the heat transfer coefficient explain any one method in detail. [5]

b) A two pass surface condenser is required to handle the exhaust from the turbine developing 15 MW with specific steam consumption of 5 kg/kWh. The pressure of the steam in the condenser vacuum is 660mm of Hg when barometer reads 760 mm of Hg. The mean velocity of water is 3 m/s, water inlet temperature is 24°C. The condensate is saturated water and outlet of cooling water is 4 °C less than that of the condenser temperature. The quality of exhaust steam is 0.9 dry. The overall heat transfer coefficient based on the outer area is 4000 W/m² °C. The water tubes are 38.4 mm in outer diameter and 29.6 mm in inner diameter. Calculate: [5]

i) Mass flow rate of water required.

ii) Condenser surface area.

iii) No of tubes required and Tube length.

Properties of stem at condenser pressure.

$P_s = 0.133 \text{ bar}$, $t_{\text{sat}} = 51^\circ\text{C}$, $h_{\text{fg}} = 2592 \text{ kJ/kg}$,

Q5) a) Enlist the different parameters considered in the designing and selection of the cooling tower. [5]

b) Write a short note on evaluation of thermal performance of the cooling tower. [5]

Q6) a) Write the short note on thermal design of the furnace. [5]

b) Discuss the methodology for the furnace design required for the application of heat treatment processes. [5]

Q7) Write a short note on (any three) [10]

a) Heat bank in furnaces

b) Thermal interface materials.

c) Thermal design of cooling tower.

d) Mechanical components in cooling tower.



Total No. of Questions : 7]

SEAT No. :

P4773

[Total No. of Pages : 3

[5060]-606

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 rules Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) A diesel engine operating on the air standard diesel cycle has six cylinders of 100mm bore & 120mm stroke. The engine speed is 1800 rpm. At the beginning of compression, the pressure & temperature of air are 1.03 bar and 35°C. If clearance volume is $1/8^{\text{th}}$ of the stroke volume. [6]

Calculate :

- i) Pressure & temperature at salient points of cycle.
- ii) Compression ratio.
- iii) Efficiency of cycle.

b) Explain octane number & cetane number. [4]

Q2) a) In a test on single cylinder oil engine with 30 cm bore and 45cm stroke working on 4 stroke cycle, the following observations were made.

Duration of trial = 1 hour

Total fuel consumption = 7.6 kg.

CV of fuel used = 45000 kJ/kg

Total revolutions made = 12000

P.T.O.

Room Temp. = 20°C

MEP = 6 bar

Net brake load = 150 kg

Brake drum diameter = 180 cm, Rope dia = 3 cm

Mass of jacket cooling water = 550 kg

Inlet temperature of jacket cooling water = 15°C

Exit temperature of jacket cooling water = 60°C

Temperature of exhaust gases = 300°C

Total air consumption = 365 kg

Specific heat of exhaust gases = 1 kJ/kg k

Calculate IP, BP, Mechanical efficiency & draw up heat balance sheet on minute basis. [6]

b) Explain with neat figure squish and tumble. [4]

Q3) a) Explain in detail sources of emission in SI engine. [5]

b) Explain with neat sketch 3-way catalytic converter. [5]

Q4) a) The cylinder of four stroke diesel engine has following specifications.

Cylinder bore = 150 mm

Max gas pressure = 3.5 MPa

Cylinder Material = Gray C.I. FG 200 (Sut = 200 N/mm²)

Factor of safety = 5

Poisson's ratio = 0.25

Allowance C for reboring (D = 150 mm) = 4 mm.

Determine the thickness of cylinder wall. Also calculate the apperant & net circumferential and longitudinal stresses in cylinder wall. [6]

b) Explain the various types of crankshaft. [4]

Q5) Explain design procedure for connecting rod. [10]

Q6) a) Explain the process of lubrication design and importance of selection of lubricant. [6]

b) Which materials are most commonly used for piston? Explain the merits and limitations. [4]

Q7) Write short notes on (Any two) : [10]

a) Design of cooling system.

b) Principle of similitude in design.

c) Emission Norms.



Total No. of Questions : 7]

SEAT No. :

P4774

[Total No. of Pages : 2

[5060]-607

M.E. (Automotive Engineering)

AUTOMOTIVE SAFETY AND REGULATIONS

(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 rules and electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Define and explain with neat sketch how a vehicle structure is designed for crashworthiness. **[5]**

b) Describe what do you understand by active safety? What are various components of it? **[5]**

Q2) a) Explain ‘injury measurement and criteria’ for human body undergone with impact during accidents. What is injury rating? Explain. **[5]**

b) Explain with neat sketch anthropometry data for passenger compartment or modern day’s car. **[5]**

Q3) a) Explain the types of safety glasses? What are the requirements of it? **[5]**

b) What are types of automobile seats? Explain with neat sketch construction of front seat? **[5]**

P.T.O.

- Q4)** a) What is the role of proper lighting and reflecting devices in automobile safety? Name different types of lighting and signaling devices used in modern automobiles? [5]
- b) 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. [5]
- Q5)** a) Describe role of side door intrusion beam in providing passive safety in cases of side impacts. [5]
- b) Explain asymmetrical beam used in head lamp. What is merits and demerits of plastic lens head lamps? [5]
- Q6)** a) Write a detail note on various automotive standard giving procedure for type approval and conforming safety of critical components. [5]
- b) Sketch any five road signs specifying dimensions and color code as per CMVR rule. [5]
- Q7)** Write short notes on the following (Any two) : [10]
- a) Adaptive front lighting system.
- b) Testing tracks for vehicles.
- c) Role of seat belt in protection against whiplash injury.
- d) Crash energy management.



Total No. of Questions : 7]

SEAT No. :

P4775

[Total No. of Pages : 2

[5060]-610

M.E. (Mechanical - Automotive Engineering)
ENGINE 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 scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Methane (CH_4) is burned with atmospheric air. The analysis of products on a 'dry' basis is as follows $\text{CO}_2 = 10\%$, $\text{O}_2 = 2.37\%$, $\text{CO} = 0.53$, $\text{N}_2 = 87.10\%$. **[6]**

- i) Determine the combustion equation.
- ii) Calculate air fuel ratio.
- iii) Percent theoretical air

b) Explain enthalpy of combustion. **[4]**

Q2) a) Ethane C_2H_6 is burned with 20% excess air during combustion process. Assuming complete combustion determine air fuel ratio, fuel air ratio and write stiochiometric combustion equation. **[5]**

b) Explain turbulent flame propagation in engine. **[5]**

Q3) a) Explain concept of lean burn engine. **[5]**

b) What are the requirements of good combustion chamber. **[5]**

P.T.O.

- Q4)** a) Explain the stages of combustion in CI engine. [5]
- b) Discuss the effect of following engine variables on flame propagation.[5]
- i) Engine speed.
 - ii) Compression ratio
 - iii) Turbulence.
- Q5)** a) What are the various possibility of combustion chamber arrangements? [5]
- b) Explain IC engine simulation. [5]
- Q6)** a) Explain the combustion theory applied to gas turbine combustion system. [5]
- b) Describe briefly factors affecting combustion chamber design in gas turbine. [5]
- Q7)** Write short notes on (Any two) : [10]
- a) Swirl measurement.
 - b) Catalytic converter.
 - c) Diesel knock.



Total No. of Questions : 5]

SEAT No. :

P4776

[Total No. of Pages : 2

[5060]-611

M.E. (Mech. - Automotive)

NOISE VIBRATION AND HARSHNESS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any Two from each question.*
- 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) Solve any Two questions :

- a) Explain the principle of wave propagation. What do you mean by Transverse and longitudinal sound waves? **[5]**
- b) Describe the different types of accelerometer mounting for vibration measurements. **[5]**
- c) A simply supported beam of 1 m length and 50 mm in 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/m². **[5]**

Q2) Solve any Two questions :

- a) Explain the different techniques used to noise control? **[5]**
- b) Explain digital signal processing technique. **[5]**
- c) Explain the Pass by Noise measurement technique of vehicle. **[5]**

P.T.O.

Q3) Solve any Two questions :

- a) Explain in detail different sound fields and state its significance. [5]
- b) What do you mean by sound intensity mapping? What is its significance in NVH? [5]
- c) Frequency spectrum analysis of the noise output of the machine using one-octave band pass filters gave the following results :

Central frequency (in Hz)	125	250	500	1000	2000	4000	8000	16000
SPL (in dB)	70	71	84	86	85	77	64	66

Calculate the overall sound pressure level? [5]

Q4) Solve any Two questions :

- a) Explain in details of Experimental Modal Analysis. [5]
- b) Impedance tube (Kundt's tube) method (ASTM E 1050). [5]
- c) What are the different types of sound Absorbers are used [5]

Q5) Write a Short Note (Any two) :

- a) Helmholtz resonator muffler. [5]
- b) Anechoic chamber and Reverberation chamber. [5]
- c) Acoustic holography technique. [5]



Total No. of Questions : 7]

SEAT No. :

P4777

[Total No. of Pages : 2

[5060]-612

M.E. (Mechanical - Automotive Engineering) (Semester - II)

AUTOMOTIVE CHASSIS 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 rules and electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) What is the purpose of independent suspension system? How is it achieved in front and rear axle? [5]

b) A helical compression spring is to be designed to absorb the shocks. The initial compression of spring is 30 mm and it is further compressed by 50mm while absorbing the shocks. The spring is to absorb 250 J of energy during the process. The spring index can be taken as 6. The spring is made of patented and cold drawn steel wire with an ultimate tensile strength of 1500 N/mm² and modulus of rigidity of 81370 N/mm². The permissible shear stress for the spring wire should be taken as 30% of ultimate tensile strength. Calculate [5]

- i) Spring stiffness
- ii) Wire diameter
- iii) Mean coil diameter
- iv) Number of active turns

P.T.O.

- Q2)** a) Differentiate between reversible and irreversible steering. [5]
b) Explain with the help of neat sketches different types of steering column. [5]
- Q3)** a) Write short note on ABS giving its advantages over normal braking system. [5]
b) Explain with the help of neat sketch self energizing disc brakes. [5]
- Q4)** a) What is run flat concept? What are the design features of run flat tyre? [5]
b) Explain tyre construction with help of neat sketch. [5]
- Q5)** a) What are the advantages and disadvantages of Tubeless Tire with respect to conventional tires? [5]
b) Give the construction of brake lining. How are they fixed to the brake shoes? [5]
- Q6)** a) With the help of neat sketch explain suspension of rigid six wheelers. [5]
b) Explain types of tracks used for vehicle evaluation. [5]
- Q7)** Write short notes on the following (Any two) : [10]
a) Application of composites in various car components.
b) Apportioning Valve.
c) Transmission of six-wheelers.



Total No. of Questions : 5]

SEAT No. :

P4778

[Total No. of Pages : 2

[5060]-614

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) Describe the construction details of Radial tire and Bias ply tire. [5]
- b) Explain variation of tractive effort with longitudinal slip. [5]
- c) Write short note with sketch on behavior of tire subjected to a side forces. [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 power requirement of a full size passenger car as a function of speed. [5]
- c) Explain Electronic Brake assist System. [5]

Q3) Attempt any TWO.

- a) Explain steering force and moments in suspension kinematics. [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 1 lb/in respectively. The CG height is 20 inches and wheel base is 102. [5]
- c) Describe anti-dive and squat geometry. [5]

P.T.O.

Q4) Attempt any TWO.

- a) Describe controlled differential steering system. [5]
- b) Explain the steady-state handling characteristics of a two-axle vehicle. [5]
- c) Sketch and explain the handling behavior of car with and without vehicle stability control system. [5]

Q5) Attempt any TWO.

- a) Write short notes on modelling of springs. [5]
- b) Explain relation between input and output spectral densities. [5]
- c) Explain the effect of wheelbase in road and suspension modelling. [5]



Total No. of Questions : 8]

SEAT No. :

P5125

[Total No. of Pages : 2

[5060]-615

M.E. (Mechanical) (Automotive Engineering)

Autotronics

(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) Explain driver and passenger comfort system in modern automobiles. **[10]**

Q2) a) Explain role of electronics in modern Automobiles. **[5]**

b) Enlist sensing devices in computerized test rings and explain any one. **[5]**

Q3) a) Explain features of electronic stability program. **[5]**

b) Explain gas analyzer in short. **[5]**

Q4) Write a short note on electronic fuel injection system in automobiles. **[10]**

Q5) a) Discuss in brief the sensors used in air bag systems. **[5]**

b) Explain constructional details of reciprocating air compressors in automobile air conditioning. **[5]**

P.T.O.

- Q6)** a) Discuss role of visual imaging system in driver assistance systems. [5]
b) Describe the side effect air bag systems. [5]
- Q7)** a) Explain general layout of automobile air conditioning system. [5]
b) Explain the Voltage-to-Current Converter in signal conditioning. [5]
- Q8)** Discuss the Onboard diagnostic system used in modern cars. [10]



Total No. of Questions : 5]

SEAT No. :

P4779

[Total No. of Pages : 2

[5060]-618
M.E. Mech. (CADME)
ADVANCED MACHINE DESIGN
(2013 Pattern)

Time : 3 Hours]

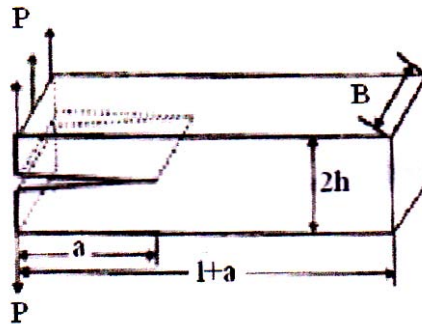
[Max. Marks : 50

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 in brief the state of strain at a point. [5]
- b) Derive the expression for Airy's stress function in rectangular coordinate. [5]
- c) Determine strain energy release rate for a double cantilever beam with $a \gg 2h$ and $l \gg 2h$ as shown in figure. The P is a applied load and B is the width of beam [5]



Q2) Attempt any TWO.

- a) Describe theory of virtual work and energy. [5]
- b) Explain the concept of energy balance during crack growth. [5]
- c) Write Short Notes on Maximum elastic strain theory. [5]

P.T.O.

Q3) Attempt any TWO.

- a) Explain Low and High cycle fatigue. [5]
- b) Explain the deflection characteristics of Belleville Spring. [5]
- c) Discuss transversed shear effect in composite laminates. [5]

Q4) Attempt any TWO.

- a) Following creep data at a certain temperature is known. [5]
 $s_1 = 10.5 \text{ MPa}$ $\dot{\epsilon}_1 = 0.012$ percent per 1000 hrs.
 $s_2 = 14 \text{ MPa}$ $\dot{\epsilon}_2 = 0.025$ percent per 1000 hrs.
Determine the constants of hyperbolic sine law and calculate the creep rates of stress 25 MPa and 28 MPa.
- b) Explain in brief the state of strain at a point. [5]
- c) Write Short Notes on Fatigue strength improvement techniques. [5]

Q5) Attempt any TWO.

- a) Two 10 teeth gears are to mesh without undercutting. The gears are generated using standard hob with 20° pressure angle. Module is 4mm while clearance is 0.2mm. Using extended centre distance method. Find (i) Hob shift (ii) Blank diameter and depth of cutter setting (iii) Actual pressure angle. [5]

Take usual notations.

$$\theta = \text{inv} \phi$$

$$\phi = v - \frac{2}{15} v^3 + \frac{3}{175} v^5 \text{ Where } v = \sqrt[3]{30}$$

θ and ϕ are in radians.

- b) Explain Transverse shear effects in composite laminates. [5]
- c) Explain octahedral shearing stress theory. [5]



Total No. of Questions : 8]

SEAT No. :

P5071

[5060]-619

[Total No. of Pages : 2

**M.E. (Mechanical) (CADME)
COMPUTERAIDED DESIGN
(2013 Course) (Semester-I) (502403)**

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 pocket non programmable electronic calculator is allowed.*

Q1) a) Explain PHIGS Graphics Standards in CAD [5]

b) Explain CAD/CAM system evaluation Criteria. [5]

Q2) a) Derive and Explain the parametric equation of line. [5]

b) Explain the use and applications of Hermite cubic splines in engineering. [5]

Q3) a) Discuss in detail the applications of rational curves in CAD along with mathematical modeling. [5]

b) Explain the parametric modeling of Surface of Revolution. [5]

Q4) Explain Surface manipulation in surface modeling. [10]

Q5) a) Discuss rotational mapping and translational mapping in detail. [5]

b) Explain Boundary Representation techniques used in solid modeling. [5]

P.T.O.

- Q6)** a) Explain the concept of Collaborative Engineering. [5]
b) Discuss isometric projection in the context of CAD. [5]
- Q7)** Explain STEP architecture in detail. [10]
- Q8)** a) Explain in detail any one algorithm used to remove hidden Surfacel. [5]
b) Explain collaborative design concept. [5]



Total No. of Questions : 7]

SEAT No. :

P4780

[Total No. of Pages : 2

[5060]-622

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 from following.*
- 2) Figures to the right indicate full marks.*

Q1) Explain Forecasting, Order Release and Shop-Floor control in Production control. **[10]**

Q2) Discuss in detail Software requirements of CIM. **[10]**

Q3) Explain **[10]**

- a) Elements of Flexible Manufacturing System.
- b) Flexible manufacturing strategy.

Q4) Explain role of CAD/CAM in CIM. **[10]**

Q5) Explain role of Kanban, JIT and 5S in Lean Manufacturing. **[10]**

P.T.O.

Q6) Discuss in detail Capacity Planning & Materials Requirements Planning in the context of Computer Integrated Manufacturing. **[10]**

Q7) Elaborate Web Based Manufacturing for :

a) Automated Welding Shop **[5]**

b) Foundry **[5]**



Total No. of Questions : 7]

SEAT No. :

P5072

[5060]-623

[Total No. of Pages : 1

M.E. (Mechanical Engineering) (CADME)
INDUSTRIAL PRODUCT DESIGN & PRODUCT LIFE CYCLE
MANAGEMENT
(2013 Credit Pattern) (Semester-II) (502408)

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 indicates full marks.*
- 4) Assume suitable data, if necessary.*

Q1) Explain quality project approach and quality problem solving process in quality function deployment with an example. **[10]**

Q2) Explain with example correlation between customer need and technology. **[10]**

Q3) Write a note on: **[10]**

- a) Product portfolio
- b) Post Teardown Report

Q4) Explain product Life Cycle Model with neat sketch. **[10]**

Q5) Discuss main management issues in product data and product workflow. **[10]**

Q6) Explain hardware & document management in concern with PDM. **[10]**

Q7) How the data issues are resolved if problem pertains in PLM? Explain with example. **[10]**



Total No. of Questions : 7]

SEAT No. :

P4781

[Total No. of Pages : 2

[5060]-624

M.E. (Mechanical) (CADME)

AUTOMATED MANUFACTURING SYSTEM MODELING

(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve any 5 questions.*
- 2) *Draw neat sketch if required.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if required.*

Q1) a) CNC machine is to cut 1000parts with cycle time of 12min. calculate no of machines given with 50hrs availability. The utilization of m/c is 100% calculate shift hr during the period. **[5]**

b) Explain Different types of Automation? And Differentiate Fixed and flexible automation? **[5]**

Q2) a) Explain various performance measures of AMS in detail? **[4]**

b) Explain typical AGV layout and its types? Also explain guidance mechanism used in AGV? An AGVS will be used to satisfy material flows indicated in the from-to Chart in the table below, which shows deliveries per hour between stations (above the slash) and distances in meters between stations (below the slash). Moves indicated by “L” are trips in which the vehicle is loaded, while “E” indicates moves in which the vehicle is empty. It is assumed that availability = 0.90, traffic factor = 0.85, and efficiency = 1.0. Speed of an AGV = 0.9 m/s. If load handling time per delivery cycle = 1.0 min, determine the number of vehicles needed to satisfy the indicated deliveries per hour? Assume that availability = 0.90. **[6]**

P.T.O.

TO		1	2	3	4
From	1	0/0	9L/90	7L/120	5L/75
	2	5E/90	0/0	0/NA	4L/80
	3	7E/120	0/NA	0/0	0/NA
	4	9E/75	0/NA	0/NA	0/0

- Q3)** a) Explain steps in DTM chain model and define Transition diagram and transition matrix in Markov chain model. [5]
- b) Explain Time reversible markov chain model in manufacturing with sketch and advantages. [5]
- Q4)** a) Explain M/M/m queue model with state diagram? [5]
- b) A CNC machine centre process raw parts one at time in M/M/1 fashion.let $\lambda=8$ parts /h and $\mu =10$ parts /h then let $\rho < 1$ so calculate following :[5]
- machine utilization
 - mean no of customers in system
 - mean no of customers in queue
 - mean waiting time in system and
 - mean waiting time in queue,
- Q5)** a) Define Petrinets with types? And explain steps in constructing the Petrinets for any one application. [5]
- b) Explain GSPN Model for FMS in deadlock prevention and Avoidances with sketch? [5]
- Q6)** Differentiate stochastic and fuzzy timed petrinets with sketch? And state its features. [10]
- Q7)** Explain GSPN model of a central server FMS with sketch? And state its features. [10]



Total No. of Questions : 7]

SEAT No. :

P4782

[Total No. of Pages : 1

[5060]-626

M.E. (Mechanical) (Computer Aided Design, Manufacturing & Engineering)

**SIMULATION MODELING
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any five questions from the following.*
- 2) Figures to the right indicate full marks.*

Q1) Describe additive congruential method and linear congruential method for Random number Generation. **[10]**

Q2) What are the steps in simulation study? Discuss limitations of simulation modeling? **[10]**

Q3) Explain the procedure for Model Building using Simulation Package with suitable example. Why verification and validation is necessary? **[10]**

Q4) Define Modeling of System Randomness. Explain various Sources of Randomness and their effect on Machine Downtime. **[10]**

Q5) What is necessity of verification and validation of model? Explain variance reduction techniques with suitable case study. **[10]**

Q6) Explain different Performance Measures in Manufacturing System Modeling. **[10]**

Q7) What is goodness of fit test? Explain. Describe any one variance reduction technique in detail. **[10]**



Total No. of Questions : 7]

SEAT No. :

P5140

[Total No. of Pages :1

[5060] - 627
M.E. (Mechanical) (CADM & E)
OPTIMIZATION TECHNIQUES
(2013 Pattern) (Semester - III)

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 indicate full marks.*
- 4) Use of calculator is allowed.*
- 5) Assume suitable data if necessary.*

Q1) Solve by Simplex method [10]

Minimize $f = -3x_1 - 2x_2$

Subject to $x_1 - x_2 \leq 1$

$3x_1 - 2x_2 \leq 6$

$x_1 \geq 0, x_2 \geq 0,$

Q2) How optimization problem can be formed & Discuss classification of optimization problem. [10]

Q3) Solve $x^2 + 54/x$ by successive quadratic interpolation method. [10]

Q4) Discuss Exhaustive Search Method & Bounding phase method for bracketing. [10]

Q5) Find Optimum solution using variable elimination Method, [10]
Minimize $F(X_1, X_2) = [X_1^2 + X_2 - 11]^2 + [X_1 + X_2^2 - 7]^2$

Q6) Explain the concept of Simulated Annealing. [10]

Q7) What is Gradients Search Method & Explain Cauchy's Method? [10]



Total No. of Questions : 8]

SEAT No. :

P4783

[Total No. of Pages : 2

[5060]-630

M.E. (Mechanical-Energy Engineering)

ADVANCED THERMODYNAMICS

(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) Explain Law of corresponding states. **[5]**

b) How real gas behaviour is analysed? State the assumptions for an ideal gas behaviour. **[5]**

Q2) a) Explain Critical point and triple point of water with sketch. **[4]**

b) A large insulated vessel is divided into two chambers, one containing 5kg of dry saturated steam at 0.2 MPa and the other 10kg of steam, 0.8 quality at 0.5 MPa. If the partition between the chambers is removed and the steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality and entropy change in the process using Mollier diagram. **[6]**

Q3) a) Explain Helmholtz function and Gibbs function? **[5]**

b) Discuss the Law of degradation of energy and availability function of closed and open system. **[5]**

P.T.O.

Q4) a) Write a note on Thermo electricity and Onsager equation. [5]

b) Calculate the energy in 40 kg of water at 75°C with respect to the surrounding at 5°C, The pressure of water being 1 atm. [5]

Q5) a) Explain Inversion Curve and Joule-Thompson Coefficient. [5]

b) Derive the relation $U = F - T \left(\frac{\partial F}{\partial T} \right)_v = -T^2 \left(\frac{\frac{\partial F}{T}}{\partial T} \right)_v$. [5]

Q6) a) Explain the criteria for chemical equilibrium. [4]

b) The following are the ultimate analysis for coal: Calculate the stoichiometric air requirement. [6]

Carbon-38%, Ash-35%, Hydrogen-5%, Sulphur-2%.

For the same data, calculate the theoretical CO₂.

If the actual measured CO₂ is 8%, find out the excess air levels?

Q7) a) Discuss the Amagat's Law and Kay's Rule. [5]

b) Explain enthalpy of formation and enthalpy of combustion. [5]

Q8) Write a note on :

a) Fugacity and activity of a species in a mixture. [5]

b) Clapeyron equation. [5]



Total No. of Questions : 8]

SEAT No. :

P4784

[Total No. of Pages : 2

[5060]-634

M.E. (Mechanical) (Energy Engineering)

ADVANCED HEAT TRANSFER

(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 an expression for generalized three dimensional heat conduction equation in Cartesian Coordinates for unsteady flow. [7]

b) Explain the significance of Nusselt Number. [3]

Q2) a) Air at 30°C is flowing across a tube with a velocity of 25 m/s . The tube could be either a square with side 5cm or a circular cylinder of diameter 5cm. The tube surface temperature is 124°C. Compare the rates of heat flow in each case. [6]

Use $Nu_D = 0.027Re_D^{0.805} Pr^{0.33}$ for circular tube

$Nu_D = 0.102Re_D^{0.657} Pr^{0.33}$ for square tube

b) What are Heisler charts? Explain its significance in solving transient conduction problems? [4]

Q3) a) An Aluminium sphere weighing 5.5 kg and initially at a temperature of 290°C is suddenly immersed in a fluid at 15°C. The convective heat transfer coefficient is 58W/m²K. Estimate the time required to cool the Aluminium to 95°C, using the lumped capacity method of analysis. [7]

b) Define and explain significance of Biot Number. [3]

P.T.O.

Q4) a) Explain velocity and thermal boundary layer. [5]

b) Write a note on Dimensionless numbers in Convection. [5]

Q5) Net radiation from the surfaces of the two large plates maintained at a temperature of 73°C and 23°C is to be reduced by 105 times. Calculate the number of radiation screens to be placed between them to achieve this effect. Assume that the emissivity of screen. $\epsilon_s = 0.05$ and that of surface $\epsilon_1 = \epsilon_2 = 0.8$. After this if one of the screen is removed how many times the net radiation be reduced? [10]

Q6) a) Explain filmwise and dropwise condensation. [6]

b) There is cylindrical projection of Diameter D and height H on a large plane surface. Find the shape factor of the projecting surface (top plate surface + curved cylindrical surface). w.r.t. to the plane surface. [4]

Q7) a) Using dimensional analysis establish a relation between Nusselt, Prandtl and Grashof numbers. [5]

b) A metal ingot. 5cm by 8cm by 12cm. at a temperature of 50°C. is losing heat by natural convection to air at 0°C. The vertical dimension is 12cm. Calculate the coefficient of heat transfer. [5]

Take Properties of Air - $\beta = 1/300 \text{ K}^{-1}$ $\nu = 15.89 \times 10^{-6} \text{ m}^2/\text{s}$

$K = 26.3 \times 10^{-3} \text{ W/mK}$ $\text{Pr} = 0.707$

Q8) Write a note on : [10]

a) Atmospheric and Solar radiation

b) Pool Boiling Curve

Table : Properties of Air

Temperature (°C)	$\nu(\text{m}^2/\text{s})$	$K(\text{W/mK})$	Pr	$\rho(\text{Kg/m}^3)$
42.5	17.4×10^{-6}	2.74×10^{-2}	0.705	1.217
77	20.92×10^{-6}	3×10^{-2}	0.7	1.217
100	23.13×10^{-6}	3.208×10^{-2}	0.688	0.946



Total No. of Questions : 8]

SEAT No. :

P4785

[Total No. of Pages : 2

[5060]-635

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) Write classification of energy sources. [6]

b) Explain the methods to derive the gaseous fuels from coal. [4]

Q2) The following are the data collected for a boiler using coal as the fuel. Find out the boiler efficiency by indirect method. Fuel firing rate = 5599.17 kg/hr. [10]

Steam generation rate = 21937.5 kg/hr Steam pressure = 43 kg/cm²(g)

Steam temperature = 377 °C Feed water temperature = 96 °C

%CO₂ 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 m² 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

P.T.O.

- Q3)** 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 m³/s. Total head is 115 m. 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. [6]
- b) Define various components of the compressed air distribution system. [4]
- Q4)** a) Explain the operating principle of stoker fired boilers. [6]
- b) Explain the topping and bottoming cycle of cogeneration. [4]
- Q5)** a) Write a note on bubbling bed boiler. [5]
- b) Energy Saving Opportunities in Cooling Towers. [5]
- Q6)** a) What is NPSH of a pump and effects of inadequate NPSH? [4]
- b) Explain the compressor modulation to improve the performance of compressed air system. [6]
- Q7)** Explain in detail any two methods to improve the efficiency of gas turbine power plant with cycle analysis. [10]
- Q8)** a) Explain working proportions for Pelton turbine. [5]
- b) Explain the factors affecting the pump performance. [5]



Total No. of Questions : 8]

SEAT No. :

P4786

[Total No. of Pages : 2

[5060]-636

M.E. (Mechanical-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 side indicate full marks.*
- 4) *Use of the logarithmic tables slide rule, Mollier charts electronic pocket calculator and steam tables is allowed.*
- 5) *Assume Suitable data, if necessary.*

Q1) a) List and explain the steps involved in detailed energy audit. **[5]**

b) Explain the safety considerations in energy audit. **[5]**

Q2) a) Explain in detail the methodology for conducting a detailed energy audit. **[5]**

b) Explain the following stating the advantages and limitations if any **[5]**

i) Simple Pay Back Period

ii) Return on Investment

iii) Internal Rate of Return

Q3) An uninsulated 100 mm pipe of 200m length carries steam at 10 kg/cm². The surface temperature measured is 165°C. Find out the annual cost saving achieved by insulating it with 50 mm. insulating material, which will bring the surface temperature down to 60°C. The boiler efficiency is 85% and the fuel oil (with GCV of 10000 Kcal/kg) cost is Rs.14000/tonne and ambient air temperature is 30°C and ambient temperature is 30°C and annual operating hour is 8000 hours. **[10]**

P.T.O.

- Q4)** a) Write short note on excess air control. [5]
b) Explain in detail condensate recovery and mention benefits of condensate recovery. [5]
- Q5)** a) Explain step by step approach for maximum demand control. [5]
b) Briefly list various energy conservation opportunities in a refrigeration plant. [5]
- Q6)** a) What are flow control strategies of the fan? [5]
b) Define energy management and objectives of the energy management. [5]
- Q7)** a) What is boiler blow down? [5]
b) Explain heat transfer loops in case of refrigeration system. [5]
- Q8)** a) Explain the classification of radioactive wastes by radioactivity concentration with the help of graph. [5]
b) Write short note on thermal heat wheels. [5]



Total No. of Questions : 7]

SEAT No. :

P4787

[Total No. of Pages : 2

[5060]-638

M.E. (Mechanical) (Energy Engineering)

NUCLEAR MATERIALS AND REACTOR FUNDAMENTALS

(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 the fission process using the liquid drop model of a nucleus.[4]

b) Describe the following processes : [6]

- i) Alpha decay
- ii) Beta-minus decay
- iii) Beta-plus decay
- iv) Electron capture
- v) Internal conversions
- vi) Isomeric transitions

Q2) a) Explain the following scattering interactions between a neutron and a nucleus : [6]

- i) Elastic scattering
- ii) Inelastic scattering

b) Why uranium-235 fissions with thermal neutrons and uranium-238 fissions only with fast neutrons? Explain in detail. [4]

P.T.O.

- Q3)** a) Describe the following reactions where a neutron is absorbed in a nucleus: [6]
i) Radioactive capture
ii) Particle ejection
b) Explain the effect of radiation damage on nuclear materials. [4]
- Q4)** a) Explain the following processes of nuclear fuel enrichment. [5]
i) Gaseous diffusion
ii) Centrifuge process
b) How nuclear fuel rods are manufactured? Explain in detail. [5]
- Q5)** a) Explain various grades of enriched uranium and their applications. [5]
b) What is In-situ leaching? Explain in detail. [5]
- Q6)** a) Describe the relationship between the delayed neutron fraction, average delayed neutron fraction, and effective delayed neutron fraction. [5]
b) What is the purpose of control rod and moderator in nuclear reactor? Explain various types of control rods and moderators. [5]
- Q7)** Define and explain the following terms : [10]
a) Enriched uranium
b) Depleted uranium



Total No. of Questions : 8]

SEAT No. :

P4788

[Total No. of Pages : 2

[5060]-639

M.E. (Mechanical) (Energy Engineering)
ENERGY SYSTEMS MODELLING AND ANALYSIS
(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 calculator is allowed.*

- Q1)** a) Explain necessity of system modeling. [4]
b) What are different types of model? Explain Mathematical model. [6]
- Q2)** a) Explain the concept of interaction between models. [6]
b) What do you mean by best fit and exact fit? [4]
- Q3)** a) Derive required expression using least square method to fit quadratic equation. [6]
b) Compare the simulation and analytical methods. [4]
- Q4)** a) Write the general procedure to fit $y = ae^{bx}$ by least square method. [6]
b) Explain numerical model. [4]
- Q5)** a) What is importance of simulation techniques in engineering applications?
Write different methods of simulation. [5]
b) Explain different steps in simulation study. [5]

P.T.O

Q6) Maximize: $Z = 2x_1 + x_2$. By using suitable Method.

[10]

Subject to: $x_1 + 2x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1 - 2x_2 \leq 1$

$x_1, x_2 \geq 0$

Q7) a) Write algorithm to find optimum design using exhaustive search technique.

[5]

b) Explain Fibonacci search technique and write its algorithm to find optimum design.

[5]

Q8) Minimize the function $f(x) = 0.65 - [0.75/(1 + x^2)] - 0.65x \tan^{-1}(1/x)$; in the interval $[0,3]$ using the golden section method with $n = 6$. Also find reduction ratio.

[10]



Total No. of Questions : 7]

SEAT No. :

P5102

[Total No. of Pages : 2

[5060]-641

M.E. (Mechanical - Mechatronics)
SYSTEM MODELLING, IDENTIFICATION & 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.*

Q1) Write the generic state space model of a MDOF system in Diagonal form and discuss the advantage of such form. **[10]**

Q2) Draw the signal flow diagram for below transfer function. **[10]**

$$\frac{C(s)}{R(s)} = \frac{24}{(s+2)(s+3)(s+4)}$$

Q3) Determine the EOM of mechanical system (Fig Q3 (a)) using the Lagrangian approach. **[10]**

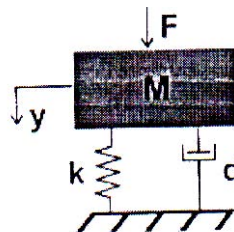


Figure Q 3

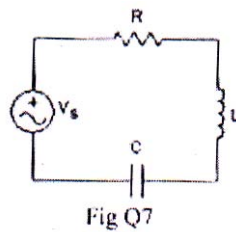
P.T.O.

Q4) Using a suitable block diagram explain the process of identification of a frequency domain model. **[10]**

Q5) List 3 types of fuzzy logic membership functions and explain their selection process. **[10]**

Q6) Draw the flow chart and explain the working of Unscented Kalman Filter. **[10]**

Q7) Draw the bond graph for the electrical system shows in figure Q7. **[10]**



Total No. of Questions : 7]

SEAT No. :

P5096

[Total No. of Pages : 2

[5060] - 642

M.E (Mechanical - Mechatronics) (Semester - I)

CONTROL SYSTEMS - I

(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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) Discuss, in detail, the advantages and dis-advantages offered by the LQR type control technique. **[10]**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3.96 & -3.42 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

$$y = [407 \quad 372.8] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0]u$$

Q2) Determine the location of the poles, the zeros and comment on the stability of the system, the open loop state space model of which is given by Eq.1 **[10]**

Q3) For the system in Eq.1, determine the controllability and the observability matrix and comment on the system's controllability and observability. **[10]**

Q4) For the system in Eq.1, using a suitable technique, determine a full state feedback gain, k, such that the desired closed loop system has its poles located at -1 and -2 respectively. Also, determine the state matrix of the closed loop system. **[10]**

P.T.O

- Q5)** Using the Ackerman's method, determine the observer gain, L , such that the observer poles are located at 6 times the closed loop poles. Consider the closed loop poles to be at -1 and -2 respectively. Also, determine the state matrix of the compensator. **[10]**
- Q6)** Draw a suitable block diagram and explain the design of a reduced order observer using a suitable example. **[10]**
- Q7)** Draw a block diagram for a control system made up of the plant, the observer and the compensator and define all the variables / parameters in the block diagram. **[10]**



Total No. of Questions : 7]

SEAT No. :

P4789

[Total No. of Pages : 2

[5060]-643

**M.E. (Mechanical) (Mechatronics)
SENSORS, TRANSDUCERS AND
INTERFACING TECHNIQUES
(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, diagrams wherever necessary.*
- 4) Use of scientific calculator is allowed.*
- 5) Assume suitable data, if necessary.*

- Q1)** a) Discuss the causes a different types of experimental errors. State the general considerations with respect to data analysis. **[5]**
- b) Seven observers were asked to make a measurement of the thickness of steel block whose actual thickness is 2.00 cm. Their readings are \Rightarrow 2.002, 2.001, 1.999, 1.997, 1.998, 2.003 & 2.003 cm. Comment on these measurements using whatever criteria you think appropriate & applicable **[5]**
- Q2)** a) State the general features of oscilloscope. Draw a neat block diagram of CRO & explain its operation. State the different applications of CRO. **[5]**
- b) With the help of neat diagram explain the working of LVDT. Draw experimental set-up for any one application using LVDT. **[5]**
- Q3)** a) Explain diaphragm & bellows gages using neat diagram. **[5]**
- b) With the suitable diagram explain ionization gage. Differentiate the same with pirani gage in detail. **[5]**
- Q4)** a) With help of neat schematic diagram explain: **[5]**
- i) Rotameter
 - ii) Ultrasonic flow meter

P.T.O

- b) Write short notes on : [5]
- i) LDA
 - ii) Pressure probes
- Q5)** a) Describe the different schemes of temp measurement by electrical effects. [5]
- b) With neat diagram explain : [5]
- i) Viscosity measurement
 - ii) pH measurement.
- Q6)** a) Explain resistances strain gages in detail. [5]
- b) Draw a neat schematic diagram of temperature compensation arrangement for resistance strain gauge & explain it. [5]
- Q7)** a) Enlist the objectives of data acquisition system. Explain the need of signal conditioning block in DAS. [5]
- b) State the different types of A-to-D converter. Draw & explain any one ADC type in detail. [5]



Total No. of Questions : 8]

SEAT No. :

P5098

[Total No. of Pages : 3

[5060]-645

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) Develop ladder program for the following industrial objective. Given START, STOP, UP and DOWN buttons are push to on momentary switches. LS1 and LS2 are limit switches of NC type. The motor M1 is employed to take the platform up and motor M2 is used to take the platform down. Figure Q3 (a) shows the details. [10]

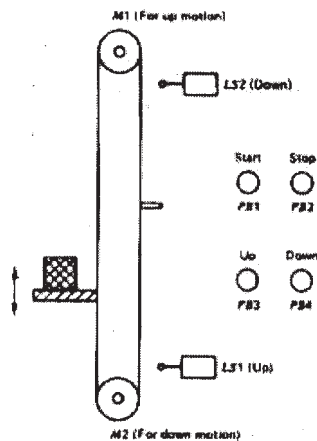


Figure Q3 (a)

P.T.O.

- a) When START button is pushed the platform shall move downwards if not at bottom.
- b) When STOP button is pushed the platform shall stop where it is.
- c) When UP button is pushed the platform shall move upward if it is not going down.
- d) When DOWN button is pushed the platform shall move downwards if it is not going up.

Write the PLC program for objectives (a) to (d) individually and then write the complete program.

- Q2)** a) Compare PLC and Computer w.r.t. Input/Output. [5]
b) Compare Function Block Diagrams and Ladder Diagrams for logic AND and logic OR. [5]
- Q3)** a) Explain Sequencer Instructions, Sequencer Programs with an example. [5]
b) Explain any two Transducers and Sensors used with PLC sequence programming. [5]
- Q4)** a) Write a PLC ladder program for staircase wiring and direction reversal of DC motor with unipolar power supply. [5]
b) Enlist the specifications of Discrete I/O Module, analog I/O Modules used in PLC. [5]
- Q5)** a) Explain Electromagnetic Relay and its use as NOT gate. [5]
b) Explain Relay Type Instruction. [5]

- Q6)** a) Compare Hard wired logic and PLC Ladder logic. [5]
b) Explain Timer Instruction and its types. [5]
- Q7)** a) Explain Jump instructions and subroutines with one example each. [6]
b) Develop a Gate Logic and corresponding PLC ladder logic diagram for any three of the following : [4]
i) $Y = (A.B) + (\bar{C} + D)$
ii) $Y = (ABC + D) (E + \bar{F})$
- Q8)** Three push-to-on buttons PB1, PB2 and PB3 are given as input and RED and GREEN light as output are given. Develop a ladder diagram to accomplish following objectives. [10]
a) When PB1 is pushed the process starts.
b) When PB2 is pushed after 5 seconds RED bulb glows.
c) When PB3 is pushed 3 times GREEN bulb glows.



Total No. of Questions : 7]

SEAT No. :

P5130

[Total No. of Pages : 2

[5060]-646

M.E. (Mechanical-Mechatronics)

CONTROL SYSTEMS II

(2013 Pattern) (Semester - II)

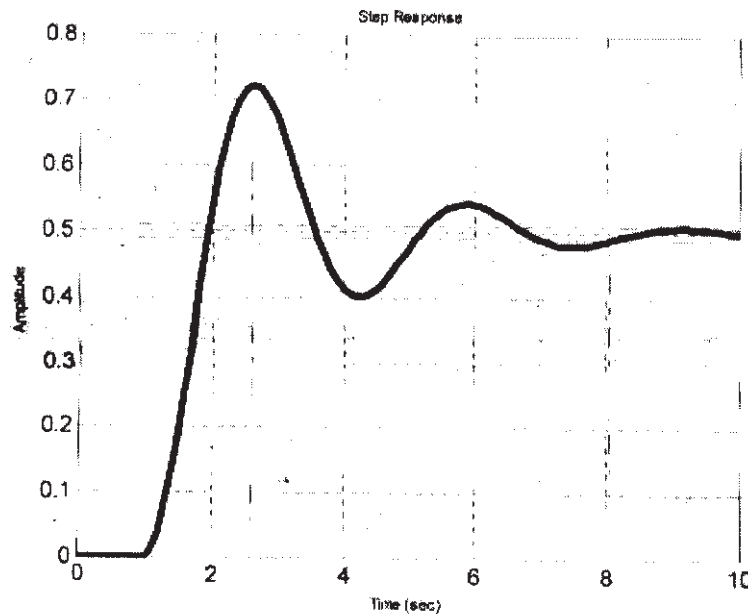
Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Answer any five questions.
- 2) Neat 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) Using a suitable technique identify a second order model from the below step response. [10]



Q2) Discuss the advantages and dis-advantages of Nyquist Plot w.r.t. to other frequency domain methods. [10]

Q3) Draw a suitable block diagram and derive the transfer function for PID control in parallel form and the equation for control signal for the said controller. [10]

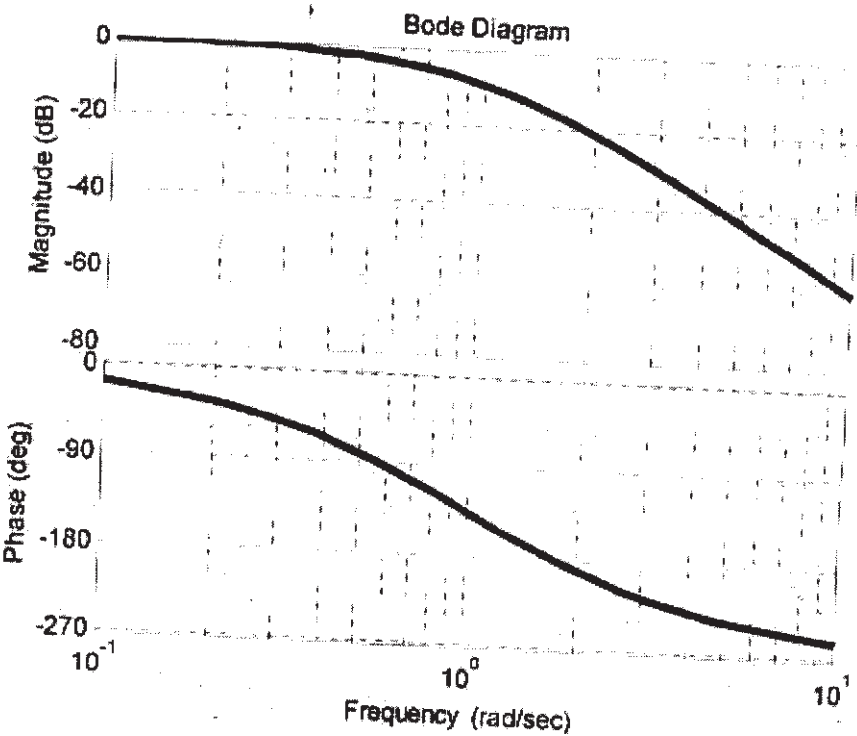
P.T.O.

Q4) Define Actuator Windup; discuss its consequences and a technique to overcome the effect of Actuator Windup. **[10]**

Q5) Draw a suitable block diagram and explain the operation of Internal Model Controller using a suitable example. **[10]**

Q6) Draw a suitable block diagram and explain the operation of Kappa Tau Controller tuning technique using a suitable example. **[10]**

Q7) Determine the Gain and the Phase Margin from below plot and comment on the system stability. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4790

[Total No. of Pages : 2

[5060]-647

**M.E. (Mechanical) (Mechatronics)
INDUSTRIAL DRIVES AND ACTUATORS
(2013 Pattern) (Semester -II)**

Time : 3 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 selection of Electric Drive with reference to : **[10]**

- a) Match between motor and Load.
- b) Thermal consideration.

Q2) Explain DC servo drives transfer function model for small signal dynamic performance **[10]**

- Q3)** a) Explain with performance curves the equal percentage valve used in industrial applications. **[5]**
- b) Explain chain boxes in mobile cranes. **[5]**

Q4) Explain how harmonic currents and losses will cause impact of non sinusoidal excitation on Induction motor. **[10]**

- Q5)** a) Discuss the applications of Hydraulic motors with suitable justifications. **[5]**
- b) Differentiate between feedback and feed-forward controller. **[5]**

P.T.O

Q6) a) Explain the operation line frequency variable voltage Induction motor drive. [6]

b) Find Torque angle relationship of synchronous motor. [4]

Q7) Explain the provision in hydraulic cylinders to avoid the jerk at the piston end. [10]

Q8) Answer any two : [10]

a) Constant power and constant torque drive.

b) Single seated valve and double seated valve.

c) Classification of electric drives.



Total No. of Questions : 8]

SEAT No. :

P4791

[Total No. of Pages : 2

[5060]-649

M.E. (Mechatronics) (Mechanical)

**MICROCONTROLLER APPLICATIONS IN EMBEDDED
SYSTEMS**

(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 whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, whenever necessary.*

- Q1)** a) Discuss flags in STATUS register of PIC18F microcontroller in detail. **[4]**
- b) Explain with neat diagram program memory of PIC18F microcontroller. **[4]**
- c) Explain with example instruction format for Bit-Oriented operations. **[2]**
- Q2)** a) Draw and explain block diagram of PIC18F microcontroller with MPU and memory. **[4]**
- b) Explain the term directive in an assembler and list out commonly used directives. **[4]**
- c) Explain the result after the execution of the following instructions. Identify the status of flags. **[2]**
- MOVLW FAH
ADDLW 38H
- Q3)** a) What is subroutine? Explain PIC18 CALL and RETURN Instructions. **[4]**
- b) Explain with Block diagram basic concepts in I/O Interfacing. **[4]**
- c) Explain stack of PIC18F microcontroller. **[2]**

P.T.O

- Q4)** a) Explain basic concepts of counters with their features. [4]
b) Draw and explain with block diagram Timer 0 of PIC18F in 16-bit Mode. [4]
c) Write different interrupts used in PIC 18 Microcontroller. [2]
- Q5)** a) Explain interfacing a temperature sensor to the A/D converter module. [4]
b) Explain in detail PIC18F A/D Converter module. [4]
c) Write different A-to-D conversion methods. [2]
- Q6)** a) Explain Hardware Aspect of the Time and Temperature Monitoring System (TTMS). [4]
b) Explain special features of the PIC18F4520 family. [4]
c) List out features of embedded systems. [2]
- Q7)** a) Draw and explain programming model of PIC 18F microcontroller. [5]
b) Explain data transfer in Inter-Integrated circuit protocol. [5]
- Q8)** a) Explain CCP Modules of PIC18F microcontroller. [5]
b) Explain with neat diagram support devices of PIC 18F microcontroller. [5]



Total No. of Questions : 8]

SEAT No. :

P4792

[Total No. of Pages : 2

[5060]-650

ME. (Mechanical) (Mechatronics)
FLEXIBLE MANUFACTURING SYSTEMS
(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 Electronic pocket Calculator is allowed.*
- 5) *Assume Suitable data, if necessary and mention it clearly.*

Q1) Explain the functions and machine tools used in modern manufacturing systems. **[10]**

Q2) In the operation of an automated production line with storage buffers, what does it mean, if a buffer is nearly always empty or nearly always full? **[10]**

Q3) Explain the effect of poor quality parts, as represented by the fraction defect rate, on the performance of an automated assembly system. **[10]**

Q4) Explain in brief component and layout of FMS **[10]**

Q5) In mixed model assembly line, what is difference between variable-rate launching and fixed rate launching. **[10]**

Q6) Write NC part program for the part shown in Fig. 1. Assume suitable data. **[10]**

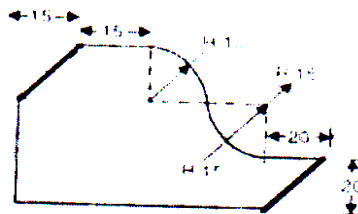


Fig. 1, Q. No.6

P.T.O

- Q.7)** a) Differentiate between DNC and CNC. [5]
b) Explain OPTIZ. [5]
- Q.8)** a) Explain Importance of SQC charts. [5]
b) Write short note on Lean Production. [5]



Total No. of Questions : 8]

SEAT No. :

P4793

[Total No. of Pages : 2

[5060]-661

M.E. (Electrical Control System)

COMPUTER TECHNIQUES IN CONTROL SYSTEM

(2013 Pattern) (Semester - I)

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) Explain what do you understand by Lagrange Function. [9]

Q2) Use analytical method to investigate for extremum point [9]

$$F(x) = -3x^4 + 10x^3 - 20.$$

Q3) Explain what do you understand by Multivariable Optimization with no constraint. Write necessary and sufficient condition. [9]

Q4) Find condition for minimization of the following condition by classical method [9]

$$F(x) = 0.5 k_2 x_1^2 + 0.5 k_3 (x_2 - x_1)^2 + 0.5 k_1 x_2^2 - P x_2$$

Q5) Explain method of conversion of non serial system to serial system problem. [16]

Q6) Use simplex method solve: [16]

$$\begin{aligned} \text{Minimize} \quad & F = X_1 - 3 X_2 + 2 X_3 \\ \text{Subject to} \quad & 3X_1 - X_2 + 2 X_3 < 7 \\ & -2X_1 + 4X_2 < 12 \\ & -4X_1 + 3 X_2 + 8 X_3 < 10 \\ & X_1, X_2, X_3, > 0 \end{aligned}$$

P.T.O

Q7) a) Explain the step by step procedure of revised simplex method. [8]

b) Write the steepest descent method of optimization of a problem. [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. :

P4794

[Total No. of Pages : 2

[5060]-662

**ME. (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) Write short note on Motivation and Leadership in process control management. [6]
- b) Draw & explain block diagram of process control system. [6]
- c) What are essential needs for a control system to be satisfied? [6]

OR

- Q2)** a) What are formal & informal groups? Describe each with example. [6]
- b) Describe with appropriate diagram, liquid level control in process industry. [6]
- c) Explain with suitable example control strategies for designing of control system. [6]

- Q3)** a) Explain The Discrete PID Control Algorithm. [8]
- b) Explain cascade control system for Continuous Stirred Tank Reactor.[8]

OR

- Q4)** 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]

P.T.O

- Q5)** a) What is one-way decoupling of two control loops? Why it could be acceptable? [8]
- b) Explain the effect of interaction on stability of process control system. [8]

OR

- Q6)** a) Explain the effect of interaction on the stability of multi loop control systems. [8]
- b) What is one way decoupling of two control loops? Why it could be acceptable? [8]



Total No. of Questions : 6]

SEAT No. :

P5073

[5060]-663

[Total No. of Pages : 2

**M.E. (Electrical) (Control System)
NONLINEAR CONTROL SYSTEM
(2013 Course) (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 indicate full marks.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

Q1) a) Explain in details various nonlinearities present in the system. **[4]**

b) Draw phase plane trajectory by Isocline method for unity feedback control system having an ideal relay with output ± 2 cascaded with

$$G(S) = \frac{1}{S^2 + 2S}. \text{ Consider initial condition } (1,0) \quad \mathbf{[5]}$$

c) Derive describing function for relay with dead zone. **[4]**

d) Explain for a given function concepts of

i) Positive and negative definite

ii) Positive and negative semidefinite

iii) Indefinite **[5]**

OR

Q2) a) Explain various methods for analysis of Nonlinear control system. **[4]**

b) Explain Delta method to plot phase plane trajectory. **[5]**

c) Express the scalar function given below in Quadratic form and test it for definiteness $V(x) = 2x_1^2 + 3x_2^2 + 4x_3^2 + 2x_1x_2 - 3x_2x_3 + 5x_1x_3$. **[4]**

d) A unity feedback control system having ideal relay with output ± 1

cascaded with $G(S) = \frac{1}{S(S+2)(S+3)}$. Apply describing function

method to determine stability. Calculate amplitude and frequency of limit cycle. **[5]**

P.T.O.

- Q3)** a) Explain Liapunov indirect method to determine stability. [8]
- b) Select Liapunov function as $V(x) = 2x_1^2 + x_2^2$ and determine stability for $\dot{x}_1 = x_2, \dot{x}_2 = -x_1 - 2x_2$. [8]

OR

- Q4)** a) Explain krasovskii method to determine stability of system. [8]
- b) For LTI system $\dot{x} = Ax$ derive expression $A^T P + PA = -Q$ where P and Q are square symmetric positive definite matrix. [8]

Q5) Write short note on: [16]

- a) Input-Output Linearization.
- b) Notion of sliding mode control.

OR

- Q6)** a) Explain indetail feed back Linearization. [6]
- b) Explain Nonlinear control system design using sliding mode technique. [10]

x x x

Total No. of Questions : 4]

SEAT No. :

P4795

[Total No. of Pages : 2

[5060]-664
M.E. (Electrical)
RESEARCH METHODOLOGY
Control Systems / Power Electronics and Drives / Power
Systems
(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.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) Explain what is meant by research? What are the characteristics of research? [5]
- b) Explain the following terms. [4]
- i) Review
 - ii) Patent

OR

- a) Distinguish between Research methods and Research methodology. [5]
- b) With examples explain primary and secondary sources. [4]

- Q2)** a) Explain the characteristic of good sampling design. [5]
- b) What are the methods available for data collection? Explain any one in brief. [4]

OR

- a) Explain the following terms: [5]
 - i) Systematic bias
 - ii) Sampling error
- b) Explain the following processing operations in context of data collection and analysis. [4]
 - i) Coding
 - ii) Classification

P.T.O

- Q3)** a) Detail the structure of a technical report. [8]
b) What are the important steps needed for doing an effective Oral presentation? [8]

OR

- a) What are the different types of reports? Explain the supplementary parts of a technical report. [8]
b) Explain the usefulness of Latex in technical report writing. [8]

- Q4)** a) What are the different parts of a technical research proposal? [10]
b) Clearly explain the salient points of review paper and poster paper. [6]

OR

- a) What are the different parts of a technical research proposal? [10]
b) Explain the following terms in detail. [6]
i) Copyright
ii) Trademark



Total No. of Questions : 6]

SEAT No. :

P5074

[5060]-666

[Total No. of Pages : 2

M.E.(Electrical) (Control Systems)
MULTIVARIABLE AND OPTIMAL CONTROL SYSTEMS
(2013 Credit Pattern) (Semester-II) (503107)

Time :3Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
- 2) *Assume suitable data if necessary.*

- Q1)** a) Explain the concept of stability of multivariable control system represented in state space. **[4]**
- b) Explain with block diagram the structure of a typical multivariable control system. Explain any one industrial multivariable control system. **[5]**
- c) Explain decoupling or non-interactive control for multivariable control system design. **[5]**
- d) Discuss factors to be considered in the formation of an optimal control problem using quadratic performance index. **[4]**

OR

- Q2)** a) Discuss in detail the pole placement using Linear state Variable Feedback in multivariable control system. Draw appropriate block diagram. **[5]**
- b) Define and explain the concept of controllability and observability of multivariable control system. **[4]**
- c) Discuss any one classical method which can be extended to analysis of multivariable control system. State its limitations. **[4]**
- d) Explain clearly the iterative method for the numerical solution of reduced order matrix Riccati Equation. **[5]**

P.T.O.

- Q3)** a) Consider the system with state equation $\dot{x}_1 = x_2, \dot{x}_2 = -x_2 + u$ the performance index to be minimize is $J = \frac{1}{2} \int_{t_0}^{t_1} (x_1^2 + u^2) dt$ Find the optimal control $u^*(t)$ satisfying $-1 \leq x_1 \leq 2$ for $t \in [t_0, t_1]$ [8]
- b) Outline the procedure for solving optimal control problem using Pontryagin's minimum principle. [8]

OR

- Q4)** a) State and explain the Pontryagin's minimum principle. [8]
- b) Discuss briefly the relation between the Pontryagin's minimum principle and dynamic programming. [8]

- Q5)** a) Explain the bang-bang control strategy and state the merits of bang-bang controller [8]
- b) Plant equations are given by $\dot{x}_1 = x_2, \dot{x}_2 = u$ Minimize performance index $J = \frac{1}{2} \int_{t_0}^{t_1} (u^2) dt, t_0 = 0, t_1 = 2.$ [8]

OR

- Q6)** a) Define and explain singular control problem. [8]
- b) Draw the block diagram showing the structure of Feedback time- optimal (minimum time) control system and explain with an example the minimum time-optimal control problem. [8]



Total No. of Questions : 7]

SEAT No. :

P4796

[Total No. of Pages : 2

[5060]-667

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.4 or Q.5, Q.6 or Q.7. questions 3 is compulsory.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.

- Q1) a) Explain any two Nonparametric methods of system identification. [4]
b) Compute the QR factorization of the matrix: [6]

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 2 \\ 0 & 0 & 3 \end{bmatrix}$$

OR

- Q2) a) Estimate the parameter vector for the given model. [6]

$$y(t) = ay(t-1) + bu(t-1) + e(t)$$

t	1	2	3	4	5
$u(t)$	1	0	1	1	0
$y(t)$	0	1	-0.5	1.25	0.375

- b) What is the importance of a persistently exciting input signal in system identification? What order of p.e. is white noise? [4]

- Q3) Write notes on any two: [8]

- a) Recursive Estimation
- b) Maximum Likelihood Method
- c) Deciding the order of a Model
- d) Bayesian Learning

P.T.O

Q4) a) Prove the Matrix Inversion Lemma : **[4]**

$$[A + BCD]^{-1} = A^{-1} - A^{-1} B [C^{-1} + D A^{-1} B]^{-1} D A^{-1}$$

b) What are the various adaptive schemes and how are they implemented? **[12]**

OR

Q5) a) Explain the working of gain scheduling scheme. Give two applications of this scheme. **[8]**

b) Explain the pole placement design of an STR and derive the Diophantine equation. **[8]**

Q6) Using both the MIT rule and Lyapunov theory, design an MRAS for a system described by: **[16]**

$$G(s) = \frac{b}{s+a}, \text{ where } a \text{ and } b \text{ are unknown.}$$

The controller is given by $u(t) = \theta_1 u_c(t) + \theta_2 y(t)$, and the desired closed

loop model is $\frac{dy_m}{dx} = -a_m y_m + b_m u_c$. Draw the simulation diagram and compare

the two methods. Assume $V(\theta) = \frac{1}{2} \left[e^2 + \frac{1}{by} (b\theta_2 + a - a_m)^2 + \frac{1}{by} (b\theta_1 - b_m)^2 \right]$

OR

Q7) 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 : **[10]**

$$\frac{dv}{dt} = -av + bu \text{ and } \frac{dy}{dt} = v; \text{ where } a \text{ and } b \text{ are unknown.}$$

Assume the control law $u = \theta_1 (u_c - y) - \theta_2 v$ 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.



Total No. of Questions : 3]

P4797

SEAT No. :

[Total No. of Pages : 2

[5060]-668

M.E. (Electrical Control Systems)
ADVANCED DIGITAL CONTROL TECHNIQUES
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

- 1) *Answer all questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

Q1) Solve any three.

[18]

- a) Elaborate digital modeling with sample and hold devices. What are the important considerations while selecting the value of sampling period?
- b) Explain how stability can be improved by state feedback?
- 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.

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -1 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u(x); Y(x) = [10]x(t)$$

- d) Explain decimation and interpolation process with the help of spectral analysis.
- e) Explain with respect to Digital system:
 - i) Closed form solution of $G(T)$
 - ii) Partial matching of states

Q2) Solve any two.

[16]

- a) Design FIR filter by Fourier Series Method.
- 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.

P.T.O.

Q3) Solve any two.

[16]

- a) What are the advantages of TMS 320C54X?
- b) What is fixed point and floating point DSP? Explain in detail.
- c) Give functional block diagram of TMS 320C54X processor and explain it.
- d) Explain instruction set of TMS 320C54X DSP.



Total No. of Questions : 6]

SEAT No. :

P5075

[5060]-670

[Total No. of Pages : 2

M.E.(Electrical)(Control System)
ADVANCED DRIVES AND CONTROL
(2013 Credit Pattern) (Semester-III) (603101)

Time :3Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer Q 1 or Q 2, Q 3 or Q 4 and Q 5 or Q 6.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Explain multiquadrant operation of electric drive. **[4]**
- b) Write a detail note on torque pulsation in dc motor drive. **[4]**
- c) Explain static krammer control of induction motor drive. **[5]**
- d) Write a note on direct torque control of three phase induction motor drive. **[5]**

OR

- Q2)** a) Derive the criterion of steady state stability of electric drive. **[4]**
- b) Derive the system model of DC motor drive. **[4]**
- c) Explain the impact of nonsinusoidal oscillations on the performance of three phase induction motor drive. **[5]**
- d) Write a note on direct vector control of three phase induction motor drive. **[5]**
- Q3)** a) With reference to control of synchronous motor drive, explain dynamic d-q model. **[8]**
- b) Write a note on Switched Reluctance Motor drive. **[8]**

OR

P.T.O.

Q4) a) Explain solid state controller used for permanent magnet synchronous motor drives. [8]

b) Explain Trapezoidal SPM drive. [8]

Q5) a) Explain the effect of RMS voltage variation on the behavior of the electric drive. [8]

b) Explain phase locked loop in closed loop control of electric drive. [8]

OR

Q6) Explain the role of following controller in closed loop control of electric drive.

a) PI controller [8]

b) PID controller [8]



Total No. of Questions : 6]

SEAT No. :

P4798

[Total No. of Pages : 2

[5060]-671

M.E. (Electrical) (Control System)

COMPUTERAIDED CONTROL SYSTEM DESIGN

(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) *Assume suitable data, if necessary.*

- Q1)** a) Explain the computer method for determining the controllability and observability of control system. Draw the flow chart and give its algorithm. **[6]**
- b) Derive the transfer function of the following compensator networks and draw the corresponding Bode diagrams. **[6]**
Phase – lag network
- c) Explain the importance of computer as an aid in the analysis and design of control system. **[6]**

OR

- Q2)** a) Explain the computer method for obtaining the solution of state and output equations of a closed – loop control system represented by **[8]**
 $x(t) = Ax(t) + Bu(t)$
 $y(t) = Cx(t)$
With usual notation. Give its algorithm.
- b) Draw the block diagram of observer system and explain with the designing steps of full order observe. **[4]**
- c) Explain clearly terms ‘Absolute stability’ and ‘Relative stability’. Explain the measures of relative stability using polar plot and bode diagrams. **[6]**
- Q3)** a) Explain with diagram the working of P, PI and PID controller. **[8]**
- b) Explain step by step the design procedure of tunable PID controller using Ziegler – Nicol’s method. Give its algorithm. **[8]**

P.T.O.

OR

- Q4) a)** Explain with algorithm the computer method of design of PID controller using Ziegler-Nichols method. State the limitations of this method. [8]
- b) Consider a process control system with plant transfer function [8]

$$G_p(s) = \frac{30}{s^3 + 11s^2 + 36s + 36}$$

Design a PID controller for this system using Ziegler-Nichols method.

- Q5) a)** Draw the block diagram of a typical digital control system and explain clearly the working of each block. What is the effect of sampling period 'T' on the stability of the system? [8]
- b) Consider the system

$$x(k+1) = Gx(k) + Hx(k), \text{ where } G = \begin{bmatrix} 0 & 1 \\ 0.16 & 1 \end{bmatrix}, H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Determine a suitable state feedback gain matrix K such that the system will have the closed loop poles at $z = 0.5 + j0.5$, $z = 0.5 - j0.5$ [8]

OR

- Q6) a)** Discuss the advantages of digital controller over continuous time controller, also explain the problems in implementing digital control system. [8]
- b) A discrete time control system is represented by the differential equation $x(k+1) = Fx(k) + Gu(k)$. Where k is the sampling instant, x(k) is n x 1 state vector, u(k) is m x 1 control vector, F and G are constant matrices of compatible dimensions. Explain the computer method for obtaining closed loop system response. Draw flow chart and give its algorithm. [8]



Total No. of Questions : 3]

SEAT No. :

P4799

[Total No. of Pages : 2

[5060]-673

M.E. (Electrical) (Power Electronics & Drives)
MODELING AND ANALYSIS OF ELECTRICAL MACHINES
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instuction:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

Q1) a) Draw and explain the representation diagrams of basic two-pole machine and primitive machine for the following machines: **[8]**

- i) Three phase induction motor
- ii) dc compound machine
- iii) dc shunt machine.

OR

The brush axis of a separately excited dc motor armature is displaced from q-axis by an angle α degrees. Show that its electromagnetic torque T_e given by the expression, **[8]**

$$T_e = [M_d I_f I_a \cos \alpha + \frac{1}{2} I_a^2 (L_d - L_q) \sin 2\alpha]$$

b) Giving example, explain the term 'Invariance of power as applied to transformation theory in Electrical machines. **[10]**

OR

From the voltage equations in d-q frame, derive the expression for instantaneous torque of a three-phase induction motor.

Q2) a) Using the impedance matrix for a 3-phase, 4-salient pole synchronous machine fitted with amortisseurs, derive the expression for instantaneous torque. **[10]**

b) A 3 phase, 50 Hz cylindrical-rotor synchronous machine has the following parameters: **[8]**

Armature leakage inductance = 0.35 mH

Self-inductance for phase A 3.15 mH

For this machine, calculate the Synchronous reactance

Q3) Write the short notes on : (any two)

[2 × 7 = 14]

- a) Linearised model of Synchronous machine
- b) Linearised model of Induction motor
- c) Small displacement stability



Total No. of Questions : 6]

SEAT No. :

P4800

[Total No. of Pages : 1

[5060]-674

**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 students :

- 1) *Solve Q.1 or Q.2, 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) Write note on optimal selection of Pumps and Fans. [9]

b) What are symptoms of poor power quality? [9]

OR

Q2) a) Discuss various losses in the capacitors and maintenance of capacitors. [9]

b) Write note on interharmonics. [9]

Q3) a) Write note on power quality state estimations. [8]

b) Write detail note on different voltage variation indices. [8]

OR

Q4) a) Write the procedure to design a harmonic filter. [8]

b) What are the various causes of voltage flicker? [8]

Q5) a) Write detail note on Power quality measuring equipment. [8]

b) Enlist the different power quality monitoring standards and explain them. [8]

OR

Q6) a) Explain objectives and consideration of power quality monitoring [8]

b) Explain the application of intelligent system in power quality monitoring. [8]



Total No. of Questions : 6]

SEAT No. :

P4801

[Total No. of Pages : 2

[5060]-675

M.E. (Electrical) (Power Electronics & Drives)

POWER CONVERTERS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of electronic calculator is allowed.*
- 4) *Assume Suitable data, if necessary*

Q1) a) Explain with necessary diagrams and waveforms the operation of a single phase half controlled converter. Derive expression for average output power. **[10]**

b) Explain Single pulse width modulation and Sinusoidal pulse width modulation technique **[8]**

OR

Q2) a) Explain six step voltage source inverter (120 deg mode) with necessary waveforms and derive line- line output voltage equation using Fourier series. **[10]**

b) Explain the Buck Converter with necessary wave forms **[8]**

Q3) a) Draw circuit diagram of single phase cycloconverter and explain its working with output waveforms. **[8]**

b) What are the advantages and limitations of ZCS converter **[8]**

OR

Q4) a) With a neat diagram explain the working of series loaded resonant half bridge dc-dc converter **[8]**

b) Write a short note on classification of Resonant converters **[8]**

Q5) a) A single phase ac voltage regulator with RL load has following details
supply voltage = 230 V 50Hz R=4 ohms and $\omega L=3$ ohms [8]
Calculate control range of firing angle ,Maximum value of RMS load
current Maximum power.

b) Explain the working of a AC voltage controller with RL load [8]

OR

Q6) a) Explain three phase AC voltage controller with necessary circuit diagram
and waveforms. [8]

b) A 230 V 1kW electric heater is fed through AC voltage controller from
230V,50Hz Ac supply. Find the load power for a firing angle delay of 70
degrees [8]



Total No. of Questions : 8]

SEAT No. :

P4802

[Total No. of Pages : 2

[5060]-677

M.E. (Electrical) (Power Electronics & Drives)

AC AND DC DRIVES

(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to candidates :

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*

Q1) a) Explain field oriented control of induction motor. State the merits of vector control of induction motor. **[5]**

b) With the complete implementation block diagram explain static Kramer drive system. **[4]**

OR

Q2) a) Explain speed control of DC series motor fed from single phase semi-converter for discontinuous mode operation. Also Discuss output waveform and output equation. **[5]**

b) Explain single quadrant operation of DC chopper fed Series motor. Evaluate the performance parameters. **[4]**

Q3) a) Explain implementation of vector control of induction motor for stator field oriented control of induction motor. **[5]**

b) Explain closed loop speed control of induction motor using stator voltage control. **[4]**

OR

Q4) a) Explain speed control of DC separately excited motor fed by fully controlled converter for continuous conduction mode. Also Discuss output waveform and output equation. **[5]**

b) Explain two quadrant operation of DC chopper fed separately excited DC motor. **[4]**

P.T.O.

- Q5)** a) Explain the construction and operation of variable reluctance motor. Also discuss the control circuit and motor performance characteristics. [8]
b) Explain the operation and driver circuit of Brushless DC motor. Also explain induced voltages, phase current and torque equation. [8]

OR

- Q6)** a) What is multi-stack stepper motor. Discuss its performance characteristics. [8]
b) Explain the modes of operation of switched reluctance motor. Discuss its control circuit and performance characteristics. [8]

- Q7)** a) Explain the dynamic model of three phase Induction motor. [8]
b) Derive the Transfer Function of separately excited DC motor. [8]

OR

- Q8)** a) Express the dynamic model of three phase Induction motor in different reference frames. [8]
b) Derive the transfer function of armature controlled separately excited DC motor and draw the control system diagram. [8]



Total No. of Questions : 8]

SEAT No. :

P4803

[Total No. of Pages : 2

[5060]-678

**M.E. (Electrical) (Power Electronics & Drives)
DESIGN OF POWER ELECTRONIC SYSTEMS
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

- 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 MOSFET. **[9]**

OR

Q2) Derive the mathematical modeling of Buck converter using circuit averaging method. **[9]**

Q3) a) Design a heat sink for a dc-dc Boost system. **[6]**

b) Explain need and importance of heat sink in power converters. **[3]**

OR

Q4) Explain procedure for designing inductor for power electronic application in detail with flow chart. **[9]**

Q5) A 10 hp, 1700rpm, self excited dc motor , driven from a 120V, 60Hz source, has the following parameters: $R_a = 0.02\Omega$, $L_a = 1\text{mH}$, $R_f = 150\Omega$, $k_m = 0.5 \text{ N-m/A}^2 /$, $k_e = 0.608 \text{ V/A.rad/sec}$. The field is separately energized by a full bridge rectified dc derived from the ac 120V, 60Hz source. The motor speed is to be varied from 10% to the rated speed at a constant torque. The maximum peak-to-peak torque ripple should not exceed 5% of the rated torque. Design an ac-dc converter for the motor. **[16]**

OR

Q6) Explain the zero current switching technique in a Buck converter with necessary diagrams and waveforms. **[16]**

P.T.O.

- Q7)** a) What are the requirements of gate drive circuit. Explain any one gate drive circuit for SCR. [8]
- b) Explain need of snubber. Derive equation for snubber capacitance and resistance. [8]

OR

- Q8)** a) What is need of isolation? How electrical isolation is provided to any power device? Explain with example. [8]
- b) Explain working of turn on snubber with circuit diagram and waveforms. [8]



Total No. of Questions : 6]

SEAT No. :

P4805

[Total No. of Pages : 2

[5060]-681

M.E. (Electrical) (Power Electronics & Drives)

POWER ELECTRONICS APPLICATIONS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q5. 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) *Assume suitable data, if necessary.*

- Q1)** a) What are different methods of compensations in power system? Compare these methods with due justification. **[5]**
- b) Obtain detailed analysis of six pulse converter used for HVDC link. **[5]**
- c) Explain the basic principle of working of TCSC. Draw its block diagram including various controls. **[8]**

OR

- Q2)** a) Draw and explain block diagram of solar power system. **[9]**
- b) Explain the operation of TSC and TCR with neat diagram. Draw. V-I characteristic. **[9]**

- Q3)** a) Compare the rotating synchronous compensator and STATCOM. Explain working of STATCOM and various controls with the help of block diagram. **[10]**
- b) What are the methods for output voltage control of STATCOM? Explain in detail. **[6]**

OR

- Q4)** a) Derive the relationship between power system parameters for control of real power flow. Hence state various methods to control it using FACTS control devices. **[10]**
- b) Explain the working principle of UPFC **[6]**

- Q5) a)** Describe the principle of working of Hybrid vehicle system. [10]
Develop necessary block diagram using power electronics.
- b) Explain working and applications of UPS. [6]

OR

- Q6) a)** What are the methods of battery charging system? Explain in details. [10]
- b) What are the advantages of electronics ballast? Explain its working. [6]



Total No. of Questions : 6]

SEAT No. :

P4806

[Total No. of Pages : 2

[5060]-682

M.E. (Electrical-Power Electronics & Drives)

POWER ELECTRONICS IN SMART GRID

(2013 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 indicate full marks.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

- Q1)** a) What are the, attributes of the smart grid costs and benefits of smart grid? [4]
- b) Explain Structure of the HFAC power distribution system for the Space Station program. [4]
- c) Discuss the EMC related phenomena in smart system. [4]
- d) What are the driving forces for distributed generations? [6]

OR

- Q2)** a) Describe low carbon central generation related to smart grid. [4]
- b) Discuss different power quality issues in smart grid system. [4]
- c) Explain reliability issues in high frequency devices used in space applications. [4]
- d) What are the integration and interconnection concerns of distributed generations? [6]

- Q3)** a) Describe Advanced Metering Infrastructure (AMI) in smart grid system. [8]
- b) Explain Cyber security and importance of it with respective to in smart grid system. [8]

OR

- Q4)** a) Compare between Home Area Network (HAN) and Wide Area Network (WAN). [8]
- b) What is CLOUD computing? What are its benefits? [8]

P.T.O.

- Q5)** a) Explain Dynamic static synchronous series controller. [8]
b) Explain operation of D-STATCOM for voltage regulation in voltage control mode. [8]

OR

- Q6)** a) Explain AC/AC step voltage regulator. [8]
b) Explain operation of D-STATCOM along with decoupled current control method. [8]



Total No. of Questions : 5]

SEAT No. :

P5076

[Total No. of Pages : 2

[5060]-684

M.E. (Electrical) (Power Systems)

COMPUTER APPLICATIONS IN POWER SYSTEMS

(2013 Pattern) (Semester - I) (503201)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Q(1) is compulsory.*
- 2) *Solve Q(2) Or Q(3) and Q(4) or Q(5).*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Scientific non-programmable calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

Q1) Solve any Three :

[18]

- a) Maximize $6x_1^2 + 5x_2^2$ subjected to $x_1 + 5x_2 \geq 3$ and $x_1, x_2 \geq 0$.
- b) Minimize $f(\mathbf{X}) = 5x_1^2 + x_2^2 + 2x_1x_2 - 8$ with starting point $\begin{bmatrix} 0 \\ -2 \end{bmatrix}$ using Newton's Method (perform one iterations).
- c) With the help of flowchart explain contingency analysis procedure.
- d) Derive AC DC load flow equation. Also state the assumptions.

Q2) The incremental production cost of two thermal plants is as follows. [16]

$$\frac{dc_1}{dp_1} = 27.5 + 0.165P_1 \text{ \$/MWh}$$

$$\frac{dc_2}{dp_2} = 19.8 + 0.264P_2 \text{ \$/MWh}$$

The limits are $P_{\min} = 10\text{MW}$, $P_{\max} = 100\text{MW}$. On a typical day, demand with respect to time is given. Complete the following table for economical load dispatch.

P.T.O.

Time	Load (P_D) MW	λ \$/MWh	P_1 (MW)	P_2 (MW)
12 midnight - 6AM	50	?	?	?
6AM - 12noon	100	?	?	?
12noon - 2PM	75	?	?	?
2PM - 6PM	125	?	?	?
6PM-9PM	175	?	?	?
9PM - 12midnight	50	?	?	?

OR

- Q3)** a) Explain solution economic load dispatch problem using Newton-Raphson method. [8]
b) The incremental fuel cost in Rs/MWh for a plant with two units is

$$\frac{dc_1}{dp_1} = 0.25P_1 + 40$$

$$\frac{dc_2}{dp_2} = 0.30P_2 + 30$$

Assuming both units operate all times, what is the saving in fuel cost in Rs/h for optimal scheduling of total load of 250MW compared to equal distribution of load between the two units. [8]

- Q4)** a) The transmission loss-coefficient are given below on a base of 100MVA

$$B = \begin{bmatrix} 0.01 & -0.001 & -0.002 \\ -0.001 & 0.02 & -0.003 \\ -0.002 & -0.003 & 0.03 \end{bmatrix}$$

Three plants supply as follow:

$$P_1 = 100\text{MW}, P_2 = 200\text{MW}, P_3 = 300\text{MW}.$$

Calculate the transmission loss and the incremental transmission losses with respect to plan 1,2, and 3. [8]

- b) Derive general formula of fault current and fault voltage for LG type fault. [8]

OR

- Q5)** a) Show that transmission loss formula is a function of generation and load. [8]
b) Derive B-coefficient formula used in economic dispatch. [8]



Total No. of Questions : 5]

SEAT No. :

P4807

[Total No. of Pages : 2

[5060]-685

**M.E. Electrical (Power Systems)
POWER SECTOR ECONOMICS AND MANAGEMENT
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

- 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) Attempt any three from following : **[18]**

- a) What the conditions that lead to restructuring of power sector.
- b) Explain tariff determination phases.
- c) Calculate internal rate of return for following details. Capital investment of Rs 1,00,000 and profits for six years at a rate of Rs.20,000/- per annum. The choices of discounting rates are 10%, 14% and 16%.
- d) Differentiate between forward market and future market.
- e) Explain following terms with respect to tariff
 - i) Fuel cost adjustments
 - ii) Subsidy and cross-subsidy

Q2) a) Share the experiences of electricity reforms from Latin American Nations. **[8]**

b) What is market power? How it is exercised and controlled? **[8]**

OR

Q3) a) Zonal pricing method and locational marginal pricing method. **[8]**

b) Discuss following: **[8]**

- i) Effect of external factors on market settlement.
- ii) Market efficiency and market clearing price.

P.T.O.

- Q4)** a) Explain components in transmission pricing. Also state effect of transmission planning on pricing. [8]
- b) Explain with suitable examples congestion management. [8]

OR

- Q5)** a) What is arbitrage? What is the effect of this on system operation? Explain with example. [8]
- b) What are different ancillary services? Explain ancillary service market and auction. [8]



Total No. of Questions : 7]

SEAT No. :

P5090

[5060]-686

[Total No. of Pages : 2

M.E. (Electrical) (Power System)
POWER SYSTEM MODELLING
(2013 Course) (503203) (Semester - I)

Time : 3 Hours]

[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

$$[P] = \begin{bmatrix} k_d \cos \theta & k_q \sin \theta & k_0 \\ k_d \cos \left(\theta - \frac{2\pi}{3} \right) & k_q \sin \left(\theta - \frac{2\pi}{3} \right) & k_0 \\ k_d \cos \left(\theta + \frac{2\pi}{3} \right) & k_q \sin \left(\theta + \frac{2\pi}{3} \right) & k_0 \end{bmatrix}$$

(where, $K_d = K_q = \sqrt{2/3}$ and $K_0 = \sqrt{1/3}$)

- Q1)** a) With the help of suitable assumptions and diagram, derive the expression for stator to rotor Mutual inductance (winding 'a' and 'f') for the synchronous machine model considering generator convention. Write each step in detail. **[9]**
- b) A synchronous machine is having one damper winding on d -axis and one damper windings on q -axis. Derive the stator and rotor voltage equations in $dq0$ frame of reference for this machine. Write down assumptions involve in it. **[9]**

OR

P.T.O.

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 δ_2 . **[18]**

Q3) What is the function of Voltage regulator? Explain with the help of suitable block diagram, the working of solid state voltage regulators. **[10]**

OR

Q4) Explain working of alternator rectifier exciter system with the help of equivalent circuit diagram/the block diagram. **[10]**

Q5) Develop the model of long transmission line. Discuss about the assumptions and approximations involved in it. **[10]**

OR

Q6) State and explain basic types of SVCs with the help of equivalent circuit diagram/the block diagram. **[10]**

Q7) Short note on **[12]**

- a) Effect of additional fixed capacitor on operating characteristics of SVC
- b) d-q transformation using α - β variables.

x x x

Total No. of Questions : 6]

SEAT No. :

P5077

[5060]-688

[Total No. of Pages :1

M.E. (Electrical) (Power Systems)
POWER SYSTEM DYNAMICS
(2013 Course) (503207) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Solve total three questions. Answer any one from Q1 or Q2, Q3 or Q4, and Q5 or Q6 each.*
- 2) *Assume suitable data if necessary.*
- 3) *Write down all the assumptions made.*

Q1) Classify and discuss the various states of operations and the security of the system as per DyLiacco, and Fink and Carlson with the help of suitable example. **[18]**

OR

Q2) Explain with suitable example the equal area criterion method for the study of transient stability. State clearly the assumptions made. **[18]**

Q3) Two finite machines are connected through a) 'T' circuit and b) 'pi' circuit transmission line. Assuming mechanical input constant, calculate the equivalent machine angle and inertia constant if (i) $H_1 < H_2$ (ii) $H_1 > H_2$. Also state the mode in which system will operate. **[16]**

OR

Q4) Derive an expression for small signal analysis of multi-machine system considering simplified model of synchronous machine. State any assumption made. **[16]**

Q5) 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. **[16]**

OR

Q6) Explain the concept of islanding. When it is needed to implement? How the system will behave if there is no facility of islanding? State various types of islanding methods. **[16]**



Total No. of Questions : 5]

SEAT No. :

P4808

[Total No. of Pages : 2

[5060]-689

**M.E. (Electrical) (Power Systems)
POWER SYSTEM PLANNING & RELIABILITY
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

- 1) *Solve total three questions. Solve Q2 or Q3. Solve Q4 or Q5.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

Q1) Solve any three [18]

- a) Describe factors affecting non-weather sensitive load forecast.
- b) Explain Normal Distribution method in details.
- c) Explain Markov process for reliability analysis.
- d) Explain equivalent forced outage rate.

Q2) a) Explain the concept of transmission reliability and data required for composite system reliability. [10]

b) What are the objectives of transmission planning? [6]

OR

Q3) a) What do you mean by composite system reliability? Explain in detail the data required for composite system reliability. [10]

b) Describe the factors affecting transmission system planning. [6]

Q4) a) Explain the effects of lateral distribution and disconnect in distribution system. [10]

b) Describe the methods to improve distribution system reliability. [6]

OR

- Q5) a)** Explain the following concept in context with distribution system planning and reliability **[10]**
- i) Network reconfiguration
 - ii) Interruption indices
- b) Explain basic reliability evaluation techniques for parallel network. **[6]**



Total No. of Questions : 5]

SEAT No. :

P4809

[Total No. of Pages : 2

[5060]-690

**M.E. (Electrical) (Power Systems)
HVDC AND FLEXIBLE AC TRANSMISSION
(2013 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) Use of Calculator is allowed.*
- 4) Assume Suitable data if necessary.*

Q1) Solve anyTHREE:

[18]

- a) Draw the Block diagram of UPFC & explain the function of each block.
- b) What controls are employed in HVDC system? Explain.
- c) Explain the operation of STATCOM with control scheme.
- d) Compare SVC with STATCOM along with their control characteristics.
- e) Explain the working of static synchronous series compensator.
- f) What are the different dc link converter topologies. Explain any one in detail.

Q2) a) Explain different configurations of multi terminal HVDC system. [8]

- b) Compare HVDC Light with HVDC Transmission system with advantages & disadvantages **[8]**

OR

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]**

P.T.O.

- Q4)** a) Explain HVDC protection schemes used against over voltages. [8]
b) Explain the principle & operation of VSC (Voltage Source Converter) of HVDC transmission. [8]

OR

- Q5)** a) Write about the different existing HVDC links and proposed links in India. [8]
b) Compare conventional HVDC with Voltage Source Converter HVDC [8]



Total No. of Questions : 7]

SEAT No. :

P4810

[Total No. of Pages : 2

[5060]-692

**M.E. (Electrical) (Power System)
ADVANCED POWER SYSTEM PROTECTION
(2013 Pattern) (Semester - III)**

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 and Q.7.*
- 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 numerical overcurrent protection with a flow chart. **[9]**

OR

Q2) With a neat block diagram explain hardware design of digital protection of transmission line. Explain function of each block. **[9]**

Q3) What are the faults in synchronous generator? Explain digital protection scheme based on second harmonic current induced. **[9]**

OR

Q4) With a neat diagram explain working of Bucholtz relay. Give fault analysis based on gases. **[9]**

Q5) a) Explain multi-zone protection scheme using distance relays. **[8]**

b) Explain distance relay setting. **[8]**

OR

P.T.O.

- Q6)** a) Explain under-reach and over-reach phenomena in overcurrent relays. **[8]**
- b) i) Explain man-machine interface subsystem. **[8]**
- ii) Explain applications of computer graphics.

Q7) Answer any two **[16]**

- a) Short circuit studies in multi-phase systems.
- b) Explain features of PC-based integrated software for short circuit studies.
- c) Develop algorithm for short circuit studies.
- d) Explain transformation to symmetrical components. Write all necessary equations.



Total No. of Questions : 5]

SEAT No. :

P4811

[Total No. of Pages : 2

[5060]-693

**M.E. (Electrical) (Power Systems)
POWER QUALITY ASSESSMENT AND MITIGATION
(2013 Pattern) (Semester - III)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to students :

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

Q1) Attempt any three of following :

[18]

- a) How good grounding practices reduces power quality problems.
- b) Explain process of resonance and associated transient over voltages and give associated analysis
- c) A motor has a peak starting current of 20A. When the source voltage is 120V. The inductive reactance of cable is 20hm. Estimate voltage sag at motor terminals. Now capacitor of 60hm reactance is added across motor terminals estimate new value of voltage sag.
- d) A distribution feeder is powering 100 computers. The total current of all computers can be expressed by $i = 4 + 50\sin(2\pi 60t) + 30\sin(2\pi 180t) + 10\sin(2\pi 300t) + 5\sin(2\pi 420t)$ A.
Calculate the THD at the feeder. Now a line of 100A (rms) is connected to same feeder compute new value of THD.
- e) Why special treatment is required for triplen harmonics? Explain harmonic resonating conditions.
- f) Explain ill effects produced by harmonics on
 - i) Household appliances and office automation equipment
 - ii) Transformer and power capacitors.

Q2) a) With block diagram explain essential parts of power quality analyser. **[8]**

b) Explain selection process of transducers used in power quality monitoring. **[8]**

OR

P.T.O.

- Q3)** a) Explain process of selection of monitoring locations. Also state restrictions on monitoring intervals. [8]
- b) Give requirements for [8]
- i) Harmonic monitoring
- ii) Transient monitoring

- Q4)** a) Explain different assessment techniques for power quality monitoring [8]
- b) Explain role of custom power devices in power quality improvement. [8]

OR

- Q5)** a) Explain power quality state estimation. Also explain observability analysis in power quality assessment. [8]
- b) What are different power quality standards used for assessment of power quality. [8]



Total No. of Questions : 8]

SEAT No. :

P4812

[Total No. of Pages : 2

[5060]-701

M.E. (Electronics and Telecommunications)

**MODELING & SIMULATION OF COMMUNICATION
NETWORK**

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

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *All question carry equal marks.*
- 2) *Solve any five questions.*
- 3) *Assume suitable data wherever necessary.*
- 4) *Your answer as whole will be given weightage.*

Q1) a) What are the various impacting factors of Communication system over others? **[5]**

b) Explain different aspects of methodology with respect to the simulation of the design of equalizer. **[5]**

Q2) a) Why Sampling Frequency is very important in Communication systems? And how aliasing effect can be minimized? **[5]**

b) Write Short Note on: **[5]**

i) Upsampling and Interpolation.

ii) Nonlinear & time varying Signals.

Q3) a) Explain the Low pass complex envelope for bandpass signals related to simulation in time and frequency domain. **[5]**

b) Explain mixed congruence algorithm for uniform random number generation. **[5]**

P.T.O.

- Q4)** a) Explain how to map uniform random variables to an arbitrary pdf using inverse transform method. [5]
- b) With a neat sketch, explain 4 bit PN Sequence generator in detail. [5]
- Q5)** a) Write Short Note on: [5]
- i) Scatter plots
- ii) Semi analytic techniques
- b) Explain in brief about correlated gaussian random numbers. [5]
- Q6)** a) Explain Monte Carlo simulation of a wireless system. [5]
- b) What are the different types of empirical models based on swept tone measurements. [5]
- Q7)** a) Explain in brief the modeling and simulation of memory less nonlinearities. [5]
- b) Explain short notes on: [5]
- i) Pdf estimators
- ii) Poissonian modeling of network traffic
- Q8)** a) Explain in brief about modeling and simulation of time varying systems. [5]
- b) Write short notes on: [5]
- i) Tap Delay model
- ii) Random Process Models



Total No. of Questions : 8]

SEAT No. :

P5095

[Total No. of Pages : 2

[5060] - 702
M.E (E & TC)
COMMUNICATION NETWORKS
Spread Spectrum and CDMA Systems
(2013 Pattern)

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) Explain hybrid DS/FH spread spectrum system with block diagram and derive the equation for power spectral density of the transmitted signal $S_t(t)$. **[6]**
- b) Write short note on fundamentals of sequence generators. **[4]**
- Q2)** a) Explain the block diagram of sequential detector for detecting whether phase of the receiver generated spreading waveform is correct. **[5]**
- b) Draw the block diagram of RASE synchronization system with DLL code tracking loop. **[5]**
- Q3)** a) Compare the performance of coherent direct sequence spread spectrum system in single-Tone and Multi-Tone jamming. **[6]**
- b) What is optimum decoding rule? **[4]**
- Q4)** a) Explain the basic concept of interleaving. **[4]**
- b) Explain the block diagram of concatenated coding communication system. **[4]**
- c) What are coding bounds? **[2]**

P.T.O

- Q5)** a) Discuss CDMA based standards and frequency allocations. [4]
b) Explain in brief: [6]
i) CDMA in Military Applications
ii) CDMA in GPS Receiver
- Q6)** a) Discuss evolution of various CDMA technologies. [5]
b) Explain in detail the adaptive power control mechanism used in CDMA with necessary diagram. Discuss the benefits of adaptive power control. [5]
- Q7)** a) Explain the terms in brief: [5]
i) Fading in CDMA system
ii) Near - Far Problem
b) Explain in detail, physical and logical channels in WCDMA. [5]
- Q8)** a) Write short note on CDMA2000. [5]
b) How Rake receiver helps in multipath environment to improve the quality of signal in CDMA Technology [5]



Total No. of Questions : 8]

SEAT No. :

P4813

[Total No. of Pages : 3

[5060]-703

M.E. (Electronics and Telecommunication)
DETECTION AND ESTIMATION THEORY
Communication Network
(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) *Assume suitable data if necessary.*

- Q1)** a) Explain Bayes criterion to calculate cost of risk with diagram of decision regions. [4]
- b) Derive an expression for likelihood ratio test for binary Hypothesis. [4]
- c) Draw the decision space diagram of M - Hypothesis problem. [2]
- Q2)** a) Obtain the optimum decision rule for the receiver taking K samples X_1, X_2, \dots, X_k . A source whose output under Hypothesis H_1 is a constant voltage of value "M" and zero under H_0 . The signal is corrupted by noise samples which are independent gaussian r.v, each with mean zero and variance σ^2 ? [4]
- b) Describe the working principles of Adoptive CFAR detection for fixed Threshold. [4]
- c) Explain in brief the significance of performance bounds and approximation. [2]

P.T.O.

- Q3)** a) Explain in brief two methods of vector random processes. [4]
- b) For a triangular correlation function:

$$k_n(t - \mu) = 1 - |t - \mu| \text{ for } |t - \mu| \leq 1$$

$$= 0 \quad \text{else where.}$$
Find the eigen functions and eigen values over the interval (0,T) when $T < 1$. [4]
- c) Define and explain in brief periodic processes. [2]
- Q4)** a) Describe the working operation of continuous no - memory modulation system with neat block diagram. [4]
- b) With neat diagram, explain multiple channel system for estimation of multi dimensional waveform. [4]
- c) Explain the estimation technique on non-random waveform. [2]
- Q5)** a) With mathematical expression explain the working of correlation receiver to detect signals in AWGN. [4]
- b) Describe the working operation of ARMA processes with neat diagram. [4]
- c) Compare weiner and kalman filters. [2]
- Q6)** a) Explain working operation of optimum realizable filter. [4]
- b) Derive a proof to explain the theorem of orthogonality principle. [2]
- c) Obtain an estimate of $S(t)$ in terms of the present value of $k(t)$ to determine minimum mean-square error for the observation process $X(t) = S(t) + N(t)$. $S(t)$ and $N(t)$ are zero mean wide - sense stationary processes. [4]

Q7) a) Derive an expression for maximum likelihood estimator (MLE). List criteria for good estimator. [5]

b) The received signal under hypothesis H_1 and H_0 are:

$$H_1 = M + N_k \quad K = 1, 2, \dots, k$$

$$H_0 = N_k \quad K = 1, 2, \dots, k$$

Obtain the maximum likelihood [ML] estimate \hat{M}_m of the mean, assuming the constant m is not known. [5]

Q8) a) With neat diagram, explain in brief 3 cost function of Bayes estimation. [5]

b) Derive an expression for Risk function of a maximum A posteriori estimator. [5]



Total No. of Questions : 10]

SEAT No. :

P5118

[Total No. of Pages : 3

[5060]-704
M.E. (E & TC) (Digital Systems)
RESEARCH METHODOLOGY
(2013 Pattern)

Time : 3 Hours]

[Maximum Marks : 50

Instructions :

- 1) *Right side figure indicate marks.*
- 2) *Solve Q. 1 OR Q. 2, Q. 3 OR Q. 4, Q.5 OR Q.6, Q. 7 OR Q. 8, Q. 9 OR Q.10.*

- Q1)** a) What is research? Explain significance of research in modern times? [5]
b) Describe the role of data collection in research? Explain data collection using digital computer systems? [5]

OR

- Q2)** a) What are the sources of research problem? Explain with suitable example. [5]
b) What are the different characteristics of instruments? Explain each with suitable example? [5]

- Q3)** a) Set a computational model to predict performance of experimental system. [6]
b) Explain role of Principal Component Analysis (PCA) in research. [4]

OR

- Q4)** a) What is State vector Machines (SVM)? How it is useful in research? [5]
b) Discuss the important of mathematical models in Engineering Research study. [5]

- Q5)** a) Explain asymptotic analysis of systems? Explain with suitable example. [5]

P.T.O

- b) What is performance curves? Explain the role of performance curves to study trends and tendencies. [5]

OR

- Q6)** a) Explain sensitivity theory and applications in modeling and prediction and performance analysis. [5]

- b) Explain multiscale modeling of process system? How to verify its performance? [5]

- Q7)** a) Explain role of probability study in research? [3]

- b) The following data are expected to follow a linear relationship of the form $y = ax + b$. Obtain the best linear relation in accordance with a least square analysis.

Calculate standard deviation of the data from the result. [7]

X	0.9	2.3	3.3	4.5	5.7	6.7
Y	1.1	1.6	2.6	3.2	4.0	5.0

OR

- Q8)** a) The following 10 observations were recorded when measuring voltage 41.7, 42.0, 41.8, 42.0, 42.1, 41.9, 42.0, 41.9, 42.5, and 41.8, V find

i) Mean ii) Standard Deviation iii) Variance [6]

- b) Explain the terms

i) Confidence interval

ii) Confidence level

iii) Confidence interval of mean [4]

- Q9)** a) Describe, in brief, the layout of a research report, covering all relevant points. [5]

- b) Write a short note on 'Documentation' in the context of a research report. [5]

OR

- Q10)**a) What are the different forms in which a research work may be reported? [6]
- b) What are the characteristics of a good research report? [4]



Total No. of Questions : 8]

SEAT No. :

P4814

[Total No. of Pages : 2

[5060]-706

M.E. (Electronics and Telecommunication)

COMMUNICATION NETWORKS

Traffic Analysis and QOS

(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) Use of Calculator is allowed.*
- 4) Assume suitable data if necessary.*

Q1) a) Explain the system utility for management? **[4]**

b) Define TMN & Explain in detail TMN Service architecture? **[4]**

c) Prepare a chart for functional roll of management tools? **[2]**

Q2) a) Define & Explain NMS design in detail? **[4]**

b) Explain basic foundation of network management & functional model?[4]

c) Explain in detail the network management standards? **[2]**

Q3) a) Explain TMN Conceptual Model? **[4]**

b) Write short note on broadband network services? **[4]**

c) Describe MIB Engineering in detail? **[2]**

P.T.O.

- Q4)** a) Describe functional model in detail? [4]
b) What are the system utilities for management? [4]
c) Write Differential service of TMN? [2]
- 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 Integrated services? [4]
b) Explain Link control mechanism (Stop and Wait ARQ)? [4]
c) What are Services categories define by ATM forum? [2]
- Q7)** a) Define MPLS & Explain it in detail? [4]
b) Explain mechanism for congestion control? [4]
c) Explain Cell Delay Variation? [2]
- Q8)** a) Explain Traffic control & congestion control in ATM networks? [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. :

P4815

[Total No. of Pages : 2

[5060]-707

M.E. (E&TC) (Communication Networks) (Semester - II)
BROADBAND WIRELESS TECHNOLOGIES
(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 electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Explain working of OFDM system with a suitable block diagram. Also indicate need of cyclic prefix and guard interval. How orthogonality is achieved in OFDM system? **[5]**

b) Explain CP-CDMA (Cyclic prefix-based code-division multiple access) System with a suitable block diagram. **[5]**

Q2) a) Derive expression for Channel capacity of SISO channel. Hence compare the Capacity for AWGN channels and SISO Rayleigh fading channels. **[5]**

b) What are the different diversity techniques? When space time coding is used? Hence explain Alamouti codes and its properties. **[5]**

Q3) a) Explain Multiple-time-hopping PPM UWB system with variable bit rate transmission. **[5]**

b) How CSMA/CA MAC works? **[5]**

Q4) a) Explain reservation MAC with reference to frame format for dynamic TDMA. Hence define: silent state, contention state and reservation state. **[5]**

b) Compare and contrast DTOR (directional transmission and Omni-directional reception) and DTDR (directional transmission and directional reception) schemes for directional antenna MAC. **[5]**

P.T.O.

- Q5)** a) Compare and contrast Adaptive Routing Protocol and Scalable Routing Protocol. [4]
- b) Explain Hop Count and Cumulative Round-Trip Time with reference to Routing Metrics. [4]
- c) What is the importance of routing protocols in multi-hop networks? [2]
- Q6)** a) Discuss general properties of WiMAX Mesh. [5]
- b) Describe centralized bandwidth scheduling and distributed bandwidth scheduling in WiMAX Mesh Network. [5]
- Q7)** a) How Quality of Service is implemented for upstream and downstream in EPONS? [5]
- b) Explain different techniques to mitigate the bandwidth management for Multichannel EPONS. [5]
- Q8)** a) Explain any one integration architectures for EPON and WiMAX. [5]
- b) What are the advantages of a WOBAN (wireless-optical broadband access network) over the wire-line optical and wireless networks? [5]



Total No. of Questions : 8]

SEAT No. :

P4816

[Total No. of Pages : 2

[5060]-708

M.E. (E & TC) (Communication Network) (Semester - II)

504509 : OPTICAL NETWORK

(2013 Pattern) (Credit System)

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 Network Architecture in detail and compare it with Telecommunications Networks. **[5]**

b) Describe the second generation optical networks along with the key network elements responsible for optical networking. **[5]**

Q2) a) Derive the expression for power penalty in an optical network. **[5]**

b) Describe the effect of nonlinearities in optical communication systems mathematically. **[5]**

Q3) a) What is the principle of operation of an isolator and circulator? Give example of isolator and circulators Applications. **[5]**

b) Describe Solitons and enumerate its features and applications. **[5]**

Q4) a) What is the need of wavelength stabilization in the optical transmission system? **[5]**

b) Explain the protocol stack alternatives for optical network in detail. **[5]**

P.T.O.

- Q5)** a) Describe optical backbone and the necessity of IP for it. [5]
b) Describe the frame structure and network configurations defined for SONET and SDH with diagrams. [5]
- Q6)** a) Explain the OTN layered model in detail. [5]
b) Describe SDH multiplexing hierarchy in detail. [5]
- Q7)** a) Write a short note on Multiprotocol Lambda switching (MPλS). [5]
b) Explain DWDM in contrast with conventional WDM. [5]
- Q8)** a) Describe the MPLS traffic engineering along with its QOS parameters. [5]
b) Explain the in-band and out-of-band control signaling and its importance. [5]



Total No. of Questions : 8]

SEAT No. :

P4817

[Total No. of Pages : 2

[5060]-710

M.E. (E &T.C.) (Communication Network)

MOBILE COMPUTING

(2013 Couse) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer 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) Discuss the case studies of secure mobile application development. **[5]**

b) Explain the various types of mobilities used in mobile computing environment? **[5]**

Q2) a) Discuss wireless LAN architecture. **[5]**

b) Explain in details 4 G LTE network architecture and discuss different entities used. **[5]**

Q3) a) Explain VOIP architecture. **[4]**

b) What are the fundamentals of wireless markup language WML script application. **[4]**

c) Compare and contrast multiple access techniques. **[2]**

P.T.O.

- Q4)** a) Explain how the GSM system can be enhanced to use of a GPRS system. [4]
- b) What is handoff? What is roaming? How do you performing handoff during roaming? [4]
- c) Discuss various service applications of GPRS. [2]
- Q5)** a) Discuss in details H. 323. [4]
- b) Explain various security models used in mobile computing. [4]
- c) Write a note on CDMA. [2]
- Q6)** a) Explain 4G mobile telephone technology. [4]
- b) Explain dynamic channel allocation. [4]
- c) How can IP help to transfer multiple data. [2]
- Q7)** a) Discuss 3G mobile telephone technology. [4]
- b) Explain in detail concept of WLL. [4]
- c) Discuss in detail about Wi-Max technology. [2]
- Q8)** a) Discuss Bluetooth and its protocol stack. [4]
- b) Explain 802.11 with typical architecture. [4]
- c) Write a short note on: MIMO. [2]



Total No. of Questions : 8]

SEAT No. :

P5078

[5060]-711

[Total No. of Pages : 3

**M.E. (E & TC) (Communication Networks)
DIGITAL COMMUNICATION RECEIVERS
(2013 Course) (604502) (Semester - III)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any 5 Questions out of 8.*
- 2) *Neat diagrams and waveforms must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, mollier charts, electronic packet Calculator and stream tables is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Explain the terms with reference to Baseband & Bandpass communication **[5]**

- i) Half power BW.
- ii) Noise equivalent BW.
- iii) Null – to – null BW.
- iv) 99% of power BW (use numerical methods)
- v) BW beyond which the attenuation is 35dBs.
- vi) Absolute BW.

b) Determine a set of orthonormal functions for the four signals given below. **[5]**

The signal $S_1(t)$ has energy $\int_0^2 S_1^2(t) dt = 2$.

$$S_1(t) = 1 \quad ; 0 < t < 2$$
$$= 0 \quad ; \text{otherwise}$$

$$S_3(t) = 1 \quad ; 0 < t < 2$$
$$= -1 \quad ; 2 < t < 3$$
$$= 0 \quad ; \text{otherwise}$$

$$S_2(t) = 1 \quad ; 0 < t < 1$$
$$= -1 \quad ; 1 < t < 2$$
$$= 0 \quad ; \text{otherwise}$$

$$S_4(t) = -1 \quad ; 0 < t < 3$$
$$= 0 \quad ; \text{otherwise}$$

P.T.O.

Q2) a) Why do BPSK & QPSK manifest the same bit error probability relation? [5]

b) What is the significance of phasor constellational diagrams, Why FSK in orthogonal can not be seen on phasor? [5]

Q3) a) Describe Correlation Receiver & Matched Filter Receiver used for implementing the optimal Receiver for AWGN channel with respect to MAP receiver. [4]

b) Consider the signal

$$s(t) = (A/T)t \cos 2 \pi f_c t \quad , \quad 0 \leq t \leq T$$
$$= 0 \quad , \quad \text{otherwise}$$

Determine the Impulse response of the Matched Filter for the above signal and output at $t = T$. [4]

c) Difference between Maximum a Posteriori Prob Rule (MAP) and Maximum Likelihood Rule (ML) for receiver. [2]

Q4) a) Explain how the Probability of Error is reduced by using Envelope detection for Correlated binary signal. [4]

b) A matched filter has the frequency response

$$H(f) = (1 - e^{-j2\pi f T}) / j2\pi f \quad [4]$$

Determine the impulse response $h(t)$ corresponding to $H(f)$.

c) Describe in brief the Optimum demodulation & Detection for CPM signal. [2]

Q5) a) What are the statistical models for Multipath fading channels? Explain them. [4]

b) Explain Non-Decision-directed PLL for carrier phase estimation of PAM signals. [4]

c) Explain Maximum Likelihood carrier phase estimation. [2]

- Q6)** a) What is small scale fading? Explain the factors influencing small scale fading. [5]
- b) Describe different types of symbol synchronization techniques. [5]
- Q7)** a) Explain with an example, how the optimization takes place with Carrier Phase Estimation. [4]
- b) Explain Blind Equalization based on Max Likelihood Criteria. [4]
- c) Draw the Adaptive Zero Forcing Equalizer. [2]
- Q8)** a) Explain in brief: [4]
- i) KALMAN algorithm for Adaptive Equalization.
- ii) Stochastic gradient algorithm for Blind Equalization.
- b) Determine the Joint ML (Maximum Likelihood) estimate of ζ and θ for QAM. [4]
- c) Draw the block diagram of equalizer based on the tentative decision and on decisions from the viterbi decoder. [2]

x x x

Total No. of Questions : 8]

SEAT No. :

P4818

[Total No. of Pages : 3

[5060]-713

M.E. (E &TC) (Microwave)

ELECTROMAGNETICS AND ANTENNA THEORY

(2013 Pattern) (Semester - I) (Revised)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Answer any five question.
- 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 various feeding techniques Used in Microstrip Antenna, explain them with illustrative diagrams and also compare. [4]

b) Let the permittivity be $5\mu\text{H/m}$ in the region A where $x < 0$, and $20\mu\text{H/m}$ in region B where $x > 0$. If there is a surface current density $\vec{K} = 150\hat{a}_y - 200\hat{a}_z$ A/m at $x = 0$, and $\vec{H}_A = 300\hat{a}_x - 400\hat{a}_y + 500\hat{a}_z$ A/m, find \vec{H}_B [6]

Q2) Explain the significance of Retarded Vector magnetic potential; explain its significance in solving electromagnetic problems with relevant mathematical expressions. Formulate the retarded vector magnetic potential for infinitesimal current element and solve it for the electric and magnetic fields for far field condition. [10]

Q3) a) Derive the attenuation constant and phase constant for good conductor and explain the significance of the skin depth. [4]

b) Explain the Structural details, dimensions, radiation pattern, specifications, features and applications of Helical and explain the design procedure with relevant mathematical expressions and illustrative diagrams. [6]

P.T.O.

- Q4) a)** Draw the Structural details, radiation pattern and explain the design procedure, specifications, features and applications of Microstrip Antenna. [6]
- b) Derive the boundary conditions for the boundary between two magnetic materials having different permittivity. [4]
- Q5) a)** Calculate the array coefficients using Design Dolph-Tschebyscheff's procedure for $N = 8$ and side lobe level to be below 35 dB. [5]
- b) Draw the geometrical details of the circular array, write its array factor and explain its features and applications with the help of radiation pattern. [5]
- Q6) a)** Explain the Uniqueness and Huygens's Principles with illustrative diagrams and mathematical expressions. Also discuss the applications of these principles. [4]
- b) Derive the array factor for a linear array of N elements taking the center element as reference element. Assume the number of elements N to be odd. [4]
- c) Draw the typical radiation pattern of an antenna and explain the various terminologies associated with it. [2]
- Q7) a)** Design Yagi Uda antenna of six elements to provide a gain of 10dB, if the operating frequency is 250MHz. [4]
- b) The plane wave $\vec{E} = 150 \cos(\omega t - z) \hat{a}_x$ V/m in air normally hits a lossless medium $\mu = 2\mu_0$, $\epsilon = 5\epsilon_0$ at $z = 0$. [6]
- i) find Reflection coefficient, transmission coefficient and standing wave ration.

Calculate the reflected electric and magnetic field.

- Q8)** a) The aperture dimensions of a pyramidal horn are 15×5 cm. It is operating at a frequency of 6 GHz. Find the beam width, power gain and directivity. **[4]**
- b) Write the expression for current distribution for the half wave dipole; write its far field equation, its power radiated and radiation resistance. **[4]**
- c) Define the terms Radiation resistance, Radiation Intensity, Radiation power density. **[2]**



Total No. of Questions : 8]

SEAT No :

P5079

[5060]-714

[Total No. of Pages : 2

**M.E. (E & TC) (Microwave)
RF AND MICROWAVE CIRCUITS
(2013 Pattern) (504302) (Semester - I)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve any five questions.*
- 2) *Figures to the right indicates full marks.*
- 3) *Assume Suitable data whenever necessary.*

Q1) a) Derive the expression for lumped element circuit model for transmission line. **[5]**

b) Explain the concept of Intersymbol interference. how ISI affects the wireless communication? **[5]**

Q2) a) Derive the expression for propagation constant, Impedance and power flow for the lossless Co-axial line. **[5]**

b) A Two port network is known to have the following scattering matrix. **[5]**

$$[S] = \begin{bmatrix} 0.15 \angle 0^\circ & 0.85 \angle -45^\circ \\ 0.85 \angle 45^\circ & 0.2 \angle 0^\circ \end{bmatrix}$$

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?

Q3) a) Write a note on dynamic range and source of noise in microwave circuits. **[5]**

b) Explain with equivalent circuit diagram working of **[5]**
i) Wilkinson power divider.
ii) Lange coupler

P.T.O.

- Q4)** a) Explain in detail the working of P-channel mosfet and its electronic applications. [5]
- b) Describe in detail operating principle of IMPATT diode. [5]
- Q5)** a) Design a single-section quarter wave matching transformer to match a 10Ω load to 50Ω transmission line at $f_0 = 3\text{ GHz}$. Determine the percent band width for which the $\text{SWR} \leq 1.5$. [5]
- b) Explain in detail working principle of voltage controlled oscillator. [5]
- Q6)** a) A MOSFET operated at 5.7 GHz has the following S-parameters: [5]
 $S_{11} = 0.5 \angle -60^\circ$, $S_{12} = 0.02 \angle 0^\circ$, $S_{21} = 6.5 \angle 115^\circ$, $S_{22} = 0.6 \angle -35^\circ$
 i) Determine if the circuit is unconditionally stable.
 ii) Find the maximum power gain under optimal choice of the reflection coefficient assuming the unilateral design
- b) Explain the working principle of PIN Diode. [5]
- Q7)** a) Explain in detail, the concept of stability circle for stability consideration related to amplifier design. [5]
- b) With the help of equivalent circuit diagram Explain the working of crystal oscillator. [5]
- Q8)** An RF amplifier has following S - Parameters: [10]
 $S_{11} = 0.3 \angle -70^\circ$, $S_{12} = 0.2 \angle -10^\circ$, $S_{21} = 3.5 \angle 85^\circ$, $S_{22} = 0.4 \angle -45^\circ$.
 Furthermore, the input side of the amplifier is connected to voltage source with $V_s = 5\text{V}$ 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.
- a) Transducer gain G_T , Unilateral transducer gain G_{TU} , available gain G_A , operating power gain G and
- b) Power delivered to load P_L , available power P_A and incident power to the amplifier P_{inc} .



Total No. of Questions : 8]

SEAT No. :

P4819

[Total No. of Pages : 2

[5060]-715
M.E. (E&TC) (Microwave)
MICROWAVE MEASUREMENT

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Attempt any one questions from Q. 1 and Q. 2.*
- 2) *Attempt any two from Q.3, Q.4, and Q.5.*
- 3) *Attempt any two from Q.6, Q.7, and Q. 8.*

Q1) a) Give the importance of measurement related to Microwave. **[5]**

b) Explain the characteristic impedance for a parallel wire transmission line.**[5]**

Q2) a) What is the advantage of 'S' parameter for Microwave T - Junction. **[5]**

b) Explain the concept of Uncertainty related to RF match. **[5]**

Q3) Explain the meaning of connector cleaning, connector life, and connector recession. Explain in detail with necessary diagram. **[10]**

Q4) Describe the different methods of attenuation. Explain the mismatch error with necessary diagram. **[10]**

Q5) Define Noise. State and explain the different types of noise and sources? Explain its significance. **[10]**

P.T.O.

Q6) Draw the blocks schematic of spectrum analyzer. Explain with practical example the working of spectrum analyzer. **[10]**

Q7) Name the different power sensors used in Microwave measurement. Explain any the in detail. **[10]**

Q8) Explain the working of vector network Analyzer with mathematical analysis. **[10]**



Total No. of Questions : 8]

SEAT No. :

P4820

[Total No. of Pages : 2

[5060]-717
M.E. (E &T.C.) (Microwave)
COMPUTATIONAL ELECTROMAGNETICS
(2013 Credit Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

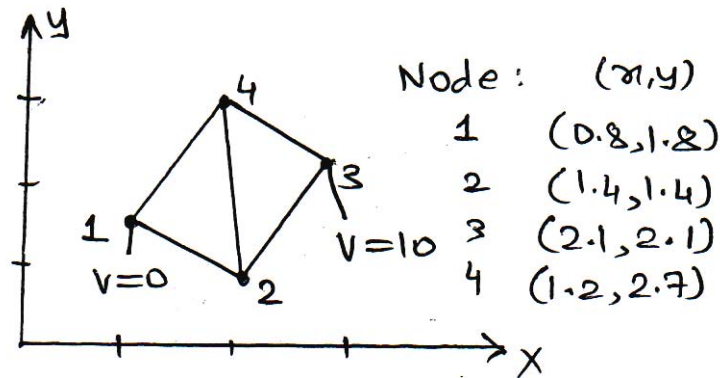
- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) Explain various common techniques to solve an electromagnetic problem. **[5]**
- b) Explain in short Green's function in two dimensional. **[5]**
- Q2)** a) Explain the concept of FDTD. **[5]**
- b) Explain application of one dimensional FDTD analysis. **[5]**
- Q3)** Explain in detail finite difference analysis for guiding structures. **[10]**
- Q4)** a) Explain Ritz variational method. **[5]**
- b) Explain applications of Ritz variational method. **[5]**
- Q5)** a) Explain advances in FDTD. **[5]**
- b) Explain method of weighted residual. **[5]**

P.T.O.

- Q6) a) Compare FEM & MOM. [5]
 b) Compare FDM, FDTD. [5]

Q7) Consider two element mesh as shown in figure given below. Using FEM determine the potential within the mesh. [10]



- Q8) a) Explain Galerkins method. [5]
 b) Explain point matching method. [5]



Total No. of Questions : 8]

SEAT No. :

P5129

[Total No. of Pages : 2

[5060]-718

M.E. (Electronics and Telecom) (Microwave)

RF AND MMIC TECHNOLOGY

(2013 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 indicate full marks.*
- 3) *Use of Calculator is allowed.*
- 4) *Assume suitable data if necessary.*

Q1) With the help of necessary block diagrams, discuss and compare the performance of phased array antenna by using conventional TWT amplifier and MMIC based solid state power amplifiers. **[12]**

OR

Q2) Describe the design and working principles of microstrip couplers and power splitters. **[12]**

Q3) a) Compare harmonic balance method used for synthesis of MMICs with other techniques. **[6]**

b) Explain synthesis of n-port on the base of elementary two port. **[7]**

OR

Q4) Describe in detail the use of Volterra series technique used in design of nonlinear circuits. **[13]**

Q5) Draw and explain in detail the complete MMIC design cycle. **[12]**

P.T.O.

OR

Q6) With the help of necessary schematics, describe the design process for switches. [12]

- Q7)** a) Explain device and circuit measurement techniques in MMIC. [7]
b) Describe the MMIC test system. [6]

OR

- Q8)** a) Explain network matrix decomposition of microwave circuits. [7]
b) Describe Applications of MMIC in satellite communication. [6]



Total No. of Questions : 8]

SEAT No. :

P5138

[Total No. of Pages : 2

[5060] - 719

M.E. (E&TC) (Microwave) (Semester - II)

WIRELESS COMMUNICATION SYSTEM

(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) Derive the signal to interference ratio for the worst case scenario of the co channel Interference with help of relevant diagrams. [5]

b) Draw the detailed architecture diagram of UMTS and explain each of the blocks. [5]

Q2) Explain the following with reference to UMTS in detail with illustrative diagrams and numerical values. [10]

- a) FDD,TDD
- b) UTRAN
- c) GMSC
- d) HLR
- e) GGSN

Q3) a) In a switching office an equipment component with an average holding time of 5 seconds has a peg count of 450 for a one-hour-period. Assuming there was no overflow, how much usage in call=seconds, CCS, and Erlangs has accumulated on the piece of the equipment. [7]

b) If the carried load for a component is 3000CCS at 5% blocking, what is the offered load? [3]

P.T.O.

- Q4)** a) What is the modulation scheme used in GSM and explain the same with relevant mathematical expressions and wave form. [4]
 b) Draw the functional block diagram of DSS-CDMA and explain. [6]
- Q5)** a) Explain the various multiple access techniques in Wireless Communications System with relevant features and compare. [8]
 b) Compare the features of CDMA and GSM with relevant numerical values. [2]
- Q6)** a) A free space LOS microwave link operating at 12GHz consists of transmit and receive antenna each having a gain of 30dB and the distance between them is 60km and the power radiated by the transmit antenna is 20W. Calculate the path loss of the link and the received power. Write the Friis transmit equation and explain. [5]
 b) Explain the following capacity enhancement schemes in detail with relevant expressions and diagrams. [5]
 i) Cell Splitting
 ii) Overlaid cells
 iii) Cell Sectoring
- Q7)** a) Write a note on power control and power saving mechanisms in cellular systems. [3]
 b) Explain the multipath fading in detail and also the terms, delay spread, ISI, Coherent Bandwidth. [5]
 c) Draw the TDMA structure. [2]
- Q8)** a) Explain the GSM network switching system with the help of network architecture diagram. [5]
 b) What are the defining factors and parameters of the wireless standard, Explain the evolution of wireless communication systems from 1G to 4G mentioning all defining factors of the wireless standard. [5]



Total No. of Questions : 6]

SEAT No. :

P5080

[5060]-721

[Total No. of Pages : 2

**M.E.(E&TC) (Microwave)
EMI AND EMC TECHNIQUES
(2013 Pattern) (Semester-III) (604301)**

Time :3Hours]

[Max. Marks : 50

Instructions to the candidates:

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

Q1) a) What is electrostatic discharge(ESD)? **[4]**

Explain with example of charge accumulation and discharge.

b) Explain cross talk minimization techniques in PCB design. **[4]**

c) Explain the difference between grounding and bounding. **[2]**

Q2) a) What is need of EMI/EMC testing? What are the different testing methods? **[4]**

b) What is amplitude culling and frequency culling with respect to transmitter and receiver circuit? **[4]**

c) What is difference between inter system EMI and Intra system EMI?[2]

Q3) a) Explain in detail conducted, radiated and transient EMI with example.[4]

b) Explain modeling techniques of class A and class B interference. **[4]**

c) Explain EMI prediction considerations for Antenna design **[2]**

P.T.O.

- Q4)** a) Compare Five different approaches for measurement of radiated emission (RE) and radiation susceptibility (RS) of an equipment. [4]
- b) What is microwave anechoic chamber? How it is used for EMI testing? [4]
- c) What are the precautions required in earthing? [2]
- Q5)** a) Explain single point, multi point and hybrid grounding techniques. [5]
- b) Write short note on shielding. Explain E-field and H-field shielding effectiveness. [5]
- Q6)** a) Explain common mode and differential mode filter design for power line. [5]
- b) Explain EMI standards for Military and Industrial Applications. [5]



Total No. of Questions : 8]

SEAT No. :

P4821

[Total No. of Pages : 2

[5060]-722

M.E. (E &TC) (Microwave)

RADAR & SATELLITE COMMUNICATIONS

(2013 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) *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. **[5]**

b) Derive the radar range equation? Explain the factors that affect the maximum range of radar. **[5]**

Q2) a) Explain with neat block diagram the working principle of military radar system. Also discuss the various additional features available in military radars. **[5]**

b) Explain with neat block diagram the working principle of Moving Target Indicator (MTI) radar. **[5]**

Q3) a) Discuss various types of antennas used for RADAR applications. Also discuss the polarization for the antennas used. **[3]**

b) Explain the concept of "Pulse Compression". **[3]**

c) Differentiate between Continuous Wave & Pulsed radar systems. **[4]**

P.T.O.

Q4) Write short notes on: **[10]**

- a) Frequency Diversity radar
- b) Blind Speeds
- c) Radar Clutters
- d) Radar Beacons

Q5) a) With respect to satellite communication explain the following: **[4]**

- i) Apogee and Perigee
 - ii) Mean and True anomaly
- b) What is a geostationary orbit? Which conditions should be fulfilled to attain a geostationary orbit? Also list the advantages and disadvantages of GEO satellites. **[6]**

Q6) a) Comment on various interferences and noise sources in satellite communication system. **[5]**

b) List and discuss the various orbits defined for satellite communication. **[5]**

Q7) Explain the various multiple access technologies. **[10]**

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

- a) Orbital Perturbations
- b) Antennas used in Satellite Communication
- c) Argument of Perigee
- d) Reciprocity theorem used for Antenna



Total No. of Questions : 8]

SEAT No. :

P4822

[Total No. of Pages : 3

[5060]-724
M.E. (E &TC) (Signal Processing)
IMAGE PROCESSING & ANALYSIS
(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) *All questions carry equal marks.*
- 4) *You are advised to attempt not more than five questions.*
- 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) a) Explain the following terms w.r.t. image. **[4]**

- i) Critical fusion frequency
- ii) Simultaneous contrast
- iii) Spatial Vs temporal effects
- iv) Visibility function

b) Explain following stastical parameters for an image and calculate all these parameters for segment of an image given below. **[6]**

- i) Mean
- ii) Variance
- iii) Histogram
- iv) Standard deviation

$$img = \begin{bmatrix} 20 & 140 & 100 & 20 \\ 20 & 140 & 100 & 20 \\ 240 & 140 & 240 & 240 \\ 240 & 140 & 240 & 240 \end{bmatrix}$$

P.T.O.

- Q2)** a) Draw & explain gray level human vision model. [5]
- b) Explain Hadamard transform? Derive Hadamard transform matrix of order 8. What is sequency? [5]

- Q3)** a) Explain the different techniques for sharpeing an image in spatial domain. [5]
- b) What is histogram and histogram equalization? Find out the equalized histogram for the following image. [5]

Gray level	0	1	2	3	4	5	6	7
Count	10	50	75	75	100	60	20	10

- Q4)** a) Justify with example, how median filtering is better than average filtering in removal of salt and pepper noise in an image. [5]
- b) Explain K-L transform and its importance compare it with DCT. [5]
- Q5)** a) Explain two different boundary descriptors in detail. [6]
- b) What is edge detection? How edge detection algorithm can be used to detect the liquid content of a transperent bottle. Propose the complete algorithm & mention the assumptions made. [4]
- Q6)** a) What is image restoration? With the help of neat diagram explain image degradation model. [4]
- b) Explain image segmentation based on Thresholding. Explain the various types of thresholding techniques used in image segmentation. [6]

- Q7)** a) Explain basic operations of morphology. And hence explain hit or miss transform and its application. [6]
- b) How the object boundary is represented with the help of fourier descriptors. What is its advantage. [4]
- Q8)** a) Explain different types of redundancies present in an image. State techniques to remove each of them. [5]
- b) How DCT is useful in image compression. Explain zonal coding & threshold coding technique. [5]



[5060]-725

M.E. (E &T.C.) (Signal Processing)

SIGNAL PROCESSING TECHNIQUES

(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 indicate full marks.
- 4) Assume suitable data if necessary.

Q1) a) Design a linear phase FIR low pass filter for the following specifications: [5]

$$H_d(e^{jw}) = \begin{cases} e^{-j2w} & \text{for } 0 \leq |w| \leq \pi/4 \\ 0 & \text{for } \pi/4 \leq |w| \leq \pi \end{cases}$$

Use a Hamming window. Find the values of $h(n)$ for $N = 5$. Also find magnitude and phase response.

b) Design a digital Butterworth filter that satisfies following specifications: [5]

$$0.707 \leq |H(e^{jw})| \leq 1 \quad \text{for } 0 \leq w \leq \pi/2$$

$$|H(e^{jw})| \leq 0.2 \quad \text{for } 3\pi/4 \leq w \leq \pi$$

Use bilinear transformation. Assume $T = 1$ sec.

Q2) a) Use frequency sampling method to design a FIR low pass filter to meet following constraints: [5]

$$H_d(e^{jw}) = \begin{cases} e^{-j(N-1)w/2} & \text{for } 0 \leq |w| \leq \pi/2 \\ 0 & \text{for } \pi/2 \leq |w| \leq \pi \end{cases}$$

Consider $N = 7$.

b) Explain the application of multirate DSP in sub-band coding of speech and audio signals. [5]

P.T.O.

- Q3)** a) For the FIR Wiener filter derive the Wiener-Hopf equations and the mean-square error. [4]
- b) Explain polyphase structure for interpolators. [4]
- c) Compare impulse invariance transformation with bilinear transformation in IIR filter design. [2]

- Q4)** a) Find the Padé approximation of a second-order all-pole model for a signal $x(n)$. Whose six values are:

$$x = [1, 1.5, 0.75, 0.375, 0.1875, 0.0938]^T$$

Consider number of poles $p = 2$ and number of zeros, $q = 0$. [4]

- b) Explain circular buffering and Barrel shifter of DSP processor. [4]
- c) What is the need of anti-aliasing filter in decimator? Explain with neat diagram. [2]

- Q5)** a) Compare type I, type II, type III and type IV FIR filter. [4]

- b) Design a three-stage decimator to reduce sampling rate from 96 kHz to 1 kHz and satisfies following specifications: [4]

Pass band ripple = 0.01, Stop band ripple = 0.001, Highest frequency of interest = 450 Hz. Assume decimation factors - 8, 6, 2.

- c) Given analog filter transfer function $H(s) = 2/(s + 1)(s + 2)$. Determine $H(z)$ using impulse invariance method. Assume $T = 1$ sec. [2]

- Q6)** a) Explain the properties of unfolding with suitable example. [4]
- b) Draw a functional block diagram and explain architecture of a typical DSP processor. [4]
- c) Determine $y(n)$ in terms of $x(n)$ for the following multirate system: [2]



- Q7)** a) With the help of suitable block diagram explain sampling rate conversion by rational factor. Derive input-output signal relationship. Draw input-output spectrum. [4]
- b) Explain retiming for clock period minimization with suitable example. [4]
- c) Why FIR filters are inherently stable? Explain. [2]
- Q8)** a) Explain a noise cancellation scheme based on adaptive filter. [4]
- b) Write a short note on: [4]
- i) VLIW architecture,
 - ii) Pipelining
- c) How to overcome frequency warping effect in bilinear transformation? [2]



[5060]-726

M.E. (E & T.C.) (Signal Processing)

MIXED SIGNAL PROCESSING SYSTEM & DESIGN

(2013 Pattern)

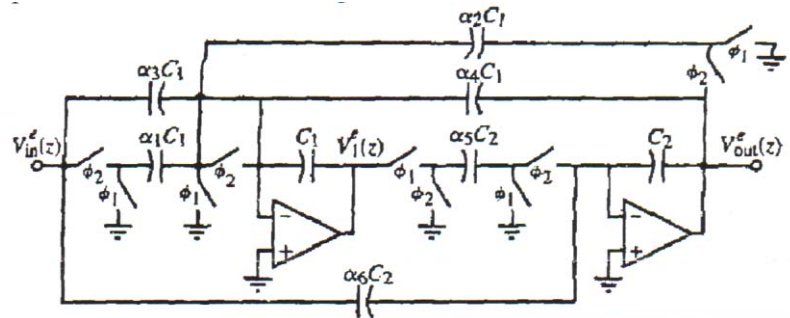
Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Answer any five 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)** Assume that the Noninverting and inverting voltage amplifiers have been designed for a voltage gain of + 10 and – 10 if $av_d(0)$ is 1000. Find the actual voltage gains for each amplifier. Also draw z-domain model for the ideal op amp. **[5]**
- b)** Explain Pipeline ADC with suitable diagram, also explain how multi-bit pipeline ADC is useful in digital error correction. **[5]**
- Q2) a)** Describe the non idealities in switched capacitor circuits due to MOS transistors and operational amplifier. **[3]**
- b)** Discuss the differences between Nyquist rate ADC and oversampling ADC. **[2]**
- c)** Assume that the specifications of a switched capacitor high Q biquad are $f_0 = 1\text{kHz}$, $Q = 10$, $K_0 = K_2 = 0$ and $K_1 = 2\pi f_0/Q$ (a band pass filter). The clock frequency is 100 kHz. Design capacitor ratios for the following figure. Determine maximum capacitor ratio and total capacitance for the following circuit. Assume C_1 and C_2 have unit values. **[5]**



- Q3)** a) Explain Frequency response of the switched capacitor amplifier. [3]
- b) Explain concept of switch capacitor resistor. [2]
- c) Design an 8-bit current steering DAC using binary-weighted current sources. Assume that the smallest current source will have a value of $1\mu\text{A}$. What is the range of values that the current source corresponding to the MSB can have while maintaining an INL of $\frac{1}{2}$ LSB? [5]
- Q4)** a) Derive the value of resistance emulated by series parallel switched capacitor. [5]
- b) Draw block diagram of delta sigma DAC. [5]
- Q5)** a) What is VCO? Explain source coupled VCO with the help of suitable diagram, also determine its frequency of oscillation. [5]
- b) Explain term "digital correction" in multiple bit pipeline ADC. [5]
- Q6)** a) Explain types of phase detector with suitable diagram. [5]
- b) What is loop filter? Compare active PI and Passive lag loop filter on the basis of K_f , ϵ , ω_n , $\Delta\omega L$. [5]
- Q7)** a) What is jitter? Explain its effect in DLL & PLL, also explain its reduction techniques. [5]
- b) Explain how is testing of ADC are done with respect to [5]
- i) Input output test
- ii) Spectral output test

- Q8)** a) Design a switched capacitor realization for a first order, high pass circuit with a high frequency gain of -10 and a -3 dB frequency of 1 KHz using a clock of 100 kHz. **[5]**
- b) Explain in detail successive approximation ADC with suitable diagram, waveform and algorithm, also perform operation of 3 bit successive approximation ADC with $V_{REF} = 8\text{v}$ & $V_{IN} = 5.5\text{v}$. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4825

[Total No. of Pages : 3

[5060]-728

M.E. (E &T.C.) (Signal Processing)

SPEECH SIGNAL PROCESSING

(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) *You are advised to attempt not more than five questions.*
- 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.*
- 7) *Assume suitable data if necessary.*

Q1) a) Explain LTI & LTV model for speech production system. **[5]**

b) Define following parameters with respect to speech signal.

- i) Energy measurement.
- ii) Zero crossing Rate (ZCR)
- iii) normalized Auto correlation.
- iv) Spectrum tilt.

Explain how Autocorrelation can be used to detect voiced & unvoiced signal. **[5]**

Q2) a) Define pitch frequency. Explain in detail the Auto correlation method for finding pitch period. **[5]**

b) What is cepstrum? Why is the cepstral domain preferred for pitch measurement. How it done, explain. **[5]**

P.T.O.

- Q3)** a) What is formant frequencies. How will you relate it to the vocal tract. Explain procedure for finding formant frequencies using log spectrum. **[5]**
- b) What is the Mel scale & Bark scale. **[2]**
- c) What is STFT? How it is useful for speech analysis? **[3]**
- Q4)** a) Explain the Burg algorithm for calculation of predictor coefficients. **[5]**
- b) What is forward linear prediction? What the different approaches to find LPC. Derive the normal equation for auto correlation. **[5]**
- Q5)** a) Explain Mid-rise and Mid-thread uniform quantizer. What is drawback of it while coding a speech signal & explain distortions or errors produced due to it. **[4]**
- b) With the help of neat block diagram explain forward & back ward adaptive quantizer. **[6]**
- Q6)** a) Let the voice signal samples be 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, and 1.8. Find the step size & quantization noise power for a signal & for a difference signal if a 4 bit quantizer is used. **[5]**
- b) With the help of block schematic explain backward adaptive. Delta Modulation encoder and decoder. **[5]**

Q7) a) What is sub-band coding? How to allocate number of bits to each sub-band. Explain how it is useful for speech coding. [5]

b) Explain speech enhancement technique in transform domain. What is the need of speech enhancement. [5]

Q8) Write short notes on following (Any Two): [10]

a) Speaker identification.

b) Adaptive echo cancellation.

c) G.726 speech coding standard.



[5060]-729
M.E. (E&Tc.) (Signal Processing)
ARCHITECTURE FOR SIGNAL PROCESSING
ALGORITHMS
(2013 Pattern) (Semester II)

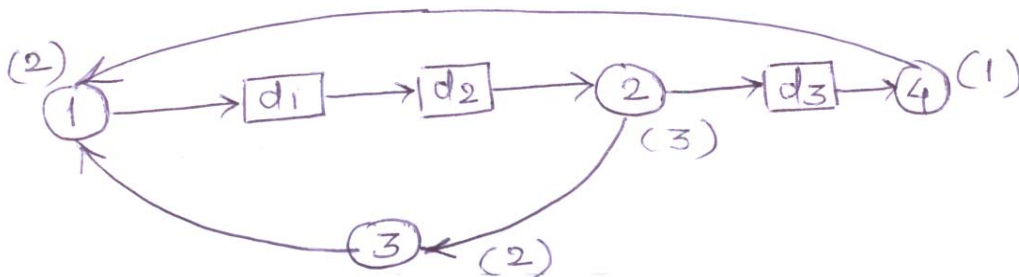
Time : 3 Hours]

[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) Find the filter response of $h(n) = \{0, 2, 3\}$ for input signal $x(n) = \{0, 1, 2, 3, 4, 5, 1, 2\}$ using overlap and save method. **[5]**
- b) Find iteration bound of a given data flow using any one algorithm. **[5]**



- Q2)** a) Calculate of DFT of $P(x, y)$, if **[5]**

$$P(x, y) = \begin{bmatrix} 5 & 1 & 1 & 4 \\ 1 & 2 & 2 & 2 \\ 1 & 4 & 1 & 3 \\ 4 & 2 & 1 & 3 \end{bmatrix}$$

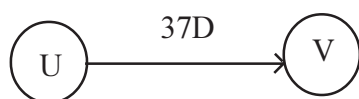
- b) Derive the expression for power consumption of M-level parallel system. **[5]**

P.T.O.

- Q3)** a) Explain the concept of dyadic, decomposition, translation and scaling in DWT. [4]
- b) For a given system apply a retiming technique to reduce a clock period.
 $y(n) = a y(n - 1) + b y(n - 3) + x(n)$.
 Where y is output and x is input & a, b are the constants. [4]
- c) Obtain Canonic signed digit representation of 2's complement number 1.01110110. [2]

- Q4)** a) Where hybrid Radix - 2 addition is used? Explain the steps carried out in it. [4]
- b) Explain Horner's Rule for precision improvement in Canonic signed digit arithmetic. [4]
- c) Explain the terms: [2]
- i) Iteration bound
 - ii) Loop bound in signal flow graph.

- Q5)** a) Construct a 4×4 linear convolution using 2×2 short convolution. [4]
- b) Unfold the given graph using folding factor 4. Explain the steps. [4]



- c) Explain what is use of systolic array. [2]
- Q6)** a) Obtain data broadcast structure for a given system
 $y(n) = a x(n) + b x(n - 2) + c x(n - 3)$
 Where y is output and x is input, a, b, c are the constant for a given system. [4]
- b) Calculate DCT for a $x(n)$, [4]
 Where $x(n) = \{1, 3, 2, 4, 5, 2, 3\}$
- c) Explain the properties of retiming. [2]

- Q7)** a) Find DFT using Decimation in frequency FFT method of $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ [4]
b) Explain Goertzel algorithm. [4]
c) How pipelining processing is useful in power consumption. [2]
- Q8)** a) Explain the bit serial multiplier using any one method. [4]
b) What are the limitations of carry ripple multipliers. How to overcome it. [4]
c) Explain any two properties of DFT. [2]



Total No. of Questions : 8]

SEAT No. :

P4827

[Total No. of Pages : 2

[5060]-730

M.E. (E&TC) (Signal Processing)
BIOMEDICAL SIGNAL PROCESSING
(2013 Course) (Semester - II) (Elective - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer 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) Explain cardio-vascular system in detail. [6]
b) Explain origin of bio-signals and action potential. [4]

- Q2)** a) With the help of neat waveform explain ECG and its generation in detail. [6]
b) Draw and explain ECG acquisition methods. [4]

- Q3)** a) Draw and explain the working of Instrumentation Amplifier. What is its significance in Biomedical signal processing? [6]
b) Write a note on Biomedical Transducers. [4]

- Q4)** a) Explain various techniques of grounding and shielding implemented for electrical safety of Medical Instruments. [6]
b) Explain the generation of EEG waveform and specify different frequency ranges in it. [4]

P.T.O.

- Q5)** a) Compare FIR and IIR filters. [6]
- b) Explain with suitable diagrams and equations, the significance of wavelet transforms in biomedical signal processing. [4]
- Q6)** a) How is multilayer perceptron useful in classification of ECG waveforms as normal and abnormal. [6]
- b) What is phonocardiography? Explain with the help of waveforms. [4]
- Q7)** a) Compare PCA and ICA. Mention applications of each technique. [6]
- b) What is fMRI? Explain its applications. [4]
- Q8)** a) What are AR, MA and ARMA models for spectral estimation of signals? [6]
- b) Discuss Wiener filter in detail. [4]



Total No. of Questions : 8]

SEAT No. :

P4828

[Total No. of Pages : 2

[5060]-732
M.E. (E&Tc) (Signal Processing)
STATISTICAL SIGNAL PROCESSING
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Solve any five 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) What do you mean by signal modeling give its applications. **[5]**

b) A signal x is given below that is to be approximated. Use pade approximation for $p = 2$, $q = 0$ and $p = q = 1$. **[5]**

$$X = \{1, 1.500, 0.750, 0.375, 0.185, 0.0938\}$$

Q2) a) Given the signal $x(n)$ consisting single pulse of length N

$$X(n) = 1 ; n = 0, 1, 2, \dots, N - 1$$

$$0 ; n = \text{elsewhere}$$

Use PRONEY'S method to model $x(n)$, having one pole and one zero. **[5]**

b) Explain in detail Least Square method of signal modeling and give its advantages as well as limitations. **[5]**

Q3) a) Explain in detail AR, MA and ARMA process. **[5]**

b) Given the signal $x(n)$ consisting single pulse of length N

$$X(n) = 1 ; n = 0, 1, 2, \dots, N - 1$$

$$0 ; n = \text{elsewhere}$$

Use SHANK'S method to model $x(n)$, having one pole and one zero. **[5]**

P.T.O.

- Q4)** a) If $H(Z)$ is a p th-order all-pole filter, given $h(n)$ for $n = 0, 1, \dots, N$, then the stability of $H(z)$ may be determined. If this is true, explain the procedure and list any conditions that must be placed on p or N . If false, explain why it cannot be done. [5]
- b) Explain Levinson - Durbin algorithm. [5]
- Q5)** a) Explain how wiener filter can be used for noise cancellation. [5]
- b) We have a signal $x(n)$. Obtain an all-pole model of the form
- $$H(z) = \frac{b(0)}{1 + a(1)z^{-1} + a(2)z^{-2}}$$
- Using the autocorrelation method, find explicit formulas for $b(0)$, $a(1)$ and $a(2)$ in terms of $r_{x(0)}$, $r_{x(1)}$ and $r_{x(2)}$. [5]
- Q6)** a) State CR lower bound theorem, and explain with its regularity condition. [3]
- b) Explain modified covariance method of parametric spectrum estimation. [4]
- c) Compare of NLMS over LMS. [3]
- Q7)** a) Explain Blackman tukey algorithm for power spectrum estimation in detail. [3]
- b) Write LMS algorithms for n^{th} order FIR filter. State its convergence property. [3]
- c) Explain Orthogonality principle for linear estimators hence Explain MVUE-minimum variance unbiased estimates. [4]
- Q8)** a) Write a note on channel equalization using adaptive filters. [3]
- b) Prove that modified periodogram is not a consistent estimate of the power spectrum. [4]
- c) Draw block diagram of adaptive filter and explain its applications. [3]



Total No. of Questions : 8]

SEAT No. :

P4829

[Total No. of Pages : 2

[5060] - 733

M.E. (E & TC) (Signal Processing)

**STILL IMAGE AND MOVING PICTURE COMPRESSION
STANDARDS**

(2013 Pattern) (Semester - III)

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 side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

Q1) a) What are the different types of image formats used in Digital Video. What is the need of these formats? [4]

b) Define Discrete Wavelet Transform. Explain any one type of Wavelet Transform in detail. [6]

Q2) a) Which modes are supported by the JPEG standard? Describe the lossless JPEG approach. [5]

b) Explain the need for standardization in image transmission and reception. Illustrate the interleaved and non-interleaved ordering for color images. [5]

Q3) a) State the basic objectives of Set Partitioning in Hierarchical Trees (SPIHT) algorithm. Define spatial orientation trees and set partitioning rules. [5]

b) Explain the importance of EBCOT used in JPEG 2000. Explain Tier-1 Coding. [5]

Q4) a) Enlist and define the matching criteria for block motion estimation. Explain full search block motion (FSBM) estimation. [5]

b) With the help of a block Diagram, describe the core encoder of JPEG. [5]

P.T.O.

- Q5)** a) Enlist MPEG1 picture types. Give their significance and coding technique. What preprocessing step is necessary for MPEG1 encoding? [6]
- b) For a SIF 625 video to be coded at 1.2 Mbps, a structure of $N = 12$ and $M = 3$ is used.
- Calculate the target bit rate for the GOP. Draw the structure. Assuming a coding ratio of 6:3:2, find the target bit rate for each I, P and B pictures. [4]
- Q6)** a) For MPEG2, considering SNR scalability prove the statement: “Codec can also be called a coefficient amplitude scalability unit”. [6]
- b) Give applications of Scalability. [4]
- Q7)** a) In what aspects does H.263 differ from MPEG1? [5]
- b) What is deblocking filter? Why is it needed? [5]
- Q8)** a) Compare MPEG-4 and H.263. [5]
- b) Give the methods of Image segmentation for MPEG-4. [5]



Total No. of Questions : 8]

SEAT No. :

P4830

[Total No. of Pages : 2

[5060] - 735

M.E. (E & TC) (VLSI & Embedded Systems)

DIGITAL CMOS DESIGN

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any five questions.*
- 2) *Assume Suitable data if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of non programmable pocket calculator is allowed.*

Q1) a) With the help of cross sectional view & equivalent circuit of MOSFET, explain various parasitic capacitances involved. Compare these capacitances for different operating regions of MOSFET. [5]

b) What is meant by technology? What is current technology? List layout design rules in detail. [5]

Q2) a) Along with the suitable example, explain RC delay model. How is it helpful to designer? [5]

b) What is significance of static & short circuit power dissipation? How to minimize them? [5]

Q3) a) Explore CMOS fabrication process in detail. [4]

b) Explain technology scaling & its types along with suitable examples.[4]

c) What is lambda parameter? Mention utility. [2]

Q4) a) Derive the expression for power delay product. What is its significance in design? What is its relation with fan out? [4]

b) Explore the methodology involved in logical efforts. Give suitable example. [4]

c) Write note on propagation delay. [2]

P.T.O.

- Q5)** a) Design CMOS logic for $Y = ABC + DEFGH$ & calculate active area on chip. [4]
b) Draw a typical logic circuit susceptible to hazards. Explain the causes of hazards & explain along with timing diagram in detail. [4]
c) What is pass transistor logic? [2]
- Q6)** a) What are merits of Transmission Gate (TG)? Design one bit latch using TGs. Compare with conventional method. [4]
b) Draw FSM diagram for 1011 Mealy sequence detector & write HDL code for it. How to make this circuit immune to metastability? [4]
c) Compare CMOS NAND & NOR in detail. [2]
- Q7)** a) Explain cascode voltage switch logic with appropriate example. [4]
b) What is need of domino logic? Explore in detail. [4]
c) What are merits of BiCMOS circuit? Give example. [2]
- Q8)** a) List the low power design techniques. Explore any one in detail. [4]
b) What materials are being used for improvement of performance? Explain in brief. [4]
c) Write note on comparison of logic families. [2]



Total No. of Questions : 8]

SEAT No. :

P4831

[Total No. of Pages : 2

[5060] - 736

M.E. (E & TC) (VLSI & Embedded Systems)

EMBEDDED SYSTEM DESIGN

(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) *All questions carry equal marks.*
- 5) *Assume Suitable data if necessary.*

Q1) a) Discuss the constraints that should be considered when formulating a design Specification for an embedded system. [5]

b) Discuss in detail V type life cycle model with its advantages, disadvantages and applications. [5]

Q2) a) Define design metrics. Explain the design challenges for optimization of design metrics. [4]

b) Compare the functional model and architectural model of an embedded system. [3]

c) Explain partitioning and decomposing a system in system design phase. [3]

Q3) a) With the help of block diagram explain ARM9TDMI 5 stage pipeline organisation. [4]

b) Explain the ARM architectural support for system development. [3]

c) Explain in detail memory hierarchy & memory subsystem architecture. [3]

Q4) a) Explain the ARM floating point architecture in detail. [4]

b) Write a note on “Development Tools”, for an embedded system. [3]

c) Write a note on I2C & SPI protocol. [3]

P.T.O.

- Q5)** a) Explain in brief the Kernel Configuration (Kconfig) file. [5]
b) What is a device driver? With the help of suitable example explain the structure of Device driver program [5]
- Q6)** a) Differentiate between BIOS and boot loader. [4]
b) Explain the storage considerations in an embedded Linux. [3]
c) Explain "Flash File System", in an embedded Linux system. [3]
- Q7)** a) Explain in detail architecture of Android Operating System. [4]
b) Explain in detail structure of android applications. [4]
c) Write short note on, "Content Providers". [2]
- Q8)** a) What is "Android manifest"? Explain in brief the structure of Android manifest file. [5]
b) Write short note on : [5]
i) API with reference to Android OS.
ii) Telephony and SMS



Total No. of Questions : 8]

SEAT No. :

P4832

[Total No. of Pages : 2

[5060] - 737

M.E. (E & TC) (VLSI & Embedded Systems)

RECONFIGURABLE COMPUTING

(2013 Pattern) (Semester - I)

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 side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Explain key differences between Configurable, Programmable, and fixed- Function devices. [4]
b) What are Research challenges in RC? What is state of Art? [4]
c) What is key relation between interconnect, configuration memory and active logic. [2]
- Q2)** a) Discuss general purpose computing issues. [5]
b) Explain the Metric: Density and Diversity. [5]
- Q3)** a) Compare ASIC, GPP, FPGA, Memory, RALU, PDSP with respect to power consumption, design efforts, throughput and NRE. [4]
b) Explain VLIW processor, discuss its failure from performing at peak.[4]
c) Explain the term Multi-Context. [2]
- Q4)** a) Explain the hierarchical interconnect scheme. [4]
b) What are issues in Reconfigurable Network Design. [4]
c) Brief on channel and wire growth. [2]

P.T.O.

- Q5)** a) What are different instruction compression techniques? Explain any one. [4]
b) Find the number of interconnect bits required for a 1000 4-LUT device with 200 inputs. [4]
c) Explain the terms Architecture W & Design W. [2]
- Q6)** a) Draw and explain the architecture of DPGA. [5]
b) Explain with suitable diagram the time switched input register. [5]
- Q7)** a) What are working RC examples? What tasks are being performed by them? [5]
b) Explain MATRIX as reconfigurable architecture. [5]
- Q8)** a) Explain Rapid prototyping as the application of RC. [4]
b) Explain Multicontext FPGA as platform for RC. [4]
c) Brief on the term partial reconfigurability. [2]



Total No. of Questions : 8]

SEAT No. :

P4833

[Total No. of Pages : 2

[5060] - 739

M.E. (E & TC) (VLSI & Embedded Systems)

ANALOG CMOS DESIGN

(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) *Assume Suitable data if necessary.*

- Q1)** a) Explain MOSFET as a switch? Comment on signal degradation in pass transistor. [4]
b) Explain CMOS inverting amplifiers. [3]
c) What is the need of Voltage/current reference? [3]
- Q2)** a) Explain in detail common source amplifier. [4]
b) How current sink and current source are implemented using MOSFET. 'What are the voltage compliances? How to improve? [4]
c) Write short note on MOSFET as a diode. [2]
- Q3)** a) Explain CMOS differential amplifier using NMOS transistors with large signal analysis. [4]
b) Discuss any two approaches to implementing the output amplifier. [4]
c) Write short note on Micro power opamp. [2]
- Q4)** a) Explain large signal analysis of differential amplifier. [4]
b) Explain Low noise opamp using MOSFETS. [4]
c) Write short note on cascode amplifier. [2]

P.T.O.

- Q5)** a) Explain short circuit time constant method for bandwidth estimation.[4]
b) Explain current scaling Digital to Analog Convertor. [4]
c) Explain Neutralization and unilateralization approaches of Tuned amplifier. [2]
- Q6)** a) Explain Shunt peaked amplifier for bandwidth enhancement. [4]
b) Explain different switched capacitor circuits that emulate a resistor.[4]
c) Explain Two Port bandwidth enhancement technique. [2]
- Q7)** a) Discuss various LNA topologies with respect to power versus noise match. [5]
b) What is Differential LNA , how it overcomes the drawbacks in single ended LNA [5]
- Q8)** a) Explore different characteristics of mixer. [4]
b) Explain advanced trends in RF chip design. [6]



Total No. of Questions : 8]

SEAT No. :

P4834

[Total No. of Pages : 2

[5060] - 740

M.E. (E & TC) (VLSI & Embedded Systems)

SYSTEM ON CHIP DESIGN

(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 indicater full marks.*
- 4) *Use of electronic pocket calculators is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Draw and explain hierarchy of abstraction levels. [4]
b) Differentiate Concurrency Vs parallelism. [4]
c) Explain the term deep-submicron effect. What is current CMOS design feature Size'? [2]
- Q2)** a) What are the limitations of ' data flow models'? In which model these are rectified? [4]
b) Explain with an example sequential targets for static schedule design.[4]
c) What is advantage of pipelining of SDF graphs'? [2]
- Q3)** a) Explain hardware implementation of Euclid's algorithm through SDF. [4]
b) Draw and explain CFG of the CGD program. [4]
c) Differentiate : CFD Vs DFG? [2]
- Q4)** a) What are limitations of FSMs? [4]
b) Draw and explain design flow to convert software source code into instructions for a processor. [4]
c) Why increased instruction latency of a RISC processor is usually not a problem? [2]

P.T.O.

- Q5)** a) When sequential read - write race occurs? Explain it with an example?[4]
b) Explain the scope of STA. What is its main limitation? [4]
c) Which factors affecting delay and slew? [2]
- Q6)** a) Explain the challenge with bus synchronization design? [4]
b) Explain the factors which affect power. [4]
c) How noise margin is maintained in 0.8 V domains using level shifter?[2]
- Q7)** a) Explain memory hierarchy trade-offs and characteristics. [4]
b) What are limitations of DRAM scheduler designs? [4]
c) Which techniques are used for lowering operating voltage? [2]
- Q8)** a) Explain energy - ware device scheduling algorithm. [4]
b) Explain SoC design flow for verification environment? [4]
c) Which IEEE standars is used for SoC test? Draw the IEEE SOC test architecture. [2]



Total No. of Questions : 8]

SEAT No. :

P4835

[Total No. of Pages : 2

[5060]-741

M.E. (E & TC) (VLSI & Embedded Systems)

EMBEDDED SIGNAL PROCESSOR

(2013Pattern) (Credit System) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer any five.*
- 2) *Figures to the right indicate full marks.*

Q1) a) Explain the block diagram of software development tools for designing of DSP applications system. [4]

b) Obtain the cascade realization of system function
 $H(z) = (1 + 2z^{-2} - z^{-2})(1 + z^{-1} - z^{-2})$. [4]

c) What is the concept of moving window in signal processing? [2]

Q2) a) What are the important issues in selecting hardware components and interfacing external hardware devices to DSP processor? [3]

b) Compute the 4-point DFT of the sequence $x(n) = (1 \ 2 \ 1 \ 0)$. [4]

c) Explain the adaptive filter algorithm for noise cancellation. [3]

Q3) a) Find the 8 point DFT of a sequence $x(n) = (1 \ 1 \ 1 \ 1 \ 0 \ 0 \ 0 \ 0)$ using DIT-FFT radix 2 Algorithm. [6]

b) Compare IIR and FIR digital filters. [4]

P.T.O.

- Q4)** a) Draw and explain the architecture of Blackfin processor. [5]
b) What are the important feature of TMS320C67XX processor? Draw and explain the block diagram of TMS320C67XX. [5]
- Q5)** a) Justify the necessity of MAC and Barrel shifter in DSP processor. [3]
b) What is the need of code optimization? Explain different code optimization methods for developing DSP system. [3]
c) Compare and contrast fixed and floating point processors. [4]
- Q6)** a) Explain different addressing modes of TMS320C54XX. [4]
b) Compare TMS320C54XX and TMS320C67XXN with respect to architecture, MIPS, memories, and addressing modes. [6]
- Q7)** a) Write short note on audio coding and audio effects applications using DSP techniques. [5]
b) What is the need of image enhancement? Explain the different methods of image enhancement. [5]
- Q8)** a) Explain wavelet transform and its applications. [5]
b) Explain DTMF generation and detection application using DSP techniques. [5]



Total No. of Questions : 8]

SEAT No. :

P4836

[Total No. of Pages : 3

[5060]-743

M.E. (E & TC) (VLSI & Embedded Systems)

FAULT TOLERANT SYSTEMS

(2013 Pattern) (Credit System) (Semester - III)

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 a primitive cube table for the following equation. [3]

$$F = \overline{X_1}\overline{X_2} + X_1\overline{X_2} + \overline{X_1}X_2X_3$$

b) What do you mean by Static and Dynamic Hazards? Explain? [4]

c) Define unknown logic value and construct truth tables of 3 - valued logic for OR & AND gate. [3]

Q2) a) Write short note on Delay Modeling with timing diagrams for different delay models. [4]

b) Define and explain Event driven simulation in detail. [3]

c) Construct a binary decision diagram for a given function. [3]

$$F = A\overline{B}C + \overline{A}C + BC$$

P.T.O.

Q3) a) For the circuit of figure. 1 **[5]**

- i) Find the set of all tests that detects the fault $c s-a-1$.
- ii) Find the set of all tests that detects the fault $a s-a-0$.
- iii) Find the set of all tests that detects the multiple faults $\{c s-a-1, a s-a-0\}$.

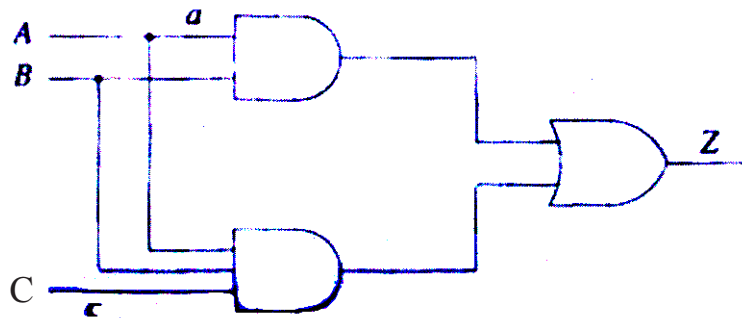


Figure .1

b) Explain in brief **[5]**

- i) Fault dominance
- ii) Equivalent fault collapsing
- iii) Dominance fault collapsing

Q4) a) Explain in detail different fault models. Give their advantages and disadvantages. **[6]**

b) Explain any two techniques of DFT to increase controllability and predictability? **[4]**

- Q5)** a) Explain in brief parity check function with self checking 3-bit parity checker and general self-checking parity checker. [5]
- b) Give classification of different compression techniques. Explain parity check compression. [5]
- Q6)** a) Explain signature analyzer in compression techniques. Also give one Example. [5]
- b) Write a brief note explaining the working of self checking Berger code. [5]
- Q7)** a) Write short note on built in self test. [5]
- b) Explain in detail: PLA testing. [5]
- Q8)** a) What is error masking? Give the techniques to measure masking techniques to measure masking characteristics in compression techniques? [5]
- b) Explain in detail logical fault model. [5]



Total No. of Questions : 8]

SEAT No. :

P5124

[Total No. of Pages : 2

[5060]-744

M.E. (E&TC) (VLSI and Embedded Systems)

ASIC DESIGN

(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 indicate full marks.*
- 4) Use of electronic pocket calculators is allowed.*
- 5) Assume suitable data, if necessary.*

Q1) a) Draw the design flow for an ASIC design process and explain each step. **[4]**

b) What do you mean by ASIC cell library? And what should it contain? **[3]**

c) Compare different ASIC technologies **[3]**

Q2) a) Explain in detail Gate array based ASICs. **[4]**

b) Differentiate static and dynamic timing analysis. Which is better? and why? **[3]**

c) Write a VHDL code for sequence detector, which detects the sequence '1101' using moore machine. **[3]**

Q3) a) What is cross talk delay and cross talk noise in context to ASIC design? Which parameter it will severely affect? **[4]**

b) Explain Gate level mixed mode simulation and testing of ASIC. **[4]**

c) Explain the synthesis process in detail. **[2]**

P.T.O.

- 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]
- Q5)** a) What are objectives of system partitioning and explain different algorithms used for the same. [4]
b) What are the factors contributes to best 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 any 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) Briefly explain Boundary scan test. [4]
c) Define the term controllability and observability. [2]
- Q8)** a) Explain the Built In Self Test (BIST) with example. [5]
b) Write short notes on Any two: [5]
i) Design Rule check (DRC)
ii) Features of EDA tools
iii) Fault simulation



Total No. of Questions : 8]

SEAT No. :

P4837

[Total No. of Pages : 3

[5060] - 751

M.E. (Electronics) (Digital System)

MICROELECTRONICS

(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any FIVE questions.*
- 2) *All question 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*
- 6) *Use of calculator is allowed*

Q1) a) Explain MOS characteristics with drain current equation in each region also draw small signal equivalent circuit. [5]

b) Draw and explain CMOS inverter voltage transfer characteristics and also explain effect of β_n/β_p ratio on inverter characteristics. [5]

Q2) a) What is pass transistor logic? What are the advantages and disadvantages of pass transistor logic? [4]

b) Explain any two non ideal IV effects. [4]

c) What is RC delay model? Explain in detail. [2]

Q3) a) Enlist and explain steps involved in Gate and Source/Drain fabrication. [5]

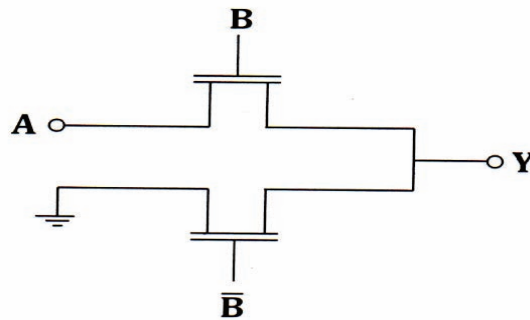
b) What is inter-connect? What is best possible metal for interconnect? Is it used? If not why? [5]

Q4) a) Why stick diagrams are drawn? Sketch stick diagram for a CMOS gate computing $y = \overline{(A + B + C)}.D$ [4]

P.T.O.

- b) Design 2:1 Mux using conventional logic, pass transistor logic and transmission gate also compare the design. [4]
- c) What is DRC? [2]

- Q5)** a) Explain Linear Delay Model. [4]
- b) State different types of power dissipation in CMOS circuit also derive the expression for dynamic power dissipation. [4]
- c) Which circuit is represented by following MOS Transistors. State its advantages and disadvantages. [2]



- Q6)** a) What are different power reduction techniques in low power design. [4]
- b) What are the sources of variation in circuit behavior. Explain in relation with Design Margin. [4]
- c) You are considering lowering V_{DD} to try to save power in a static CMOS gate. You will also scale V_t proportionally to maintain performance. Will dynamic power consumption go up or down? Will static power consumption go up or down. [2]
- Q7)** a) What are the important characteristics of OPAMP and explain two stage CMOS OPAMP. [5]
- b) Sketch 3 input XOR function using following circuit techniques. [5]
- i) Static CMOS
 - ii) Pseudo-nMOS
 - iii) Dual-rail domino
 - iv) Transmission gate
 - v) Pass transistors

Q8) a) Sketch transistor level schematic for a single stage CMOS logic gate for each of the following function. **[4]**

i) $Y = \overline{A + BCD}$

ii) $Y = \overline{(AB + C).D}$

iii) $Y = \overline{(A + B).C + DE}$

iv) $Y = AB + CD$

b) Write short notes (any two) **[4]**

i) Current Mirror circuit

ii) CMOS RF Circuit

iii) Bi-CMOS Circuit

c) What is Tristate inverter? Explain tristate inverter with a neat circuit diagram. **[2]**



Total No. of Questions : 8]

SEAT No. :

P4838

[Total No. of Pages : 2

[5060]-752

M.E. Electronics (Digital Systems)
DIGITAL SIGNAL PROCESSING ARCHITECTURES
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

Solve any five questions.

- Q1)** a) Compute a 4. point DFT of following sequence. [4]
 $x(n) = \{3,9,5,7\}$
- b) Explain overlap and save method for filtering long sequence. [3]
- c) Explain Periodicity, Linearity and symmetry properties of DFT. [3]
- Q2)** a) Compare computational complexity for Direct computation of the DFT versus FFT algorithm. [3]
- b) Explain DTMF signal detection using Goertzel algorithm. [4]
- c) Why ideal low pass filters can not be designed? Explain in detail. [3]
- Q3)** a) Compare up-sampler with interpolator and down-sampler with decimator. [3]
- b) Design sampling rate converter for a factor of $I/D = 7/9$. [4]
- c) Explain frequency spectrum at the output of each block in a decimator. [3]
- Q4)** a) Design a two stage decimator for the following specification. [5]
 $D = 100$
Passband : $0 \leq F \leq 50$
Transition band : $50 \leq F \leq 55$
Input sampling Rate : 10000 HZ
Ripple $\delta_1 = 10^{-1}$ $\delta_2 = 10^{-3}$
- b) Explain application of multirate DSP as an implementation of digital filter banks. [5]

P.T.O.

- Q5)** a) Calculate the wavelet decomposition for the impulse response $h(n) = \{1,2,4,7\}$ [5]
b) Draw and explain Radix - 2 DIF FFT, 8 point structure, with example. [5]
- Q6)** a) Explain SHARC processor (ADSP 21020) block diagram. [5]
b) Calculate multiplication of 14 and -5 using Booth's multiplication algorithm. [5]
- Q7)** a) What is the code composer studio? Explain the use of CCS in developing signal processing application. [5]
b) Draw and explain architecture of Black fin's Digital signal processor (ADSP BF 536). [5]
- Q8)** a) Derive the expression for impulse response of FIR band stop filter. [5]
b) A FIR filter (digital) has the unit impulse response $h[n] = [2,2,1]$ and input sequence is $x(n) = [3,0,-2,0,2,1,0,-2,1,0]$. Determine the responses of the filter for $x[n]$ using overlap add method. [5]



Total No. of Questions : 8]

SEAT No. :

P4839

[Total No. of Pages : 2

[5060]-753

**M.E. Electronics
EMBEDDED SYSTEM 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) *Assume suitable data if necessary.*

- Q1)** a) Design requirements of sophisticated embedded system [4]
b) Compare V model with water fall model. [4]
c) What is primary purpose of the design specification? [2]
- Q2)** a) Explain the architectural model with example. [4]
b) Explain the important hardware development tools used in embedded system design. [4]
c) What are the major reason for partitioning system. [2]
- Q3)** a) Explain how ARM architectural support for operating System [4]
b) Compare ARM7 with ARM9TDMI architecture [4]
c) Write load or store instruction from memory to register for ARM processor. [2]
- Q4)** a) Explain with example that ARM architectural support for high level language [4]
b) Explain in detail memory subsystem architecture [4]
c) Explain different modes of ARM architecture [2]
- Q5)** a) What are steps to implement device driver for blinking of LED? [4]
b) What are storage consideration in case of embedded linux? [4]
c) What are the features of embedded linux? [2]

P.T.O.

- Q6)** a) Explain cross development tools for Embedded linux target [4]
b) Explain Linux kernel configuration steps [4]
c) Explain linux kernel architecture [2]
- Q7)** a) Explain telephony and SMS services in android? [4]
b) Describe the structure of android? [4]
c) What is difference between application and services in case Android?[2]
- Q8)** a) What is the network services support provided by Android? [4]
b) Explain how data stores in android. [4]
c) Write different applications of Android. [2]



Total No. of Questions : 8]

SEAT No. :

P4840

[Total No. of Pages : 2

[5060]-756

M.E. (Electronics) (Digital Systems)

DESIGN FOR TESTABILITY

(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 calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Implement three input EXOR using 4:1 multiplexer **[5]**

b) Implement $f = \bar{W}_1\bar{W}_3 + W_1W_2 + W_1W_3$ using Shannon expansion (use 4:1 Mux) **[5]**

Q2) a) Write VHDL code for 16:1 multiplexer using generate statement. **[5]**

b) Draw the state assignment table and state diagram for following: **[5]**

Input			
0	A	A	A
1	B	C	C
Output	0	0	1

Q3) a) Design an FSM that has an input W and output Z. The machine is a sequence detector that produce $z = 1$ when the previous two values were 00 or 11, otherwise $z=0$. **[5]**

b) Explain H-tree clock distribution network, Explain why it is required. **[5]**

P.T.O.

- Q4)** a) Explain the working of SRAM Cell. [5]
 b) Explain the state reduction procedure. [5]

Present state	Next State				Output
	00	01	10	11	
A	A	F	C	-	0
B	A	B	-	H	1
C	G	-	C	D	0
D	-	F	-	D	1
E	G	-	E	D	1
F	-	F	-	K	0
G	G	B	J	-	0
H	-	L	E	H	1
J	G	-	J	-	0
K	-	B	E	K	1
L	A	L	-	K	1

- Q5)** a) Explain Moore type FSM for serial adder. [5]
 b) Explain Mealy model implementation of the arbiter FSM. [5]

- Q6)** a) Explain the steps involved in scan path Technique. [5]
 b) Write a VHDL code using CASE to design a mealy machine for $z=1$ for second occurrence of $x = 1$ else 0. [5]

- Q7)** a) Draw and explain the built in logic block observer. [5]
 b) Find hazard free minimum cost implementation for the function of $f(x_1, x_2, \dots, x_n) = \sum m(0, 4, 11, 13, 15) + D(2, 3, 5, 10)$ [5]

- Q8)** a) Draw the ASM chart of divider. [5]
 b) Write short note on design for testability. [5]



Total No. of Questions : 8]

SEAT No. :

P4841

[Total No. of Pages : 2

[5060] - 757
M.E. (Electronics Digital System)
PLDs AND ASIC DESIGN
(2013 Pattern)

Time : 3 Hours]

[Max. 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) What is structured ASIC? How does this compare and differ from the traditional ASIC and the PLD? [5]
- b) Write VHDL code for 4:1 multiplexer and the test bench to simulate it. [5]
- Q2)** a) What are the different examinations are carried out in the static timing analysis. [4]
- b) Write a note on System on Chip. [4]
- c) What are data path and control Path? [2]
- Q3)** a) Explain the resource sharing in a system design with suitable example. [4]
- b) Explain the Complex Programmable Logic Device Cool Runner. [4]
- c) What is the process statement in VHDL? [2]
- Q4)** a) Explain the architecture and applications of Field Programmable Gate Array. [5]
- b) Explain the various packages available in VHDL. [5]

P.T.O.

- Q5)** a) Draw and describe architecture of Xilinx Virtex-II Pro. [4]
b) Explain one hot encoding. [4]
c) Enlist applications of CPLDs. [2]
- Q6)** a) How to debug the FPGA Design? Explain the role of Chipscope Pro. [4]
b) Describe the three phases in the simulation of VHDL code. [3]
c) Explain different programming technologies used to configure FPGAs [3]
- Q7)** a) Explain any ASIC Design tool. [4]
b) Describe ASIC Cell libraries. [4]
c) What is IP Core? How its significance in the design process? [2]
- Q8)** a) Explain the design and development of serial/parallel converter. [5]
b) Explain the ASIC design flow in detail. [5]



Total No. of Questions : 8]

SEAT No. :

P4842

[Total No. of Pages : 3

[5060] - 758

M.E. (Electronics) (Digital System)
RANDOM SIGNALS AND PROCESSES
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any five questions out of 8 questions.*
- 2) *Answer to all questions must be written in detail to its fullest length.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Use of calculators is allowed.*
- 6) *Assume suitable data.*

Q1) a) state and explain Baye's Theorem. **[5]**

b) A ball is drawn at random from a box containing seven white balls, three red balls and six green balls. Determine the probability that the ball drawn is **[5]**

- i) White
- ii) Red
- iii) Green
- iv) Not red
- v) Red or White

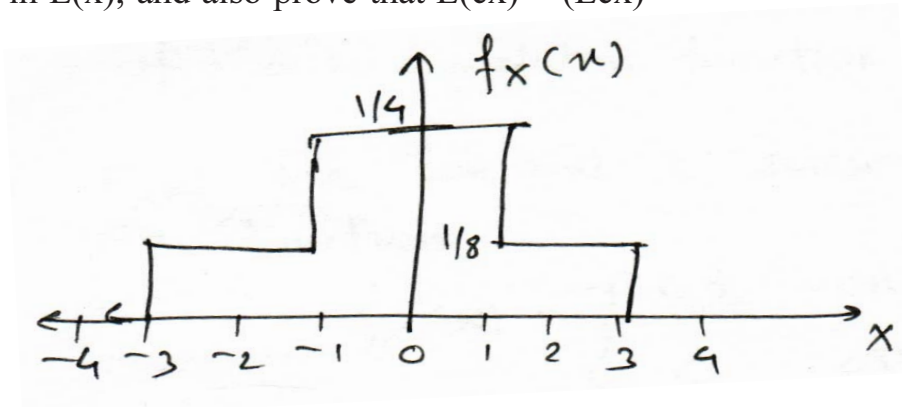
Q2) a) Let X and Y are two random variables with the joint density function

$$f_{xy}(x, y) = \begin{cases} x^2 + \frac{xy}{3}; & 0 \leq x \leq 1 \text{ and } 0 \leq y \leq 2 \\ 0 & \text{otherwise} \end{cases} \quad [5]$$

- i) check that $f_{xy}(x, y)$ is a density function.
 - ii) Find the marginal density function $f_x(x)$
- b) Define four properties of Joint density function. **[5]**

P.T.O.

- Q3) a)** State and explain Chi-square test and K-S test. [5]
- b)** Consider the random variable 'x' with the distribution shown in fig '1' Fin $E(x)$; and also prove that $E(cx) = (Ecx)$ [5]



- Q4) a)** Define Kurtosis and skewness for random variable. Draw the diagram for distributions showing high and low values of Kurtosis. [3]
- b)** Consider the random process $X(t) = A \cos(\omega_0 t + c)$ where 'c' is a random variable uniformly distributed over the interval $(0, 2\pi)$ and A and ω_0 are constants. Determine the power spectral density. [4]
- c)** If a random variable obeys a uniform PDF with constant value 'A' between $x = 2$ and $x = 6$. Find 'A' and the mean value of the random variable. [3]
- Q5) a)** Define ergodicity of a random process. Define strict sense and wide sense stationary process. [4]
- b)** Describe three important properties of auto correlation function. [3]
- c)** Find the constant 'C' such that the function [3]

$$f_x(x) = \begin{cases} cx; & 0 < x < 3 \\ 0; & \text{otherwise} \end{cases}$$

If a density function.

Also find the distribution function $F_x(x)$

- Q6) a)** Define an energy signal, power signal and energy spectral density. Explain the relationship between energy spectral density and auto correlation function. [5]

- b) (x, y) is a two dimensional random variable with joint probability density function as shown in Table. [5]

Y	X	
	1	2
0	1/4	1/4
1	0	1/8
2	1/4	1/8

- i) Sketch $f_x(x, y)$
- ii) Compute $f_x(1)$ and $f_x(2)$
- iii) Are X and Y independent?

Q7) a) State and explain simple binary hypothesis test principle. [5]

b) Compare MMSE and MAP. [5]

Q8) a) State and explain Cramer Rao Inequality. [3]

b) What is need of estimator. [2]

c) What are moment generating functions? Discuss the use of such functions with suitable examples. [5]



Total No. of Questions : 8]

SEAT No. :

P4843

[Total No. of Pages : 2

[5060] - 760

M.E. (Electronics) (Digital System)
IMAGE PROCESSING AND COMPUTER VISION
(2013 Credit Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any five questions.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Assume suitable data if necessary.*

Q1) a) Differentiate between Spatial Domain & Frequency domain image enhancement? [5]

b) With the help of examples explain 4, 8 & m-connectivity. [5]

Q2) a) Name different types of gray scale transformation, Explain them in brief and obtain the digital negative of the following 8 bits per pixel.[5]

121	205	217	156	151
139	127	157	117	125
252	117	236	138	142
227	182	178	197	242
201	106	119	251	240

b) Explain how 2 dimensional DCT is useful in image processing. [5]

Q3) a) What is histogram? Explain histogram equalization technique. [5]

b) What are image sharpening filters? Explain the various types of it. [5]

Q4) a) Write a short note on Wavelet transform. [5]

P.T.O.

- b) What is meant by Masking? What is the output using 3 x 3 median filter for the following given image by replicating border pixels: [5]

15	15	15	25	15	15
15	8	20	10	8	15
15	8	20	2	8	15
15	8	10	2	24	15
15	15	10	2	15	15

- Q5)** a) Explain in detail the MTF for human vision. [5]
b) Explain different surfaces used in radiometry and also explain which is better. [5]
- Q6)** a) Explain Marr's top bottom approach for 2D to full 3D conversion. [5]
b) What are intrinsic and extrinsic calibration parameters of a single-perspective camera? How are they estimated from known scenes. [5]
- Q7)** a) Explain different ways of estimating homography from point correspondences. [5]
b) How can we decompose the fundamental matrix to camera matrices. [5]
- Q8)** a) Write Short Note on : [5]
i) Moire interferometry
ii) 3D line construction
b) What is the difference between fundamental and essential matrices in stereopsis. [5]



Total No. of Questions : 8]

SEAT No. :

P5081

[5060]-761

[Total No. of Pages : 2

M.E. (Electronics) (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) *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) Draw ground reflection (Two-Ray) model. Derive the path loss expression for it. [6]
b) State and explain factors influencing small scale fading. [4]
- Q2)** a) Explain various handoff strategies used in cellular system. [5]
b) Explain different techniques used for improving coverage in cellular systems. [5]
- Q3)** a) With the help of a neat diagram explain: [6]
i) Classical Aloha.
ii) Slotted Aloha.
b) What is polling scheme? [2]
c) Explain in brief inhibit sense multiple access. [2]
- Q4)** a) Explain multiple access with collision avoidance scheme in detail. [6]
b) Compare TDMA and CDMA. [4]

P.T.O.

- Q5)** a) What are the different entities and terms used to understand mobile IP. Explain each one. [5]
b) Explain dynamic source routing in mobile ad-hoc networks. [5]
- Q6)** a) With the help of neat diagram explain IP-in-IP encapsulation. [5]
b) Explain dynamic host configuration protocol with suitable diagram. [5]
- Q7)** a) Explain the operation of CSMA/CA in the IEEE 802.11. [5]
b) Explain the process, when a GSM call is originated from the PSTN. [5]
- Q8)** a) Explain channel access cycle in the HIPERLAN-1 with neat diagram. [5]
b) Draw GSM protocol architecture for signaling and explain it. [5]



Total No. of Questions : 8]

SEAT No. :

P4844

[Total No. of Pages : 3

[5060]-771

M.E. (Instrumentation & Control/Biomedical Instrumentation)
MATHEMATICAL METHODS IN INSTRUMENTATION
(2013 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 indicate full marks.*
- 4) *Use of calculator is allowed.*

Q1) a) Find the norm of each vector and distance between vectors $u = (1, 1, 2)$ and $v = (1, -1, 1)$. **[4]**

b) Examine whether the set of vectors $u = (2, 3, -1)$, $v = (-1, 4, 2)$, $w = (1, 18, -4)$ are linearly dependent or independent. **[4]**

c) Define basis and dimension of vector space. **[2]**

Q2) a) Show that the set $B = (\bar{u}_1, \bar{u}_2, \bar{u}_3)$ where $\bar{u}_1 = (0, 1, 0)$, $\bar{u}_2 = (1, 0, 1)$, $\bar{u}_3 = (1, 0, -1)$ is an orthogonal basis of \mathbb{R}^3 . **[4]**

b) Transfer the following vectors to an orthonormal vectors using Gram-Schmidt method $\bar{u}_1 = (1, 0)$, $\bar{u}_2 = (3, -5)$. **[4]**

c) Define orthogonal and orthonormal vectors with examples. **[2]**

Q3) a) Obtain Newton Raphson formula to find inverse and inverse square root of given numbers. **[5]**

b) Solve by Gauss - Elimination method **[5]**

$$6x - y - z = 19,$$

$$3x + 4y + z = 26,$$

$$x + 2y + 6z = 22.$$

P.T.O.

- Q4)** a) Explain Skewness and Kurtosis with suitable examples. [4]
 b) Find first four moments about origin and about the mean for a random variable X having density function. [6]

$$f(x) = \frac{4x(9-x^2)}{81}, 0 \leq x \leq 3. \text{ and } f(x) = 0, \text{ otherwise.}$$

- Q5)** a) Let X be a random variable define by a density function $f(x) = 3x^2$, $0 \leq x \leq 1$, and $f(x) = 0$, otherwise. Find [5]
 i) $E(X)$
 ii) $E(3X - 2)$
 iii) $E(X^2)$
 b) Find variance and standard deviation of the sum obtained in tossing a pair of fair dice. [5]

- Q6)** a) Define uniform distribution, show that mean and variance of uniform distribution are $\mu = \frac{1}{2}(a+b)$ and $\sigma^2 = \frac{1}{12}(b-a)^2$. [5]
 b) Explain Bayes theorem with suitable examples. [5]

- Q7)** a) Find singular value decomposition of the matrix. [5]

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

- b) Apply Runge-kutta method of fourth order to find approximate value of y when $x = 0.2$, given that $\frac{dy}{dx} = x + y^2$ and $y = 1$, when $x = 0$. [5]

Q8) a) Let $\bar{v}_1 = \left(\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}} \right)$ and $\bar{v}_2 = \left(\frac{-1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}} \right)$ be an orthonormal set of vectors in \mathbb{R}^3 , if $\bar{u} = (1, 2, 3)$ compute orthogonal projection \bar{u} of W and orthogonal component of \bar{u} to W . **[5]**

b) The mean inside diameter of sample of 200 washer produce by a machine is 0.502 inches and the standard deviation is 0.005 inches, the purpose for which these washer are intended allows a maximum tolerance in the diameter of 0.496 to 0.508 inches otherwise washer are considered to be defective, determine the percentage of defective washers produced by a machine. Assuming that diameter are normally distributed. (Given: Area at $z = 1.2$ is 0.3849). **[5]**



Total No. of Questions : 8]

SEAT No. :

P4845

[Total No. of Pages : 2

[5060] - 772

M.E. (Instrumentation & Control) (Biomedical Instrumentation)
BIO-SIGNAL PROCESSING
(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) *Use of electronic pocket calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

Q1) Determine and plot the frequency response of the system described by impulse response $h(n) = \{1, 2, 3, 4, 5\}$. [10]

Q2) Explain the classification of signals with examples. [10]

Q3) Define following types of systems with example : [10]

- a) Linear system
- b) Time-invariant system
- c) Casusal system

Q4) a) Determine the circular convolution of the following sequences : [6]

$$x_1(n) = \{5, 3, 2, 6\}$$

$$x_2(n) = \{7, 8, 9, 10\}$$

b) State the following properties of DFT : [4]

- i) Time reverse
- ii) Circular frequency shift

P.T.O.

Q5) An IIR digital low-pass filter is required to meet the following specifications :

Passband ripple : ≤ 1 dB

Passband edge : 1 kHz

Stopband attenuation : ≤ 40 dB

Stopband edge : 2 kHz

Sample rate : 8 kHz Design a digital Butterworth filter using bilinear transformation. **[10]**

Q6) a) Explain how the adaptive filtering techniques are used for eliminating noise interference in biomedical signal processing. **[5]**

b) Explain the LMS algorithm in adaptive filtering. **[5]**

Q7) Compute the 8-point DFT of sequence $x(n) = \cos(2\pi n)$ using decimation-in-time radix-2 FFT algorithm. **[10]**

Q8) Design an FIR low-pass filter with desired frequency response **[10]**

$$H_d(\omega) = \begin{cases} e^{-j7\omega}, & \text{for } |\omega| \leq \frac{\pi}{4} \\ 0, & \text{for } \frac{\pi}{4} < |\omega| \leq \pi \end{cases}$$

Use Hamming and Hanning window functions.



Total No. of Questions : 7]

SEAT No. :

P4859

[Total No. of Pages : 2

[5060] - 773

M.E. (Biomedical Instrumentation & Control)

ANALYTICAL INSTRUMENTATION

(2013 Pattern) (Semester - I)

Time : 2 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 candidates 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) List Advantages and disadvantages of Instrumental method over chemical analysis method. **[5]**

b) What is spectrophotometer? Explain Direct reading spectrophotometer with neat sketch. **[5]**

Q2) a) Explain V-Grooves types nebulizer with sketch. **[5]**

b) Explain AAS with neat sketch. **[5]**

Q3) a) Explain FTIR With neat sketch. **[5]**

b) Write short notes on : **[5]**

Inductively coupled plasma(ICP)

Q4) a) Explain with neat sketch phosphorimeter. **[5]**

b) Explain with neat sketch Spectrofluorimeter. **[5]**

Q5) a) Explain Any one type of detector used in HPLC with neat sketch. **[5]**

b) Explain Gas Chromatography with neat sketch. **[5]**

P.T.O.

- Q6)** a) Explain Instrumentation for 'X-ray Spectroscopy. [5]
b) Explain with neat sketch scintillation counters. [5]
- Q7)** a) Explain NMR Spectroscopy with neat sketch. [5]
b) Explain principal and experimental set up of Potentiometry. [5]



Total No. of Questions : 7

SEAT No. :

P4846

[Total No. of Pages : 2

[5060] - 774

**M.E. (Instrumentation & Control)
(Process & Biomedical Instrumentation)
RESEARCH METHODOLOGY
(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 electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) In a class of 70 students, 11 have failed and their average of marks is 4.5. The total marks secured by the entire class were 486. Find the average marks of the students who have passed. **[5]**

b) Which research is more significant for business making and how? **[5]**

Q2) a) Discuss interview as a technique of data collection. **[5]**

b) Define research. What are the various steps involved in a research process? **[5]**

Q3) a) Describe the layout of research proposal. **[5]**

b) Explain importance of referencing in research proposal. **[5]**

Q4) a) How to estimate parameters? What are different methods for analyzing these parameters? **[5]**

b) What is the relevance of Setting objectives in research? **[5]**

Q5) a) How are regression coefficients correlated to correlation coefficients? **[5]**

b) What are static characteristics of instruments used in experimental setup? **[5]**

P.T.O.

- Q6)** a) List features of questionnaire method. [5]
b) Discuss the scope of primary data in research. [5]
- Q7)** a) What is multiscale modeling? Explain with one example. [5]
b) Explain in brief role of DSP in removing noise from collected data. [5]



Total No. of Questions : 5

SEAT No. :

P4847

[Total No. of Pages : 2

[5060] - 776

M.E. (Instrumentation & Control) (Biomedical) (Semester - II)

TRANSDUCER DESIGN

(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 indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following :

- a) Explain dynamic characteristics of sensors and its importance in selection of sensors. [5]
- b) Give importance of proximity sensors. Explain any one in detail. [5]
- c) List and explain any two sensors used in biomedical applications. [5]

Q2) Attempt any two of the following :

- a) Explain advantages of semiconductor type strain gauges. [5]
- b) Explain construction and working of digital thermometer used for measurement of human body temperature. [5]
- c) Explain design of resistive sensor for measurement of level. [5]

Q3) Attempt any two of the following :

- a) Explain design of electronic load cell for measurement of weight. [5]
- b) Explain different primary force sensors in detail. [5]
- c) Explain industrial applications of gas sensors. [5]

P.T.O.

Q4) Attempt any two of the following :

- a) Give general selection criteria for any flowmeter. [5]
- b) Explain biosensors and its applications. [5]
- c) Explain manufacturing process of MEMS with neat sketch. [5]

Q5) Attempt any two of the following :

- a) List different gas sensor with its application. [5]
- b) What are chemical sensors? Explain their importance in measurement systems. [5]
- c) Write short note on LASER applications. [5]



Total No. of Questions : 8

SEAT No. :

P4848

[Total No. of Pages : 2

[5060] - 777

M.E. (Instrumentation & Control) (Biomedical Instru.)

DIGITAL IMAGE PROCESSING

(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 Calculator, log table, charts is allowed.*
- 4) *Figures to the right indicate full marks.*

Q1) a) What is digital image processing? Explain the concept using suitable example. [5]

b) Explain any one image digitizer. [5]

Q2) a) Write short note on elements of visual perception. [5]

b) Write short note on image sensing. [5]

Q3) a) Write short note on discrete cosine transform. [5]

b) Explain the concept of short time Fourier transform. [5]

Q4) a) What do you mean by image averaging & mean filter. [5]

b) What are the necessity of image enhancement? Explain with one example. [5]

Q5) Write short note on : [10]

a) Diagonalization

b) Degradation model

P.T.O.

Q6) Write short notes on : **[10]**

- a) Canny operator
- b) Sobel operator

Q7) a) Enhance the following image using minimum low pass filter. **[5]**

10 20 30
20 10 20
30 20 10

b) Explain image resolutions. **[5]**

Q8) a) Detect the edges in the following image. **[5]**

10 20 30
20 10 20
30 20 10

b) Explain image segmentation. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4849

[Total No. of Pages : 2

[5060]-778

**M.E. (Instrumentation & Control) Biomedical
COMMUNICATION PROTOCOLS FOR
INSTRUMENTATION
(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) With neat diagram explain the balanced 2 wire and 4 wire RS 485 serial interface system. [4]
- b) Explain the role of DD files in HART networks. [4]
- c) Explain the role of LAS in Fieldbus system. [2]
- Q2)** a) Explain any two Profibus PA network elements with their functions. [4]
- b) Explain point to point multidrop networks in HART devices. [4]
- c) List any two physical network design rules applying to spurs in Profibus PA. [2]
- Q3)** a) Compare Foundation Fieldbus H1, Profibus PA with respect to Communication Speed and Maximum number of stations. [4]
- b) Explain the following test procedures done during commissioning of Fieldbus devices. [4]
- i) Segment testing
 - ii) Field Device testing
- c) List the advantages of RS485. [2]

P.T.O.

- Q4)** a) List and explain any four teams involved along with their responsibilities in implementing Fieldbus on a sizable automation project. [4]
- b) Giving typical values, explain any four technical specifications of RS485. [4]
- c) Explain the following network blocks: [2]
- i) Switch
- ii) Routers
- Q5)** a) Explain the requirements of the sensor level networks and list any two protocols used in this level. [5]
- b) List and explain any three logical media access and arbitration methods. [3]
- c) Explain the Logical Link Control and Adaptation Protocol (L2CAP) layer of the Bluetooth protocol stack. [2]
- Q6)** a) Explain the different types of VCRs used in Fieldbus? [5]
- b) List and explain any three Universal HART commands. [3]
- c) Explain the classes of HART Commands. [2]
- Q7)** a) Write a short note on MODBUS RTU protocol. [5]
- b) With a neat diagram explain the typical Profibus control network in a processing facility. [5]
- Q8)** Write short notes:
- a) Advantages and Limitations of Open Networks. [5]
- b) Data Highway Plus. [5]



Total No. of Questions : 8]

SEAT No. :

P4850

[Total No. of Pages : 2

[5060]-780

M.E. (Biomedical Instrumentation)
MEDICAL IMAGING TECHNIQUES
(2013 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer any five questions.*
- 2) *Use of scientific calculator is allowed.*
- 3) *Draw diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Draw electromagnetic spectrum and explain its different ranges. [4]
b) Explain how viewing conditions affect image visibility. [4]
c) What is Confusion Matrix? [2]
- Q2)** a) Draw the diagram of Xray tube and explain principle of Xray generation. [4]
b) Describe the Schileren system used to visualize the ultrasound field. [4]
c) What are the advantages of Digital Radiography? [2]
- Q3)** a) Which different signal conditioning blocks are used in Xray machine and how do they improve the quality of Xray image? [5]
b) Describe the image reconstruction algorithm used in Computed Tomography. [5]
- Q4)** a) Define Optical Density. Elaborate the concept for radioopaque and radioluscent materials. [5]
b) What is the difference in usual Xray machine and Mammography Xray machine. [3]
c) What is Bremsstrahlung Xray? [2]

P.T.O.

- Q5)** a) List the transmission modes of ultrasound. Explain pulsed Doppler mode of transmission. [5]
- b) What are different applications of thermography? Explain any one of them in detail. [5]
- Q6)** a) Define Free Induction Decay. How does it help in identifying the problem? [3]
- b) What are the target filter combinations used for mammography? What is the selection criteria for it? [5]
- c) What are the contrast media used in Angiography? [2]
- Q7)** a) Explain the principle of Positron Emission Tomography. With the help of a diagram describe various building blocks of PET scanner. [5]
- b) With the help of neat diagram illustrate the basic principle of Nuclear magnetic resonance. [5]
- Q8)** a) What are the three basic parameters measured in ultrasound and how do they help in image formation. [5]
- b) Describe various detectors used in nuclear medicine. [3]
- b) Which contrast media are used in ultrasound? [2]



Total No. of Questions : 8]

SEAT No. :

P4851

[Total No. of Pages : 2

[5060]-781

M.E. Instrumentation and Control (Biomedical Instrumentation)
ADVANCED DIGITAL SIGNAL PROCESSING
(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.*

- Q1)** a) Define Wigner Ville Distribution and state its properties. [4]
b) Define Time frequency Distribution. Discuss its need with suitable application. [4]
c) Define STFT. [2]
- Q2)** a) Obtain the UP sampling of the causal signal $x(n) = n/2$, by the factor of 4. [5]
b) Explain Decimation with polyphase filters. [5]
- Q3)** a) Discuss SSS and WSS processes. [5]
b) Explain behaviour of linear systems with stochastic signals. [5]
- Q4)** a) Explain Blackman-Tueky method of PSD estimation. [4]
b) Define PSD and ESD. [2]
c) Explain AR models for PSD estimation. [4]

P.T.O.

- Q5)** a) Explain LMS algorithm for adaptive filter design. [5]
b) Explain Echo cancellation in communication channels using adaptive filters. [5]
- Q6)** a) Explain International broadcasting standards. [5]
b) Explain lossy and lossless of data compression. [5]
- Q7)** a) Explain polyphase filters for multivariate systems. [5]
b) Explain the need of data compression with suitable example. [5]
- Q8)** a) Discuss spectral factorization. [5]
b) Discuss power spectrum estimation. [5]



Total No. of Questions : 5]

SEAT No. :

P4852

[Total No. of Pages : 2

[5060] - 783

M.E. (Instrumentation & Control)

PROCESS INSTRUMENTATION

Transducer Design

(2013 Pattern)

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) Give detail classification of temperature sensors and transducers with their measurement ranges. [5]
- b) Explain potentiometer and its signal conditioning circuit for displacement measurement application. [5]
- c) Discuss design aspect for Capacitive transducer for level measurement. [5]

Q2) Attempt any two of the following :

- a) Select any suitable transducer for measurement of pressure and design its signal conditioning circuit for indication of pressure. [5]
- b) With neat sketch explain optical transducer for measurement of angular displacement. [5]
- c) Explain piezoelectric sensor with its signal conditioning circuit. [5]

Q3) Attempt any two of the following.

- a) Explain different sensors and transducers are used in aircraft system.[5]
- b) Explain any two types of transducer for measurement of torque. [5]
- c) Give different types gas sensors with their applications. [5]

P.T.O.

Q4) Attempt any two of the following.

- a) Explain two different modes of ultrasonic flowmeter. [5]
- b) Write note on biosensors and its applications. [5]
- c) Explain manufacturing process of MEMS with neat sketch. [5]

Q5) Attempt any two of the following.

- a) Explain chemical sensors and its applications. [5]
- b) What is LASER? Explain how it can be used as sensor? [5]
- c) Write short note on nanosensors and its applications. [5]



Total No. of Questions : 7]

SEAT No. :

P4853

[Total No. of Pages : 2

[5060] - 784

M.E. (Instrumentation & Control) (Process Instrumentation)
INDUSTRIAL AUTOMATION
(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) Explain in brief application of safety system. **[5]**

b) Discuss in brief with suitable block diagram any two major components of the DCS. **[5]**

Q2) a) List various major types of PLC analog inputs and outputs. Enlist specifications of any typical PLC. **[5]**

b) Explain HAZOP w.r.t : **[5]**

i) Definition

ii) Objectives

Q3) a) Explain in brief IEC61511 standard for functional Safety. **[5]**

b) Describe in brief SCADA systems in terms of their architecture and interface to process hardware. **[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) Explain with an example ‘Sequential Function Chart’. [5]
b) Describe the data flow and number conversions involved in PLC analog operation. [5]
- Q6)** a) Explain in brief commissioning of HART. [5]
b) Develop programmable ladder diagram to start 3 motors as per given sequence 3-2-1. [5]
- Q7)** a) Develop programmable ladder diagram for flashing of lamp for every 20 seconds. It should go off after five flashes. [5]
b) Discuss the various selection criteria that must be considered for selection of a suitable PLC for a specific process control. [5]



Total No. of Questions : 7]

SEAT No. :

P4854

[Total No. of Pages : 2

[5060] - 786

M.E. (Instrumentation & Control) (Process Instrumentation)
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) What is the need of Mathematical Model in process control? [5]
b) Design Feedback control strategy for Heat exchanger. [5]
- Q2)** a) What is Statistical Process Control? [5]
b) Explain in brief Interaction of control loops. [5]
- Q3)** a) Explain with neat sketch Model Predictive Control. [5]
b) Explain with example Control chart. [5]
- Q4)** a) Write a brief note on Inferential Control. [5]
b) State importance of DMC. [5]
- Q5)** a) Describe the procedure of empirical model identification. [5]
b) What do you mean by RGA? [5]

P.T.O.

Q6) a) Discuss in brief different types of decoupling. [5]

b) Discuss design steps of MRAS using MIT rule. [5]

Q7) a) Explain with suitable example cascade control. [5]

b) Compute RGA for given process gain matrix and decide pairing of variables. [5]

$$K = \begin{bmatrix} \frac{12.8}{16.7s+1}e^{-s} & -\frac{18.9}{21s+1}e^{-3s} \\ \frac{6.6}{10.9s+1}e^{-7s} & -\frac{19.4}{14.4s+1}e^{-3s} \end{bmatrix}$$



Total No. of Questions : 5]

SEAT No. :

P4855

[Total No. of Pages : 2

[5060] - 787

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) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure 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 clock sources of AT8535 AVR microcontroller. [5]
- b) Explain with interrupt structure of ATmega8535 AVR μ C. [5]
- c) Explain with suitable block diagram ADC pre-scalar of ATmega8535 AVR μ C. [5]

Q2) Attempt any two of the following :

- a) Explain in detail a pipeline mechanism RISC processor. [5]
- b) Explain in detail ARM registers [5]
- c) What is ARM-Thumb interworking? Explain with example. [5]

Q3) Attempt any two of the following :

- a) Explain RS-232 handshaking circuit. [5]
- b) Explain with neat schematic PC Parallel Port. [5]
- c) Explain in detail SPI. [5]

P.T.O.

Q4) Attempt any two of the following :

- a) Explain in detail the standard CAN architecture. [5]
- b) Describe the USB communication protocol. [5]
- c) Explain CAN transceiver features. [5]

Q5) Attempt any two of the following :

- a) Explain in brief hierarchical FPGA. [5]
- b) Explain different FPGA design tools. [5]
- c) Explain the basic logic programming elements of the FPGA with a suitable example? [5]



Total No. of Questions : 5]

SEAT No. :

P4856

[Total No. of Pages : 2

[5060] - 788

M.E. (Instrumentation & Control) (Process Instrumentation)

ADVANCED CONTROL SYSTEM

(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 candidates indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following :

- a) What is mean by nonlinear systems? Give its important characteristics.[5]
- b) Discuss ideal relay with its mathematical representation. [5]
- c) Define singular point and explain its different types. [5]

Q2) Attempt any two of the following :

- a) Define describing function? Find describing function for saturation.[5]
- b) Explain stability analysis of nonlinear system with describing function method with necessary diagrams. [5]
- c) Explain limit cycles in nonlinear system. [5]

Q3) Attempt any two of the following :

- a) Explain Lyapunov stability methods for nonlinear systems. [5]
- b) Define positive definite, negative definite functions with examples and its importance. [5]
- c) Determine the stability of a non-linear system governed by equation.[5]

$$\dot{x}_1 = x_1$$

$$\dot{x}_2 = x_1^2 + 2x_2^2$$

P.T.O.

Q4) Attempt any two of the following :

- a) Explain importance of feedback linearization. [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) Explain design of sliding mode controller procedure with example.[5]
- b) Design sliding mode controller for any second order control system.[5]
- c) What is chattering in SMC? Also explain techniques used for avoidance/elimination of chattering. [5]



Total No. of Questions : 5]

SEAT No. :

P4857

[Total No. of Pages : 2

[5060] - 790

M.E. (Instrumentation & Control) (Process Instrumentation)

ADVANCED SIGNAL PROCESSINGS

(2013 Pattern) (Semester - III)

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 indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

Q1) Attempt any two questions :

- a) Compute the eight point DFT using DIF FFT algorithm
$$\left\{ \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0 \right\}$$
 [5]
- b) Write short note on Time frequency analysis. [5]
- c) Explain linear predictive coding of speech signals with block diagram. [5]

Q2) Attempt any two questions :

- a) Explain one application of homomorphic deconvolution. [5]
- b) Explain application of homomorphic filtering for speech data Processings. [5]
- c) Write short note on wavelet packets. [5]

Q3) Attempt any two questions :

- a) Explain the terms interpolation and decimation. [5]
- b) Explain even band & odd band positioning in sampling rate conversion. [5]
- c) Explain subband coding in wavelet. [5]

P.T.O.

Q4) Attempt any two questions :

- a) Write short note on Pseudo QMF bank. [5]
- b) Write short note on Perfect Reconstruction (PR) systems. [5]
- c) Write short note on transform coding and LOT. [5]

Q5) Attempt any one question :

- a) Explain Bartlett and Welch method of power spectrum estimation.[10]
- b) Explain any two parametric methods for power spectrum estimations. [10]



Total No. of Questions : 7]

SEAT No. :

P4858

[Total No. of Pages : 2

[5060] - 791

M.E. (Part - II) (Process Instrumentation & Control)

BUILDING AUTOMATION

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) *Answer any five questions.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figures to the right candidates 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) Explain Fire alarm system with neat sketch. [6]

b) Write a short notes on 'Fire Signature'. [4]

Q2) a) Explain Intelligent Access Control System with neat Sketch. [6]

b) Write a short notes on PIDS for Industrial Building. [4]

Q3) a) Explain Single duct, constant volume, single zone systems Air conditioning system with neat sketch. [6]

b) Write a short notes on Air Handling Unit(AHU). [4]

Q4) a) Explain any one type of compressor used in Vapour compression cycle with neat sketch. [6]

b) Write a short notes on Hot water coil. [4]

Q5) a) Explain DDC architecture with sketch. [6]

b) Write a short notes on BACnet. [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. :

P4860

[Total No. of Pages : 2

[5060] - 801

M.E. (Computer Engineering)(Semester - I)

APPLIED ALGORITHMS

(Pattern : 2013)

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.*
- 5) *Use of calculator is allowed.*

- Q1)** a) What are the Important characteristics of an Algorithm? [5]
b) Discuss the Empirical measurements of performance of algorithms.[5]
- Q2)** a) Define asymptotic notations. Explain their signification in analyzing algorithms. [5]
b) Write about the Best-case, Average-case, and Worst-case analyses of Insertion sorting algorithm. [5]
- Q3)** a) Describe all pair shortest path Algorithm in graph. [5]
b) Which are $O(n \log n)$ sorting algorithms. [5]
- Q4)** a) Explain Prim's Algorithm for minimum spanning tree. [5]
b) Write about Greedy Kruskal's minimum spanning tree algorithm. [5]
- Q5)** a) Write the Red-Black Trees. [5]
b) Which are different Approximation scheme? [5]

P.T.O.

- Q6)** a) Explain the algorithm of Binary Search. [5]
b) What are the basic properties of Line, Intersection of Line and Line Segment? [5]
- Q7)** a) State and Explain Application of Knapsack Problem. [5]
b) Explain simplex method of LPP with example. [5]
- Q8)** a) Write short note on Epsilon Approximation. [5]
b) Consider the LP problem [5]
Maximize $Z = 15x_1 + 10x_2$
Subject to the constraints
i) $4x_1 + 6x_2 \leq 360$
ii) $3x_1 \leq 180$
iii) $5x_2 \leq 200$
 $x_1, x_2 \geq 0$



Total No. of Questions : 6]

SEAT No. :

P4861

[Total No. of Pages : 2

[5060] - 802
M.E. (Computer Engineering)
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) Define database tuning. Explain important decisions to be made during physical database design and database tuning. **[4]**

b) Explain Clustering for Index selection with suitable example. **[4]**

Q2) a) Explain different concurrency control mechanism for distributed database transactions. **[4]**

b) Explain translation of global queries to fragment queries for distributed databases. **[4]**

Q3) a) Why was the TPC-D benchmark replaced by the TPC-H and TPC-R benchmarks? **[4]**

b) Explain a model for distributed query optimization with suitable example. **[4]**

Q4) a) Consider following XML file. **[4]**

P.T.O.

```

<?xml version="1.0" encoding="UTF-8"?>
<bookstore>

<book category="COOKING">
  <title lang="en">Everyday Italian</title>
  <author>Giada De Laurentiis</author>
  <year>2005</year>
  <price>30.00</price>
</book>

<book category="CHILDREN">
  <title lang="en">Harry Potter</title>
  <author>J K. Rowling</author>
  <year>2005</year>
  <price>29.99</price>
</book>

<book category="WEB">
  <title lang="en">XQuery Kick Start</title>
  <author>James McGovern</author>
  <author>Per Bothner</author>
  <author>Kurt Cagle</author>
  <author>James Linn</author>
  <author>Vaidyanathan Nagarajan</author>
  <year>2003</year>
  <price>49.99</price>
</book>

<book category="WEB">
  <title lang="en">Learning XML</title>
  <author>Erik T. Ray</author>
  <year>2003</year>
  <price>39.95</price>
</book>
</bookstore>

```

Solve following XQuery using FLWOR expression

- i) Select all the title elements under the book elements that are under the bookstore element that have a price element with a value that is higher than 30.
 - ii) Select all the title elements under the book elements that are under the bookstore element, and return the title elements in alphabetical order.
- b) Consider XML file given in Q4 (a). Write DTD and XML Schemas for XML file given in Q4 (a). [4]
- Q5)** a) Analysis and Design the requirements for any Mobile Database application which consist of semi structured and unstructured data using any standard Mobile Database. [5]
- b) Explain Multimedia Databases with suitable example. [4]
- Q6)** a) Design fully Distributed Hadoop framework for large scale data management and analytics with suitable business application [5]
- b) Write a short note on (Any one) [4]
- i) Job Tracker and Task Tracker
 - ii) Legacy Systems.



Total No. of Questions : 6]

SEAT No. :

P4862

[Total No. of Pages :3

[5060] - 803
M.E. (Computer Engineering)
ADVANCED COMPUTER ARCHITECTURE
(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 indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is shared memory concept? Explain the different shared memory multiprocessor models. **[5]**
- b) Explain in detail generic computer architecture? **[4]**

OR

Short Notes on (Any three) **[9]**

- a) Cache Coherence problem.
- b) Pipeline Hazards.
- c) Load Balancing/Scheduling.
- d) SMP/ASMP.

- Q2)** a) Discuss and differentiate distributed memory MIMD Architecture and shared memory MIMD Architecture? **[4]**
- b) Explain the Gustafson's for fixed time speed for scaled program sizes. **[4]**

OR

- a) Explain data control and resource parallelism? **[4]**
- b) What is the degree of parallelism. Describe average parallelism in terms of DOP. **[4]**

P.T.O.

- Q3)** a) How instructions are executed? Explain FETCH, DECODE and EXECUTE and also make the diagram to explain the processor? [4]
- b) Compare the RISC & CISC architectures. [4]

OR

- a) Comment on how the superscalar can increase performance with VLIW architecture. [4]
- b) Write a short note on Array Processor and Parallel Processing. [4]

- Q4)** a) Explain the different hardware support for exposing ILP. [4]
- b) State the latency hiding techniques? Explain the relaxed memory consistency? [4]

OR

- a) What is vectorization & instruction types? Explain the distributed memory model in SIMD computer organization. [4]
- b) What is cache coherency problem. How the directory based protocol overcome the problem updating the cache blocks. [4]

- Q5)** a) Explain different services offered by cloud? What is the difference between public and private cloud? [4]
- b) Explain the features of parallel programming languages for program development. [4]

OR

- a) What conditions are for better critical section? Explain message passing & shared memory model. [4]
- b) Compare between grid and cloud computing. [4]

Q6) Write Short Notes on (Any Three)

[9]

- a) Neuro computing
- b) Grid computing
- c) Single Program Multiple Data (SPMD)
- d) Quantum computing

OR

Write Short Notes on (Any Three)

[9]

- a) GPU parallel architecture.
- b) Multiprocessor and Multicomputer.
- c) Amdahl's Law.
- d) Pipelining (Linear and non Linear)

▽▽▽▽

Total No. of Questions : 6]

SEAT No. :

P4863

[Total No. of Pages : 2

[5060] - 804

M.E. (Computer Engineering) (Semester - I)

RESEARCH METHODOLOGY

(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 indicate full marks.*
- 4) *Assume suitable data, if required.*

Q1) a) Define Research and its motivation. Explain research process in detail.[9]

OR

b) What are Intellectual Property rights? Why promote and protect intellectual property? What is a Patent? Why are patents necessary? What kinds of inventions can be Protected? [9]

Q2) a) What is research problem? What are the different techniques involved in defining the problem. [8]

OR

b) Why Literature survey in research is required? How it is conducted? Write names of top 5 referred journals in your field which are used for literature survey. [8]

Q3) a) Explain the following concept relating to research design: [8]

- i) Dependent and independent variable
- ii) Extraneous variable
- iii) Research hypothesis
- iv) Experiment

OR

b) Choose any research problem in computer engineering field to conduct the research. State different research designs and select suitable research design method for the problem you identified and justify why you selected that particular design method. [8]

P.T.O.

- Q4) a)** 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. [8]

OR

- b) Explain the use of analysis of variance (ANOVA) and covariance (ANACOVA). Briefly explain multivariate ANOVA. [8]

- Q5) a)** What is the role of statistics in research? Explain important statistical measures that are used to summarize the survey/research data. [8]

OR

- b) The procedure of testing hypothesis requires researchers to adopt several steps. Describe in brief all such step. [8]

- Q6) a)** State in brief layout of research report and what precautions one should take for writing research report. [9]

OR

- b) What is the queuing theory? What is little's law explain its use in queuing theory with suitable examples. [9]

▽▽▽▽

Total No. of Questions : 12]

SEAT No. :

P4864

[Total No. of Pages :3

[5060] - 806
M.E. (Computer Engineering)
OPERATING SYSTEM DESIGN
(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) *Figures to the right indicate full marks.*

- Q1)** a) What does an operating system do? Explain the tasks performed by Operating system as resource manager. **[5]**
- b) State and explain various communication related system calls. **[4]**

OR

- Q2)** a) What is mean by file identifiers? Which are the identifiers for standard input and standard output? How does shell does the assignments? **[5]**
- b) What is mean by design space? How it is useful in design search? **[4]**

- Q3)** a) How a problem of suspending a system call and completing it later, after another event has occurred is dealt with? Discuss it in the context of send and receive message system call. **[4]**
- b) State and Explain few simple ideas on which process implementation rests? How process table and process descriptors helps in implementation of process? **[4]**

OR

- Q4)** a) State and explain disk driver subsystem. **[4]**
- b) What problem would occur if two processes try to examine and modify the process table at the same time? What it is called? How it is dealt?[4]

P.T.O.

- Q5)** a) State and Explain the IPC pattern: Signaling. [4]
b) What do you mean by failure of process? State its different forms? How fault tolerant server system is implemented? [4]

OR

- Q6)** a) What is starvation? How it is different from deadlock? Explain the solution for starvation. [4]
b) Discuss "Win big, then give some back" in context with process. [4]

- Q7)** a) Discuss the problems that we need to deal with when we have more than one program in memory at a time. [4]
b) What is the disadvantage of putting the page table in memory and how it is addressed? [4]

OR

- Q8)** a) Explain the clock page replacement algorithm. [4]
b) Saving processing time by using more space and saving more time using more them. Which is better? Explain with example. [4]

- Q9)** a) State and Explain the functionalities of disk controller? How SCSI works? State the advantage of it. [4]
b) State the purpose of device drivers? Different types of device drivers? Unified device driver interface makes it easier for the rest of operating system - Comment. [4]

OR

- Q10)** a) What is the difference between files and open files? State and explain the operations on files and open files in Unix. [4]
b) What is mean by hinting and caching? When to use hinting instead of caching. [4]

- Q11) a)** What is the need of integrated scheduling? State and explain various schedulers need to be integrated. **[5]**
- b) How protection monitor mechanism assures software security? State with file protection example. **[4]**

OR

- Q12) a)** What is mean by authentication? Can public keys used for authentication? If yes explain the methods. **[5]**
- b) How differently system calls handled in client server model then simple operating system? **[4]**

▽▽▽▽

Total No. of Questions : 6]

SEAT No. :

P4865

[Total No. of Pages : 2

[5060] - 807

M.E. (Computer Engineering) (Semester - II)
SOFTWARE DESIGN & ARCHITECTURE
(2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Answer any three questions from Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*
- 4) Figures to the right indicate full marks.*

- Q1) a)** Explain the applicability, structure & implementation of **[8]**
- i) Adapter
 - ii) Flyweight
- b) Describe design solution. What are the two major components of a software design method. **[8]**

OR

- Q2) a)** Explain design patterns. How are they documented using a template Explain the way they are documented with examples to illustrate from FACADE pattern. **[8]**
- b) Illustrate with correct examples, various design notations that can be used to depict a system design. **[8]**

- Q3) a)** Explain various styles of Component & connector viewtype. **[8]**
- b) List various Quality Attributes of a system & explain the testability attribute with specific examples. **[8]**

OR

- Q4) a)** Define Architectural Analysis. Discuss various analysis goals that are met in Architectural Analysis with an example each. **[8]**
- b) Explain the styles of module view-type and execution Architectural view type. **[8]**

P.T.O.

- Q5)** a) Describe the components of an Data-centered Software Architecture. Evaluate the benefits and limitations of data-centered Architectures. Examine them when incorporated with other prominent architectures. **[9]**
- b) Define Model Driven Archicecture (MDA). List and explain various MDA approaches and tools. **[9]**

OR

- Q6)** a) Describe and depict a Complete object oriented analysis & design process and discuss general design principles employed in the context of object-oriented design. **[9]**
- b) Describe the concepts of Implicit Asynchronous communication Software Architecture. Discuss the benefits and limitations of the Asynchronous Software Architecture. **[9]**

▽▽▽▽

Total No. of Questions : 6]

SEAT No. :

P4866

[Total No. of Pages : 2

[5060] - 808

M.E. (Computer Engineering) (Semester - II)

ADVANCED COMPUTER NETWORKS

(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) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) Enlist and explain different network functions and explain the issue of "where to implement the capability" with suitable examples. [9]

OR

b) With respect to network design, explain the issue of reliability and mobility with suitable examples. [9]

Q2) a) Explain use of balance equation in analysis of M/M/2 and M/M/n queue model. [8]

OR

b) Explain little's theorem with proof and what is memory less property of exponential distribution. [8]

Q3) a) What is centralized network design; explain different issues associated with it. [8]

OR

b) Define minimum spanning tree and explain Bin Packing Algorithm. [8]

Q4) a) What is resource reservation with respect to quality of service in networks? Explain with suitable examples. [8]

OR

b) What is Quality of Service in network design, explain any three Quality of Service mechanisms. [8]

P.T.O.

Q5) a) What is routing using masks? Explain with suitable examples. **[8]**

OR

b) What is fragmentation? Explain fragmentation of IP packet. What if the size of an IP datagram exceeds the MTU? What if the route contains networks with different MTUs. **[8]**

Q6) Write Short notes on (any Three) [9]

- a) Domain specific networks
- b) Computer network simulation
- c) Next generation networks architecture
- d) Wireless and sensor networks.



Total No. of Questions : 6]

SEAT No. :

P4867

[Total No. of Pages : 2

[5060] - 810

M.E. (Computer Engineering) (Semester - III)

**ADVANCED STORAGE SYSTEMS AND
INFRASTRUCTURE MANAGEMENT**

(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.*

- Q1)** a) What are the benefits of using RAID3 in backup applications. Discuss in detail. **[5]**
- b) Explain the terms idle flushing, High watermark flushing & forced flushing in relevance to cache watermarking. **[5]**
- Q2)** a) What are different file sharing protocols used in NAS. Compare NFS & CIFS. **[5]**
- b) Explain in detail content Addressed Storage (CAS) architecture. What are the features & benefits of CAS. **[5]**
- Q3)** a) Define Business Continuity? Explain impact of information unavailability? **[5]**
- b) Explain Storage array based remote replication. **[5]**
- Q4)** a) Discuss the Complexity of today's computing environment. **[5]**
- b) What are Current business demands & IT Systems issues? **[5]**

P.T.O.

- Q5)** a) Explain information technology Infrastructure Library (ITIL) [5]
b) What are the factors to be Considered in designing IT organisations and IT infrastructure? [5]
- Q6)** a) Write Short note on [5]
i) Release Management
ii) Incident Management
b) Write Short note on IT Services Continuity management. [5]



Total No. of Questions : 8]

SEAT No. :

P4868

[Total No. of Pages : 2

[5060] - 811
M.E. (Computer Engineering)
ADVANCED UNIX PROGRAMMING
(2013 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any five out of 8 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 calculator is allowed.*

- Q1)** a) Write shell script to multiply two numbers. Print two numbers and the result. Also write command to execute the shell script. **[5]**
- b) Explain methods of changing file access permissions. **[3]**
- c) Write Command to find specific file with specific owner. **[2]**
- Q2)** a) Explain IA-64 architecture. **[5]**
- b) Explain I-node architecture. **[5]**
- Q3)** a) What is the use of virtual memory management? **[5]**
- b) Explain signals SIGINIT SIGKILL, SIGTERM, SIGALRM, alarm () **[5]**
- Q4)** a) Explain different I/O models. **[5]**
- b) Explain readv, writev, readn and written functions. **[5]**

P.T.O.

- Q5)** a) Explain msgget(), msgsnd(), msgrcv() in brief. [6]
b) Write a short note on Message Queues. [4]
- Q6)** a) Explain different IPC types. [5]
b) Explain working of reliable and unreliable signals. [5]
- Q7)** a) Explain RPC model in detail. [5]
b) How message reading and writing is done in pipes. [5]
- Q8)** a) Explain different models of concurrent server design. [5]
b) What is thread? Explain deadlock, starvation, priority inversion, busy waiting. [5]



Total No. of Questions : 12]

SEAT No. :

P4869

[Total No. of Pages : 2

[5060] - 813

M.E. (Computer Engineering) (Computer Networks)

ADVANCED NETWORK ALGORITHMS

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

1) *Attempt questions:*

Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10 and Q.11 or Q.12.

2) *Neat diagrams must be drawn wherever necessary.*

3) *Assume suitable data, if necessary.*

Q1) a) What are fundamental reasons for network performance degradation?[4]

b) What is the significance of Network Algorithmics. Discuss one example. [4]

OR

Q2) Explain in details Characteristics of Network Algorithmics. [8]

Q3) a) Explain the scenario of buffer validation of Application Device Channels? [6]

b) Why one should use principles stated in algorithmics theory? Give reasons. [2]

OR

Q4) a) Explain the difference between Design and Implementation principles?[4]

b) Explain the problem of policing traffic patterns. [4]

Q5) a) What is the significance of timers? [4]

b) Could timers be used for failure recovery in systems? If yes, state examples [5]

P.T.O.

OR

Q6) a) How timers are implemented for communications between members of a distributed system. [5]

b) Explain in details four component routines of a timer module. [4]

Q7) What is an exact match lookup? How it is implemented? [8]

OR

Q8) a) What is Ethernet bridge? What do you mean by challenge 2 for Ethernet? [4]

b) How look ups are scaled to higher speeds? [4]

Q9) a) Summarize the principles used in the packet classification algorithms. [4]

b) Explain with a neat diagram the problem of packet classification [4]

OR

Q10)a) Explain how backtracking algorithm in packet classification reduces memory? [4]

b) With respect to packet classification explain decision tree approach. [4]

Q11) Routers are distributed systems: Justify. What are the benefits of distributed systems? [9]

OR

Q12)a) Explain the significance of packet counting and logging in service provider networks. [5]

b) Write a short note on traffic matrices computation. [4]

▽▽▽▽

Total No. of Questions : 7]

SEAT No. :

P4870

[Total No. of Pages : 2

[5060] - 814
M.E. (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) Compare WiMAX with Other Broadband Wireless Technologies based on various Standards. [6]
b) Explain OFDMA Subchannelization: its advantages to WiMAX. [6]

OR

- Q2)** a) Briefly explain each of the technical challenges for Broadband Wireless Networks, and touch on approaches that have been explored to overcome them. [6]
b) Explain following with respect to WiMAX: Pathloss & Shadowing. [6]

- Q3)** a) What is the need of Multiprotocol Label Switching? Explain MPLS network and components. [6]
b) Explain Segmentation and concatenation of SDUs in MACPDUs. Also discuss Generic MAC Header Fields of WiMAX PDU. [6]

OR

- Q4)** a) Explain the basic components of mobile IP. Also discuss various limitations of it. [6]
b) Explain Closed-loop MIMO framework in IEEE 802.16e-2005 with Figure. [6]

P.T.O.

- Q5)** a) With figure explain end-to-end WiMAX architecture using the logical representation. [6]
- b) Illustrates the various possible handover scenarios supported in WiMAX. With figure. [7]

OR

- Q6)** a) Explain Generic AAA roaming model, Also discuss the various steps involved in device Authentication. [7]
- b) Explain the WiMAX paging network reference model. [6]

Q7) Write Short Notes on (ANY TWO) [13]

- a) 4G features and challenges,
- b) System-Level Results of Basic and Enhanced Configurations
- c) Internetworking between WLANS and 3G
- d) Benefits of Multiple-Antenna Techniques in WiMAX.

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P4871

[Total No. of Pages : 2

[5060] - 815
M.E. (Computer Network) (Semester - I)
ADVANCED DATABASES
(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 indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Discuss the indexing based on the following questions. [6]
- i) How do database indexes works
 - ii) What kind of data structure is an index
 - iii) What exactly is inside a database index
- b) What is distributed database. Discuss the distributed database architecture in details. [6]

OR

- Q2)** a) What is Database Tuning. Discuss the need of Database Tuning? What are the three broad levels database systems can be tuned to improve performance. [6]
- b) Discuss how the allocation of fragments in distributed environment helps in minimization of the average query execution time. [6]

- Q3)** a) Explain transactional workflow with suitable example. [6]
- b) What is semi-structured data model. Whether XML is a semi-structured data or not. [6]

OR

- Q4)** a) Explain with neat diagram TP Monitor components. [6]
- b) Write short note on : (Attempt any two) [6]
- i) SOAP
 - ii) XML DTD
 - iii) WSDL

P.T.O.

- Q5)** a) Explain spatial database in detail. How it is different from GIS. [7]
b) Discuss the database issues in mobile computing environment. [6]

OR

- Q6)** a) What is spatial data. How would you model spatial data in the traditional DBMS. [7]
b) How the following terms are addressed in real time database. [6]
i) Transaction Processing
ii) Locking

- Q7)** a) Discuss the tunable parameters addressing tuning of Hardware, tuning of Schema and Tuning of Indices. [6]
b) What is CouchDB. Discuss the data model and architecture of CouchDB. [7]

OR

- Q8)** a) Discuss how the large scale data management is done with HADOOP. [6]
b) Define E-Commerce and discuss any three of the following E-Commerce applications: [7]
i) E-Catalogs
ii) Market places
iii) Order Settlement
iv) Secure Payment Transactions
v) Digital Cash

▽▽▽▽

Total No. of Questions : 6]

SEAT No. :

P4872

[Total No. of Pages : 1

[5060] - 816
M.E. (Computer Network)
RESEARCH METHODOLOGY
(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) Explain the Objectives of research. [5]
b) Explain the Research process and workflow. [5]
- Q2)** a) Write a short note on Hypothesis formulation. [5]
b) Explain types of research. [5]
- Q3)** a) What are the characteristics of good research design. [5]
b) Explain Principles of experimental design. [5]
- Q4)** a) Write short note on data collection techniques. [5]
b) Write short note on ANACOVA. [5]
- Q5)** a) Explain in short measures of central tendency. [5]
b) Explain the steps involved in hypothesis testing. [5]
- Q6)** a) Explain the steps involved in interpretation. [5]
b) Write a short note on optimization methods. [5]



Total No. of Questions : 8]

SEAT No. :

P4873

[Total No. of Pages : 2

[5060] - 818

M.E. (Computer Networks) (Semester - II)

**NETWORK DESIGN, MODELLING AND ANALYSIS
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Q.3 is Compulsory, Answer any five from remaining Questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data, if necessary.*

Q1) a) The probability density function for a continuous random variable X is[4]

$$f(x) = \begin{cases} \frac{x+2}{18}, & -2 < x < 4 \\ 0, & \text{Otherwise} \end{cases}$$

Find

- i) $P(|X| < 1)$
 - ii) $P(X^2 < 9)$
 - iii) $E(X)$ and $\text{Var}(X)$
- b) Explain Exponential Distribution with its properties. [4]

Q2) a) Explain M/M/1 queue with state diagram. Explain different Applications of M/M/1 queue. [4]

b) Explain different service statistics for I/O Intensive Applications. [4]

Q3) Write a short note on (Any Two) [10]

- a) Deviation of the stationary distribution.
- b) Arrival Statistics for M/M/m queue.
- c) D/D/1 queue.

P.T.O.

Q4) a) Solve Terminal Assignment problem for given data. **[4]**

Weight of node = 01, Max. capacity of concentrator = 03

	G	H	I	K
a	6	5	4	5
b	5	7	8	1
c	4	3	2	2
d	9	7	4	5

b) Explain Bin Packing algorithm for Telephone Network Layout Optimization. **[4]**

Q5) a) Explain MENTour design in detail. **[4]**

b) How optimal selection of network attributes affect the Network Modelling? **[4]**

Q6) a) Explain simple access design problem in detail. **[4]**

b) Differentiate between backbone network and Peer to Peer network. **[4]**

Q7) a) Explain with suitable example fault tolerance in Tree Topology. **[4]**

b) Explain Multi-Hop Line Network with suitable diagram. **[4]**

Q8) Write a short note on (Any Two) : **[8]**

a) Line Crossings in access design.

b) Difficulty in Network Redesign as per new traffic.

c) Augmented MENTOR.



Total No. of Questions : 8]

SEAT No. :

P4874

[Total No. of Pages : 2

[5060] - 819

M.E. (Computer - Computer Networks) (Semester - II)

DISTRIBUTED SYSTEMS

(2013 Pattern)

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) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Figures to the right indicate full marks.*

Q1) a) Explain in detail challenges encountered during the design of distributed systems. [4]

b) Discuss the need of computer clock synchronization and its design requirements. [5]

Q2) a) Write short note on distributed objects. [4]

b) Explain remote procedure call in detail. [4]

Q3) a) Discuss Lamport's logical clock and vector clock. [4]

b) Explain Quorum based mutual exclusion algorithm. [4]

Q4) a) Discuss Centralized deadlock detection strategies. [4]

b) Discuss Lodha and Kshemkalyani's fair mutual exclusion algorithm. [4]

Q5) a) Write short note on distributed scheduling. [4]

b) Write a short note on distributed multimedia systems. [4]

P.T.O.

- Q6)** a) Discuss synchronous and asynchronous check pointing and recovery. **[4]**
b) Explain distributed shared memory architecture. **[4]**
- Q7)** a) Write short note on WSDL. **[4]**
b) Explain vote reassignment protocol. **[4]**
- Q8)** a) What is JMS? Discuss in brief with the perspective of distributed systems. **[5]**
b) Explain UDDI. **[4]**



Total No. of Questions : 12]

SEAT No. :

P4875

[Total No. of Pages : 2

[5060] - 820

M.E. (Computer Network) (Semester - II)

HIGH PERFORMANCE NETWORKS

(2013 Credit 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 Q.9 or Q.10 Q.11 or Q.12.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to right indicate full mark.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is Digital subscriber Line? Explain DSL reference model, ADSL, VDSL. [5]
b) Write short note on X.25 [4]

OR

- Q2)** a) Explain Wireless networks 802.11a\b\g\n\ac. [5]
b) Write short note FDDI. [4]

- Q3)** a) Explain Architecture of Gigabit Ethernet [4]
b) Explain Gigabit Ethernet technology and explain application of it. [4]

OR

- Q4)** a) Explain on "Full - duplex Ethernet and Operations in full duplex mode"[4]
b) Gigabit Ethernet physical layer and Ethernet frame format. [4]

- Q5)** a) Explain ATM Traffic and Service Parameter. [4]
b) Explain Adaption layer of ATM. [4]

P.T.O.

OR

- Q6)** a) Write short note on IP over ATM. [4]
b) What are the basic tasks required for internetworking over ATM? [4]

- Q7)** a) Define MPLS and Mention the main features of label switching. [4]
b) Explain MPLS forwarding operations. [4]

OR

- Q8)** a) Security MAC layer of WiMax. [4]
b) Write MPLs routing protocols any 2 in detail. [4]

- Q9)** a) Explain HSPDA protocol Stack. [4]
b) Technology Comparison between LTE and WiMAX. [4]

OR

- Q10)**a) Write a Short note on GPRS. [4]
b) Explain HSDPA and HSUPA. [4]

- Q11)**a) 3G AND 4G Architectural comparison. [5]
b) Differentiate between GSM and GPRS. [4]

OR

- Q12)**a) List out Scheduling Algorithm HSDPA Any 2 algorithm with details. [5]
b) Explain WWAN Evolution: W-CDMA HSPA, HSPA + to 3GPP LTE. [4]

▽▽▽▽

Total No. of Questions : 7]

SEAT No. :

P4876

[Total No. of Pages : 2

[5060] - 822

M.E. (Computer Networks) (Semester - III)

ADVANCED TCP/IP

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Black figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*

Q1) a) Explain with help of diagram Position of IP in TCP/ IP Protocol suites?[5]

b) Explain ICMP messages Types. [5]

Q2) a) Explain Rlogin with help of Example. [5]

b) Write note on FTP and TFTP. [5]

Q3) a) Explain MIME. [5]

b) Write difference between HTTP & HTTPS. [5]

Q4) a) Explain IPsec Protocol with help of mode. [5]

b) Explain VPN. [5]

Q5) a) Explain TCP Reno and TCP Vegas. [5]

b) Explain openloop & close loop control flow mechanism. [5]

P.T.O.

- Q6)** a) Explain DSDV protocol with one example. [5]
b) Explain TCP performance in mixed wired & wireless environment . [5]
- Q7)** a) Draw & explain TCP state transition diagram. [5]
b) Explain Socket programming primitives. [5]



Total No. of Questions : 12]

SEAT No. :

P4877

[Total No. of Pages : 2

[5060] - 823

M.E. (Computer Networks)

SYSTEM OPERATIONS AND MAINTENANCE

(2013 Pattern) (Credit System) (Semester - III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Answer Q.No.1 or 2, Q.No.3. or 4, Q.No.5 or 6, Q.No.7 or 8, Q. No.9 or 10, Q.No.11 or 12.
- 2) Figures to the right indicate full mark.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

- Q1)** a) What is microkernel? Explain microkernel based operating system. [5]
b) What are different process scheduling algorithm in IOS XOR OS. Explain Sporadic scheduling. [4]

OR

- Q2)** a) What are the functionalities of Cisco IOS XR System Manager. Explain System Manager & process lifecycle. [5]
b) Give the evolution of networking from 1980 onwards. [4]

- Q3)** a) Compare Control plane and data plane configuration management. [4]
b) List and explain services provided by SysDB. [4]

OR

- Q4)** a) Explain details of configuration commit and configuration rollback. [4]
b) What is two stage configuration model? Explain with suitable example.[4]

- Q5)** What is SNMP? Which different versions of SNMP those are supported Cisco IOS XR software? Also explain basic steps are needed to configure SNMP on an IOS XR router. [8]

P.T.O.

OR

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 Enhanced Interior Gateway Routing Protocol. [8]

OR

Q8) What is OSPF? Which are significant roles of OSPF router? [8]

Q9) What are basic requirements of multicast forwarding? Differentiate between IGMPv2 and IGMPv3. [8]

OR

Q10) Explain Label Distribution Protocol in detail for Cisco IOS XR [8]

Q11) Explain Functionalities of Three-Stage Fabric Links. [9]

OR

Q12) Explain Stepwise Creation of Secure Domain Router in Cisco IOS XR 3.5. [9]

▽▽▽▽

Total No. of Questions : 5]

SEAT No. :

P4878

[Total No. of Pages : 2

[5060] - 825
M.E. (Information Technology)
MATHEMATICAL FOUNDATION OF
INFORMATIONTECHNOLOGY
(2013 Pattern)

Time : 3 Hours]

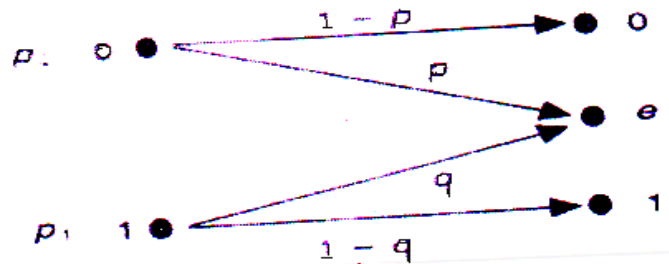
[Max. Marks :50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

Q1) Solve any two :

- a) Find the capacity of the binary erasure channel shown in the figure, where P_0 and p_1 are the priori probabilities. [5]



- b) R distinct balls are to be placed in n distinct boxes with balls in each box arranged in order. Show that there are $(n+r-1)(n+r-2) \dots (n+1)n$ ways to do so. [5]
- c) A problem on probability is given to four students A, B, C, D whose probability of solving the problem are $1/2, 3/4, 1/4, 2/5$ respectively. What is the probability that the problem will be solved? [5]

Q2) Solve any two :

- a) Using your own intuition and your own definition of universe of discourse, plot fuzzy membership functions to the following variables. [5]
- i) Full
 - ii) Empty
 - iii) Very full

P.T.O.

- b) Derive Shannon's information theorem. [5]
 c) Calculate median and mode of the data given below. Using them find arithmetic mean. [5]

Marks	10	20	30	40	50	60
No.of Students	10	41	43	67	75	81

Q3) 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) Two dice are rolled together. What is the probability that the sum of the faces will not exceed 5? Given that at least one face shows a 3? [5]
 c) Write short notes on the following [5]
 i) Additive property of Chi-square
 ii) Chi-square as a test of 'goodness of fit'.

Q4) Solve any two :

- a) Prove that the entropy for a discrete source is a maximum when the output symbols are equally probable. [5]
 b) Explain Huffman's algorithm. State its applications. [5]
 c) The membership functions for the linguistic variables "hot" and "cold" are given below [5]

$$"hot" = \left\{ \frac{0.6}{5} + \frac{0.3}{7} + \frac{0.5}{9} + \frac{0.7}{11} + \frac{1.0}{12} \right\}$$

$$"cold" = \left\{ \frac{0.3}{0} + \frac{0}{30} + \frac{1}{60} + \frac{0.5}{90} + \frac{0}{120} \right\}$$

Develop membership functions for the following linguistic phrases Very hot (2) Fairly hot (3) Not very cold.

Q5) Solve any two :

- a) Explain the terms [5]
 i) Block Codes
 ii) Tree codes.
 b) A die is thrown 144 times with the following results
 Number turned up : 1 2 3 4 5 6
 Frequency : 16 20 25 14 29 28
 Is the die unbiased?
 c) What is predicate ? How it is useful in reasoning. [5]



Total No. of Questions : 8]

SEAT No. :

P4879

[Total No. of Pages : 3

[5060] - 826

M.E.(Information Technology) (Semester - I)

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) Define following asymptotic notations. Diagrams expected.

Big O, θ , and Ω [3]

b) Prove by contradiction that there are infinite prime numbers. [3]

c) Describe Tiling problem. Prove by mathematical induction that tiling problem is always solved. [4]

Q2) a) Solve following recurrences [6]

i) $t_n = n$ if $n = 0$ or $n = 1$

$$= 5t_{n-1} - 6t_{n-2}$$

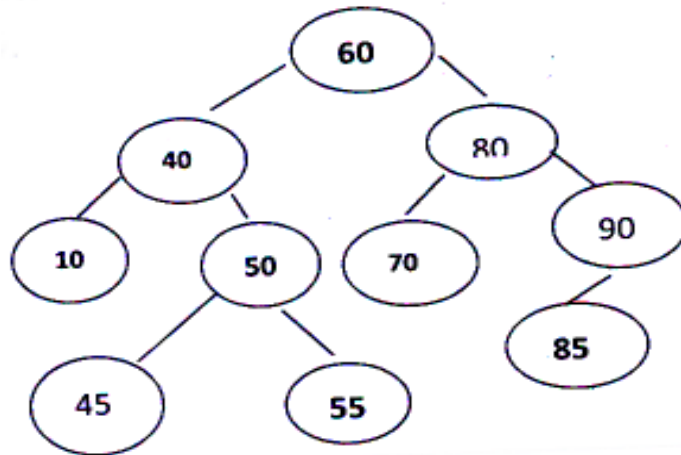
ii) $t_n = 2t_{n-1} + n$

b) Give recursive algorithm to find the maximum and minimum of an array. Give the recurrence and comment on the complexity of the algorithm by solving the recurrence. [4]

Q3) a) Explain the term Persistent data structure. Write C code to insert and delete the item from singly Linked list in persistent manner. Show the diagrams before and after insertion as well for deletion. [6]

P.T.O.

- b) Give the algorithm for deletion of an item from splay tree and then perform delete operation on following self-balancing splay tree. Element to be deleted 90. [4]



- Q4)** a) Explain the term Voroni Diagram. Give the applications of Voroni diagrams. [3]
 b) Define Red-Black Tree and give its properties. Obtain the Red-Black Tree for the Following data. Each insertion should show red and black nodes explicitly. [7]
 21,20,19,18,17,16,15,14,13,12,11,10

- Q5)** a) Write the dual of following LP. [7]
 Maximize $3x_1 + x_2 + 2x_3$
 Subject to
 $x_1 + x_2 + 3x_3 \leq 30$
 $2x_1 + 2x_2 + 5x_3 \leq 24$
 $4x_1 + x_2 + 2x_3 \leq 36$
 $x_1, x_2, x_3 \geq 0$
 Find the optimal solution for primal and dual.

- b) What is a vertex cover problem? Give approximation algorithm to find the vertex cover. [3]

- Q6)** a) Give randomized algorithm for pattern matching minimum spanning tree. [4]
 b) Give a pointer doubling algorithm for addition of n numbers. Explain with figure. Comment on its complexity and the number of processors required. [4]
 c) Explain CCW test and give an example where it is used. [2]

Q7) a) Write and Explain following on line algorithms **[6]**

i) k Server

ii) Spanning Tree

b) Explain the algorithm for 2D closest pair problem and comment on its complexity. **[4]**

Q8) a) Create a B-tree of degree 2 with following data. Draw the tree at each stage. **[5]**

F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E

b) Discuss various cases of deletion from B-tree. Explain each case with an example. **[5]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P5082

[5060]-827

[Total No. of Pages : 3

M.E. (Information Technology)
ADVANCED OPERATING SYSTEMS
(2013 Course) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Q1. is compulsory, solve any two from Q.2, Q.3 and Q.4. and solve Q.5 or Q.6. and Q.7 or Q.8.*
- 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) Following pseudo-codes are executed by two threads simultaneously.[4]

```
void proc1 ( )                void proc2 ( )
{
    pthread_mutex_lock (&m1);    pthread_mutex_lock (&m2);
    /* use object 1 */           /* use object 2 */
    pthread_mutex_lock (&m2);    pthread_mutex_lock (&m1);
    /* use objects 1 and 2 */     /* use objects 1 and 2 */
    pthread_mutex_unlock (&m2);  pthread_mutex_unlock (&m1);
    pthread_mutex_unlock (&m1);  pthread_mutex_unlock (&m2);
}                                }
```

Is there any problem with these codes? If yes, then how could it be fixed?

- b) Is program a process? A program has multiple processes but process has only a program, explain with a scenario. [3]
- c) How is the program loaded into processes? [3]

P.T.O.

- Q2)** a) Differentiate between user-level threads and kernel-level threads. [4]
 b) What is the hardware approach used to achieve mutual exclusion? [3]
 c) What is the need for the condition variable in Linux? [3]
- Q3)** a) A logical address has 32-bits. A page size is assumed to be 4KB and one entry in the page table takes 4 bytes. Answer the following.... [5]
 i) What is the size of one-level page table?
 ii) What is the size of a two-level page table?
 iii) Considering that a process on Windows or Linux requires two pages (text, data, BSS & dynamic – 1 page and stack -1 page) to be loaded in the RAM at any point in time for execution, how much saving over one-level page table can be achieved if the two-level page table has been used?
 b) What is thrashing? Explain the concept of global pool and local pool.[3]
 c) Explain what do you mean by page and frame? [2]
- Q4)** a) Explain the data block allocation for UNIX's S5FS. [4]
 b) Explain any four features of UNIX's S5FS. [4]
 c) What is an inode? [2]
- Q5)** a) What do you mean by distributed system? [2]
 b) Explain the concept of logical synchronization in the distributed system.[4]
 c) Explain any four design issues for the design of distributed operating system? [4]
- Q6)** a) What do you mean by consistency in DSM? Explain sequential and strict consistency models with example. [5]
 b) Why do you have to hold an election in the distributed system? Explain the token based election algorithm in detail. [3]
 c) What is message passing in distributed system? [2]

- Q7)** a) What are different load estimation policies in distributed operating systems? [5]
b) List and explain load transfer policies. [5]
- Q8)** a) Explain the process addressing in the distributed system? [5]
b) Write a short note on Optimal task assignment. [5]

x x x

Total No. of Questions : 5]

SEAT No. :

P4880

[Total No. of Pages : 2

[5060] - 828

M.E. (Information Technology) (Semester - I)

RESEARCH METHODOLOGY

(2013 pattern)

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.*

SECTION - I

- Q1)** a) Distinguish between Research methods and Research methodology. Briefly describe the different steps involved in a research process. [5]
- b) Explain the techniques involved in defining a research problem. [5]

OR

- b) 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]

- Q2)** a) Define the term 'Review of literature' , how is it different from traditional meaning? Enumerate the objectives and significance of review of literature. [5]
- b) Which are the types of sampling design? Explain. [5]

OR

- b) Distinguish between the following: [5]
- i) One-tailed test and two-tailed test
 - ii) Type I error and Type II error

P.T.O.

Q3) a) A population is divided into three strata so that $N_1=5000$, $N_2 = 2000$, $N_3 = 3000$ Respective standard deviations are: $\sigma_1=15$, $\sigma_2=18$ and $\sigma_3=5$. How should a sample of size $n=84$ be allocated to the three strata, if we want optimum allocation using disproportionate sampling design? [5]

b) State and explain features of well written abstract. [5]

OR

b) What do you mean by research design? Differentiate between research methodology and research design. Illustrate your answer with suitable example. [5]

Q4) a) What is a hypothesis? What characteristics it must possess in order to be a good research hypothesis? [5]

b) Enumerate conditions in which stratified sampling can be appropriately being used. What are the similarities and dissimilarities between quota sampling and stratified sampling? [5]

Q5) a) What do you mean by the term 'Randomization'? Indicate the methods of randomization and their advantages and limitations. [5]

b) Define a hypothesis. State the basic assumptions of analysis of variance. [5]

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

P4881

[Total No. of Pages : 2

[5060] - 830

M.E. (Information Technology)

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) Explain the characteristics of wireless channel. [2]
b) Compare infrastructure networks with ad-hoc networks. [4]
c) Explain the advantages and disadvantages DSR routing. [4]
- Q2)** a) Why four address fields in IEEE 802.11 MAC as against only two in IEEE 802.3 MAC frame? [3]
b) Explain the working of CSGR. [3]
c) What are the major issues for a successful ad-hoc wireless internet? [4]
- Q3)** a) Explain an architecture reference model for multicast routing protocol.[3]
b) What are the characteristics of an ideal routing protocol for ad hoc wireless networks? [3]
c) Explain Tree initialization phase of BEMR protocol. [4]
- Q4)** a) Explain the technical challenges in a PRNET. [4]
b) Explain the routing protocol, which uses a link-reversal algorithm and provides loopfree multicast path to destination node. [4]
c) How MPSP improves multicast packet delivery with bounded end-to-end delays? [2]

P.T.O.

- Q5)** a) Explain how ATCP is implemented as thin layer residing between the IP and TCP protocols. [3]
- b) What are the pros and cons of assigning the responsibility of end-to-end reliability to the application layer? [3]
- c) Explain the BEE routing protocol that attempts to combine the lazy packet scheduling and the traffic-shaping scheme. [4]
- Q6)** a) Explain in short Type I update message used in predictive location-based QoS routing protocol. [2]
- b) Explain the limitations of adapting MRSVP for ad-hoc wireless networks. [4]
- c) Explain the significance of threshold cryptography. [4]
- Q7)** a) Explain the design goals of a transport layer protocol for ad-hoc wireless networks. [5]
- b) Write a short note on; Principal of battery discharge. [5]
- Q8)** a) Compare hard state and soft state resource reservation approaches. [5]
- b) Explain the ARAN routing protocol which takes care of authentication, message integrity, and non-repudiation, but expects a small amount of prior security coordination among nodes. [5]



Total No. of Questions : 8]

SEAT No. :

P4882

[Total No. of Pages : 2

[5060] - 831
M.E. (Information Technology)
ADVANCED DATABASE SYSTEMS
(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) Assume suitable data,if necessary.*

- Q1)** a) Define distributed database system. What are various potential design issues of Distributed databases? [5]
b) Give a brief account of architectural models for distributed DBMS. [5]
- Q2)** a) What is Autonomy? Explain three dimensions along which autonomy can be specified. [5]
b) What are the successive steps of query decomposition? Explain them in detail. [5]
- Q3)** a) What is classification of concurrency control algorithm? [5]
b) Explain 3PC protocol actions with neat diagram. [5]
- Q4)** a) Explain distributed deadlock detection. [5]
b) Explain in detail Failures in Distributed DBMS. [5]
- Q5)** a) Explain shared disk architecture, shared nothing architecture, hierarchical architecture and cache-only architecture with neat sketches. [5]
b) Explain serializability in distributed system. [5]

P.T.O.

- Q6)** a) With the neat sketch write and explain KDD process. [5]
b) Differentiate between data mart and data warehouse. [5]
- Q7)** a) Explain distributed INGRES Algorithm. [5]
b) Explain operational data store. [5]
- Q8)** a) Explain Object Server and Page server architecture with neat diagram. [5]
b) Explain Naive Bayes classifier with an example. [5]



Total No. of Questions : 8]

SEAT No. :

P4883

[Total No. of Pages : 2

[5060] - 832

M.E. (Information Technology) (Semester - II)

ADVANCE COMPUTER ARCHITECTURE

(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 in brief general classification of parallel computer architecture based on the Flynn's classification. [4]
b) Discuss the limitations of Instruction Level parallelism. [2]
c) Discuss WAR and RAW data hazards in detail with appropriate example.[4]
- Q2)** a) Explain the overcoming of the data hazards with dynamic scheduling.[4]
b) What makes pipelining hard to implement? [2]
c) Explain the quantitative principles of computer design. [4]
- Q3)** a) Explain the performance and efficiency in advanced multiple issue processors. [4]
b) Explain the dynamic branch prediction. [4]
c) Differentiate between hardware versus software speculation. [2]
- Q4)** a) Explain the Interconnection networks. [4]
b) Explain the directory based cache coherence protocol. [3]
c) Explain the Symmetric shared memory architecture. [3]

P.T.O.

- Q5)** a) State the advantages and disadvantages of SMT and CMP architecture. [4]
b) Write a note on SUN CMP architecture. [3]
c) Explain the IBM cell architecture. [3]
- Q6)** a) Explain the term virtual memory and virtual machine. [4]
b) Explain the optimization of cache performance. [4]
c) Explain memory hierarchy design. [2]
- Q7)** a) Write notes on: [5]
i) Sequential Control Flow.
ii) Data flow Model.
b) Explain the term connectivity in data parallel architecture. [5]
- Q8)** a) Explain various Multicore Memory Issues. [5]
b) Explain the memory hierarchy design for ARM Cortex A8. [5]



Total No. of Questions 8 :

SEAT No. :

P4884

[Total No. of Pages : 2

[5060] - 834

**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 indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) State confidentiality and vulnerability. [2]
b) Write the critical characteristics of information. How are they used in the study of computer security? [4]
c) List the three components of the C.I.A. triangle? If the C.I.A. triangle is incomplete, why is it so commonly used in security? [4]
- Q2)** a) Write different components of an Information Security? [3]
b) What is False Accept Rate and False Reject Rate? Write example. [3]
c) Explain Hybrid firewall. [4]
- Q3)** a) Describe six components of an Information System and explain which are most directly affected by the study of computer security. [3]
b) Explain the privacy from an information security context? [3]
c) Why is data the most important asset of an organization? List assets in the organization that require protection? [4]
- Q4)** a) What is computer forensics? What are its uses? [4]
b) What is malware? How do worms differ from viruses? [4]
c) Why do employees constitute one of the greatest threats to information security? [2]

P.T.O.

- Q5)** a) What is the difference between law and ethics? What is a policy? How is it different from a law? [3]
- b) What are vulnerabilities? How do you identify them? [3]
- c) Explain the features of Biometric Access Controls. [4]
- Q6)** a) What are the differences between a policy, a standard, and a practice? What are the three types of security policies? [5]
- b) What is computer forensics? When are the results of computer forensics used? [5]
- Q7)** a) Define Cyber Crime. Enlist at least six types of cybercrime. [5]
- b) What is a honeypot? How is it different from a honeynet? [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) List five generations of firewall technology. Which generations are still in common use? [5]



Total No. of Questions : 8]

SEAT No. :

P4885

[Total No. of Pages : 3

[5060]-835

M.E. (Information Technology) (Semester - III)

NETWORK PROGRAMMING

(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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Describe the use of synchronize (syn) segment in association with three-way handshake for TCP connection establishment. **[2]**
- b) Discuss different segments used in connection establishment and terminations. Also mention some common TCP options contained in each synchronize segment. **[4]**
- c) With descriptive diagrammatic representations explain about the packets exchanged for TCP connections. **[4]**
- Q2)** a) Socket structure is used in client server communications through sockets which is specific to the supported protocol suits. With necessary diagrams do the comparisons of various socket address structures used in client-server communications. **[4]**
- b) Discuss the use of connect () function in client-server communications through sockets. **[2]**
- 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]**

P.T.O

- Q3)** a) There are several functions used in association with the routing sockets, describe in detail about the function used to examine routine table and interface list. [4]
- b) There are four functions used to describe interfaces whenever required to be used in association with routing sockets. List out these four functions and explain different arguments used in these functions. [4]
- c) Explain different types of messages exchanged across a routing socket?[2]
- Q4)** a) Describe about different resource records used in the Domain Name System (DNS). How DDNS provides additional capabilities as compare to DNS? [4]
- b) With example describe when a function is considered as re-entrant function. Discuss the approaches to design gethostbyname() and gethostbyaddress() functions as re-entrant functions. [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 associated with the client server communications using IPv4 and IPv6 based systems. what are the steps IPv4 server handles for processing of IPv6 clients depending on address types and socket types? [4]
- b) List out at-least five IPv6 address testing macros and describe the purpose of IPv6 address-testing macros with respect to interoperability in communications. [3]
- c) With logical diagrammatic representation discuss the process handled by IPv4 server for handling of an IPv6 client requests in socket based communication systems. [3]
- Q6)** a) List out different multicast socket options and explain three different options used with examples? [4]
- b) With example differentiate between unicast and multicast streaming. [2]
- c) 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]

- Q7)** a) Explain POSIX functions used for thread managements with their clear prototypes. Also discuss about the working of POSIX threads in the networking environments. [5]
- b) Usually a server is written to support multiple concurrent requests from several clients, provide the detail comparison between a socket server written using fork and using threads to support multiple clients. Justify your approach using program segments. [5]
- Q8)** a) 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]
- b) With logical diagrammatic representation discuss preforking technique used in the enhanced TCP server. Also discuss the pros and cons of preforking technique with an example. [5]



Total No. of Questions : 8]

SEAT No. :

P5101

[Total No. of Pages : 2

[5060]-841
M.E. (Chemical)
MATHEMATICAL AND STATISTICAL METHODS
(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) Find the solution to the following differentiate equation. **[5]**

$$\frac{dv}{dt} = 9.8 - 0.196v.$$

b) Explain criteria for critical point stability. **[5]**

Q2) a) Explain laplace equation in cylindrical form. **[5]**

b) Solve the first order PDE.

$$fx + x^2 yfy + f = 0$$

$$f(x = 0, y) = y^2$$

Using method of characteristics **[5]**

Q3) a) Show that an absolutely convergent infinite series of complex term is convergent. **[5]**

b) Find the laurent and Taylor series expansion of $f(z) = -\frac{2z+3}{Z^2-3z+z}$. **[5]**

P.T.O.

- Q4)** a) A has six shares in the lottery in which there are three prizes and ten blanks. B has two shares in a lottery in which there are four prizes and eight blanks. Which has the better chance to win the prize. [5]
- b) Comment on the following : [5]
The mean of a binomial distribution is 3 and variance is 4.
- Q5)** a) The mean of 200 items is 48 and their standard deviation is 3. Find the sum of all items and the sum of squares of all the items. [5]
- b) Explain residual error in regression model. [5]
- Q6)** a) Discuss types of errors associated in testing hypothesis. [5]
- b) Distinguish between experimental and extraneous variables. [5]
- Q7)** a) Given that the regression equations of Y on X and X on Y are respectively $Y = X$ and $4X - Y = 3$ and that the second moment of X about the origin is 2. Find (i) the correlation coefficient between X and Y and (ii) the standard deviation of Y. [5]
- b) Discuss the procedure for calculating the mean from ungrouped data. [5]
- Q8)** a) Elaborate model equation for latin square design. [5]
- b) Explain graphical procedure for sequential sampling. [5]



[5060] - 842
M.E. (Chemical)
PROCESS OPTIMIZATION
(2013 Pattern) (Theory)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) Answer any five 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) Find whether the following function is strictly convex / strictly concave
 $f(x) = 2x_1^2 + 5x_1x_2 + 12x_1 + 13x_2 - 4x_2^2 + 9$ [5]
- b) Write a note on - Continuity of a function. [3]
- c) Explain Nature and Scope of Optimization. [2]
- Q2)** a) State the quadratic forms are positive definite, negative definite or neither. [5]
- i) $f = x^2 - 3x - 20$
- ii) $f = -2x^2 + 8x + 4$
- b) Explain Convex function. [3]
- c) Define unimodal and multimodal function. [2]
- Q3)** a) Minimize $f(x) = x_1^2 + x_2^2 + 3$ starting at $(x^0)^T = [2 \ 1]$ in the direction $S^0 = [-2 \ -2]^T$ using simplex search method. Perform 2 steps. [5]
- b) Find whether the given direction s at the point x is descent for the function. [3]
- $f(x_1, x_2) = (x_1^2 + x_2^2 - 11)^2 + (x_1 + x_2^2 - 7)^2$ $S = (1, 0)^T$, $x = (1, 1)^T$
- c) Write a note on - Optimality criteria of Multivariable optimization. [2]

P.T.O.

- Q4)** a) Maximize $f(x) = (x_1 - 5)^2 + (x_2 - 2)^2$ Subject to linear constraints $x_1 \geq 0$, $x_2 \geq 0$, $5 - x_1 - x_2 \geq 0$, $-2.5 + x_1 - x_2 \leq 0$ Use Simplex method. [5]
- b) Write a note on - Sensitivity analysis. [3]
- c) Explain method of multipliers. [2]
- Q5)** a) Explain and write the algorithm for Random Search Method. [5]
- b) Write a short note on- Variable elimination method. [3]
- c) What are the different types of Penalty terms? [2]
- Q6)** a) Explain the differences between Genetic Algorithm and traditional methods. [5]
- b) What is fitness function in Genetic Algorithm? [3]
- c) What is 'Mutation' in Genetic Algorithm? [2]
- Q7)** a) Minimize $f(x) = x^4 + (2 / (2 + x^2)) + (5 / (3 + x^3))$. Use interval halving Method. Write complete algorithm for this method and demonstrate at least 3 steps towards finding optimized solution for the above function. [5]
- b) Minimize $f(x) = 10x^5 - 2x^4 + 5x + 40$ in the interval $[-8, 8]$. Use Secant Method. Write complete algorithm for this method and demonstrate at least 3 steps towards finding optimized solution for the above function. [5]
- Q8)** a) Minimize $f(x) = 3x^3 - 2x^2$ in the interval $[-1, 1]$. Use Newton Raphson Method. Perform 2 iterations. [5]
- b) Use Golden Search Method for above problem. Perform 2 iterations. [5]



Total No. of Questions : 8]

SEAT No. :

P5121

[Total No. of Pages : 2

[5060] - 843
M.E (Chemical)
Advanced Separation Processes
(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 regimes in cross flow electro filtration (CFE) and cake and film resistances? [5]
- b) What is the process of surface based solid-liquid separations involving a second liquid? Also mention the application? [5]
- Q2)** a) Which are the design aspects of pervaporation and permeation technique? [5]
- b) Discuss ceramic membrane and its applications. [5]
- Q3)** a) What are different types and choice of adsorbents and adsorption isotherms? [5]
- b) Describe HPLC technique along with principle, working and typical schematic diagram? [5]
- Q4)** a) Discuss in detail the reactive absorption technique for removal of hazardous gases like H₂S and SO_x? [10]

P.T.O.

- Q5)** a) Which are the different modes of operation of capillary electrophoresis? [6]
b) Explain the nature of the ion-exchange membranes used in electro dialysis? [4]
- Q6)** a) Describe the general types of equipment used for electrophoresis? [5]
b) Give the comparison of Dielectrophoresis and Electrophoresis? [5]
- Q7)** a) Write down the steps involved in lyophilization from sample preparation to final product formation? [5]
b) What are the modern techniques used for Industrial effluent treatment and discuss one of the technique? [5]
- Q8)** a) Describe principle and working of supercritical fluid extraction? [6]
b) Write a short note on oil spill waste minimization and management? [4]



Total No. of Questions : 8]

SEAT No. :

P5137

[Total No. of Pages : 2

[5060]-844

M.E. (Chemical) (Environmental Engineering)

RESEARCH METHODOLOGY

(2013 Pattern) (Credit System)

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) *Assume suitable data if necessary.*
- 4) *Solve any five full questions.*

Q1) a) What do you mean by researching? Describe the types of research. **[5]**

b) Write a note on 'Natural rate of growth of economy Vs Rate of growth of Environment related Industry.' **[5]**

Q2) a) Explain the difference between Research Methods and Research Methodology. **[5]**

b) Write a note on, 'Developments in Research for modifications in existing environmental processes.' **[5]**

Q3) a) Describe the format of research proposal. **[5]**

b) Write a note on 'Fruitful Research.' **[5]**

Q4) a) Explain the significance of Literature review in Research. **[5]**

b) What are typical methods in Controlling expenses in R & D. **[5]**

P.T.O.

- Q5)** a) Distinguish between Parametric and Non-parametric tests for hypothesis testing. [5]
- b) Write a note on 'Development in lagoons.' [5]
- Q6)** a) Discuss the steps involved in publishing a research article. [5]
- b) What is Industrial Research and how it would be converted into a fruitful application oriented one? [5]
- Q7)** a) What is Plagrism in research and how to avoid it? [5]
- b) Write a note on 'Developments in Pollution free technologies.' [5]
- Q8)** a) How an impactful of presentation can be prepared? What are the elements of effective presentation? [5]
- b) What is an interdisciplinary research? [5]



Total No. of Questions : 8]

SEAT No. :

P4886

[Total No. of Pages : 3

[5060]-846

M.E. (Chemical)

ADVANCED TRANSPORT PHENOMENA (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) Write short note on substantial time derivative and derive stokes equation. [2]

b) Derive the equation for velocity for flow through the annulus using starting following equations: [8]

$$v_z = -\frac{(P_0 - P_L)R^2}{4\mu L} \left[\left(\frac{r}{R} \right)^2 - 2\lambda^2 \ln \left(\frac{l}{R} \right) + C_2 \right]$$

BC 1: $r = kR.$ $v_z = 0$

BC 2: $r = R.$ $v_z = 0$

Q2) a) Summarize all the steps required in obtaining the equation of change for the temperature. [3]

b) Determine the temperature distribution in an incompressible liquid confined between two coaxial cylinders. The outer one of which is rotating at steady angular velocity Ω_0 and radius ratio K to be fairly small so that the curvature of the fluid streamlines must be taken into account. The temperatures of the inner and outer surfaces of the annular region are maintained at T_k and T_l respectively, with $T_k \neq T_l$. Assume steady laminar flow and neglect the temperature dependence of the physical properties. [7]

P.T.O.

- Q3)** a) Heat conduction is flowing through an annular wall of inside radius r_0 and outside radius r_1 . The thermal conductivity varies linearly with temperature from k_0 at T_0 to k_1 at T_1 . Develop an expression for the heat flow through the wall. [8]
- b) Summarize steps involved in derivation of velocity and temperature in forced convection. [2]
- Q4)** a) Obtain the equation of continuity for a multi-component mixture. Assume binary system with constant ρ^{DAB} , with constant C^{DAB} or with zero velocity. [8]
- b) Explain boundary layer separation and formation of wakes. [2]
- Q5)** a) Define the heat transfer coefficient, the Nusselt number, the Stanton number, and the Chilton - Colburn jn. How can each of these be 'decorated' to indicate the type of temperature - difference driving force that is being used? [7]
- b) What is the physical significance of the fact that the turbulent Prandtl number is of the order of unity? [3]
- Q6)** In a catalytic tubular reactor, a dilute solution of solute A in a solvent S is in fully developed laminar flow in the region $z < 0$. When it encounters the catalytic wall in the region $0 < z < L$, solute A is instantaneously and irreversibly rearranged to an isomer B. Write diffusion equation appropriate for this problem and find the solution for short distances into the reactor. Assume that the flow is isothermal and neglect the presence of B. Use the following equations: [10]

$$v_z \frac{\partial C_A}{\partial z} = D_{AS} \left[\frac{1}{r} \frac{\partial}{\partial r} \left(r \frac{\partial C_A}{\partial r} \right) + \frac{\partial^2 C_A}{\partial z^2} \right]$$

Q7) a) Compare turbulent thermal conductivity and turbulent viscosity as to definition, order of magnitude and dependence on physical properties of and nature of flow. [5]

b) Derive the equation of continuity for a multi-component mixture. [5]

Q8) Derive the expression for temperature distribution more than one independent variables. [10]



Total No. of Questions : 8]

SEAT No. :

P5134

[Total No. of Pages : 2

[5060] - 847
M.E. (Chemical Engineering)
ADVANCED PROCESS CONTROL
(2013 Pattern) (End Semester)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

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

- Q1)** a) Differentiate between dynamic, state space and transfer function domain models. Are they related to each other? [5]
- b) Enlist the stages in model derivation process. [3]
- c) Define modelling. [2]

- Q2)** a) Non-linear dynamic model equations are given as follows : [5]

$$\begin{aligned} dx_1/dt &= f_1(x_1, x_2, u) \\ dx_2/dt &= f_2(x_1, x_2, u) \text{ and} \\ y &= g(x_1, x_2, u) \end{aligned}$$

where x_1, x_2 - input variables; y - output variable and u - manipulated variable. Obtain the linearized state space equations.

- b) Differentiate between feedforward and feedback control system. [3]
- c) Define ratio controller. [2]

- Q3)** a) In a case of a 2×2 matrix system, if one RGA element in first row calculated to be $\frac{3}{4}$. According to the RGA properties, what are the other elements in the RGA matrix? [5]
- b) What is singular value decomposition? Explain. [3]
- c) Define RGA. [2]

P.T.O.

- Q4)** a) What is involved in signal conditioning? Explain. [5]
b) What is Niederlinski stability index? [3]
c) Define MIMO control system. [2]
- Q5)** a) What are three major issues raised by the use of digital computer for control system implementation. [5]
b) Differentiate between zero order and first order hold. [3]
c) How does an ideal sampler operate? [2]
- Q6)** a) Enlist and explain basic elements of Model Predictive control. [5]
b) Write short on Finite convolution model in MPC. [3]
c) Enlist one contemporary industrial control problem. [2]
- Q7)** a) What are the broad concepts involved in the application of z-transform to discrete time control system analysis. [5]
b) What are various challenges faced by plant wide control system? [3]
c) Define digital control. [2]
- Q8)** a) Why is it incorrect to assume that one can obtain the z - transform of a continuous function? [5]
b) What is pulse transfer function? [3]
c) Define analog control. [2]



Total No. of Questions : 8]

SEAT No. :

P4887

[Total No. of Pages : 3

[5060]-848
M.E. Chemical Engineering
ADVANCED REACTION ENGINEERING
(2013 Pattern)

Time : 3 Hours]

[Maximum 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 calculators is allowed.*
- 5) *Figures to the right indicate full marks.*

- Q1)** a) Explain langmuir-Hinshelwood Model. [5]
b) What is the significance of 'Thiele Modulus' catalytic reaction engineering? [3]
c) Briefly explain desirable properties of heterogeneous catalysts. [2]
- Q2)** a) Particles of uniform size are 60% converted on the average when flowing through a single fluidized bed. If the reactor is made twice as large but contains same amount of solids and with the same gas environment. determine the conversion of solids. [5]
b) Derive a model for spherical particle of unchanged size when gas film diffusion is controlling resistance. [3]
c) What are the various factors responsible for determination of the rate controlling step in fluid-particle reaction? [2]
- Q3)** a) Describe the steps that take place in a typical catalytic reaction. with a schematic diagram. [5]
b) Write the steps for modelling diffusion with reaction. [3]
c) List the catalytic reactions (any four). [2]

- Q4)** a) Derive the mass transfer coefficients in packed beds. [5]
 b) Explain the series of stirred tanks model. [3]
 c) Explain the boundary layer around the surface of a catalyst pellet. [2]
- Q5)** a) Derive the differential equation governing steady state mass transfer with reaction in the cylindrical catalyst pellet. Use usual notations. [5]
 b) Explain effective diffusivity with equation and each term. [3]
 c) What is meant by effectiveness factor. [2]
- Q6)** a) Explain briefly the mechanisms of catalyst deactivation. [5]
 b) Explain Thiele modulus? [3]
 c) Write a performance equation for reaction contacting porous catalyst particles. [2]
- Q7)** a) The second order reaction $A \rightarrow R$ is studied in an experimental recycle reactor with large recycle ratio. the data recorded are as follows: [5]
 Void volume of reactor = 1 L
 Amount of catalyst used = 3 g
 feed to the reactor: $v_0 = 1$ L/h with $C_{A0} = 2$ mol/L
 concentration of A in the exit stream from the recycle system ($C_{A \text{ out}}$) = 0.5 mol/L
 i) Find the rate constant for this reaction.
 ii) Calculate the amount of catalyst needed in a packed bed reactor to archive 80% conversion for feed to the reactor: $V_0 = 1000$ L/h and $C_{A0} = 1$ mol/L.
 a) Explain the heat effects during the reaction in porous catalyst. [3]
 b) Give classification of heterogeneous reactors. [2]

- Q8)** a) With the help of neat sketch, describe two phase fluidized bed reactor model. [5]
- b) Explain in detail about the fluidized bed reactor. [3]
- c) Application of heterogeneous catalysts. [2]



Total No. of Questions : 8]

SEAT No. :

P5133

[Total No. of Pages : 2

[5060] - 850
M.E. (Chemical)
PROCESS MODELING & SIMULATION
(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :-

- 1) Answer any 5 questions.*
- 2) Neat diagram must be drawn whenever necessary.*
- 3) Assume suitable data, if required.*
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is permitted.*

Q1) Write short notes on : **[10]**

- a) Law of conservation of momentum
- b) Transport laws

Q2) What is Steady state and non steady state model? Explain it with suitable example. **[10]**

Q3) A continuous flow distillation column is fed with a binary mixture of A and B. The relative volatility (α) of mixture is constant. Consider the plates above the feed plate. Derive the difference equations which relates the liquid composition to the plate number n, if the overall plate efficiency is 100% and explain the method of solving it. **[10]**

Q4) Explain any constrained optimization problems. **[10]**

Q5) A cup of coffee has an initial temperature of 74°C, but cools to 68°C in one minute when placed in a room with a temperature of 21°C. Let T_n be the temperature of the coffee after 'n' minutes **[10]**

- a) Write a difference equation which describes the change in temperature of the coffee from minute to minute.
- b) Solve the resulting difference equation.

P.T.O.

Q6) Explain about Sequential modular approach with a neat flow chart in process plant simulation. **[10]**

Q7) Write note on Orthogonal collocation to solve PDEs. **[10]**

Q8) Write down a computer simulation program to carry out bubble point calculations. **[10]**



Total No. of Questions : 8]

SEAT No. :

P5123

[Total No. of Pages : 2

[5060]-851

**M.E. (Chemical Engineering)
ADVANCED THERMODYNAMICS
(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 the activity versus mole fraction curves and explain the significance of the various of A/RT. [5]
- b) Derive four suffix Margules equation for activity coefficients. [5]
- Q2)** a) Explain about the equilibrium criteria for reacting mixtures. [3]
- b) Derive a correlation between equilibrium constant and change in Gibbs free energy for a reacting mixture. [3]
- c) Consider system in which the following reactions occurs:
$$\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$$
$$\text{CH}_4 + 2\text{H}_2\text{O} \rightarrow \text{CO}_2 + 4\text{H}_2$$
If there present initially 2 mole of CH_4 and 3 mole of H_2O , determine expressions for the y_i as functions of ϵ_1 and ϵ_2 . [4]
- Q3)** a) Develop the following thermodynamic properties in terms of partition functions Helmholtz free energy and Gibbs free energy. [5]
- b) 10 molecules of a gas are present in a container maintained at 298K. What is the probability that all ten molecules will be found simultaneously in one half of the container? [5]

P.T.O.

- Q4)** a) Develop the solvent activity and osmotic coefficients in terms of excess Gibbs free energy for an electrolytic solution. [5]
- b) Explain the isopiestic method. [5]
- Q5)** a) Write about the chemical variable and the second law of thermodynamics and explain the rate of entropy production. [5]
- b) Write the first law of thermodynamics for open systems and explain in detail. [5]
- Q6)** a) Derive an equation showing the effect of curvature on surface properties. [5]
- b) Explain with examples lambda transitions. [5]
- Q7)** a) Draw and explain magnetization versus applied magnetic field curves for type I and type II superconductors. [5]
- b) Define the following terms assembly canonical assembly occupational number, statistical weight factor. [5]
- Q8)** Describe in detail the Debey-huckle theory. [10]



Total No. of Questions : 8]

SEAT No. :

P5100

[Total No. of Pages : 2

[5060]-853

M.E. (Environmental Engg.) (Chemical)

APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt 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 table is allowed.*
- 5) *Assume suitable data if necessary.*

Q1) a) State the difference between mean deviation and standard deviation. **[5]**

b) Explain residual error in regression model. **[5]**

Q2) a) The mean weight loss of n - grinding balls after a certain length of time in mill slurry is 3.42 g with standard deviation of 0.68 g. construct a 99% confidence interval for the true mean weight loss of such grinding balls under standard conditions. **[5]**

b) An analysis of monthly Wages paid to the workers of two firms A and B belonging to the same industry gives following results : **[5]**

	Firm A	Firm B
No. of workers	500	600
Average daily wage	Rs. 186	Rs. 175
Variance of distribution of Wage	81	100

P.T.O.

- i) Which firm A or B has a larger Wage bill.
- ii) In which firm, A or B, is the largest variability in individual Wages.

Q3) a) Distinguish between statistic and parameter. [5]

b) Comment on factorial experimentation with suitable example. [5]

Q4) a) Explain the method of moment generating function for the CHI - Square distribution. [5]

b) Explain the tests of significance for attributes. [5]

Q5) a) Define the terms [5]

i) Factorial experiment

ii) Precision

iii) Parameters

b) Elaborate model equation for latin square design. [5]

Q6) a) What is the analysis of variance in two way classification model. [5]

b) What is optimality test. [5]

Q7) a) Explain Transportation algorithm. [5]

b) Explain graphical method for sequential sampling. [5]

Q8) a) What is randomized block design model. [5]

b) What are unbound solutions in simplex method. [5]



Total No. of Questions : 8]

SEAT No. :

P4888

[Total No. of Pages : 2

[5060]-854

**M.E. Environmental Engineering (Chemical)
ENVIRONMENTAL MANAGEMENT
(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 ecosystem and role of environmental polices. [5]
b) Explain various environmental management tools in detail. [5]
- Q2)** a) What are the subsystems of environment. [5]
b) Explain evolution of EIA in India. [5]
- Q3)** a) Explain 74th Amendment of the constitution. [5]
b) What are the directive principles of state policy. [5]
- Q4)** a) Discuss how the Bill is issued in parliament and how it becomes an Act. [5]
b) What are different environmental Act. [5]
- Q5)** a) Explain fundamental rights and duties of Indian citizen. [5]
b) Discuss safety velated rules. [5]

P.T.O

- Q6)** a) Explain the steps in the rule notification. [5]
b) Enlist different factory Act passed by Indian parliament. [5]
- Q7)** a) Explain in detail the role of central pollution control board. [5]
b) Explain carbon trading. [5]
- Q8)** a) What role is played by Ministry of Environment and forest in conservation of environment. [5]
b) Discuss general features of the annual report of the ministry of environment and forests for the current year. [5]



Total No. of Questions : 8]

SEAT No. :

P5120

[Total No. of Pages : 2

[5060] - 855
M.E. (Chemical) (Environmental)
ENVIRONMENTAL CHEMISTRY
(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, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) What is Stoichiometry and mass balance in environmental chemistry?[5]

b) Explain Second order reactions with example. [5]

Q2) Explain the term biomonitoring of water quality. Describe any three advantages of biomonitoring over chemical monitoring. [10]

Q3) What is Greenhouse Effect? Explain in detail. [10]

Q4) Describe the method for analysis of suspended particulate matter (SPM) in ambient air. [10]

Q5) How to remove the Metals from wastewater by using Ion Exchange? [10]

Q6) Explain atmospheric structure in detail. [10]

P.T.O.

Q7) What do you understand by soil temperature? Discuss factors affecting soil temperature. **[10]**

Q8) Discuss the emerging areas of Environmental chemistry. **[10]**



Total No. of Questions : 8]

SEAT No. :

P5083

[5060]-856

[Total No. of Pages : 2

M.E. (Chemical)

RESEARCH METHODOLOGY

(2013 Credit Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Solve any FIVE full 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 the typical manpower needs of a research project. **[5]**

b) Write a note on 'Developments in Natural rate of growth of economy Vs Rate of growth of Chemical Industry'. **[5]**

Q2) a) What is the status of research & development in Indian Chemical Industry? **[5]**

b) Write a note on, 'Developments in Research for modifications in existing chemical processes'. **[5]**

Q3) a) Explain the difference between Research Methods and Research Methodology. **[5]**

b) Write a note on 'Fruitful Research' **[5]**

Q4) a) Give chronological survey of research in that sub branch and its role in improving standard of life of society. **[5]**

b) Write a note on "Controlling expenses in R & D". **[5]**

Q5) a) Explain the significance of Literature review in Research. **[5]**

b) Write a note on 'Developments in Micro reactor Technology'. **[5]**

P.T.O.

- Q6)** a) What is an interdisciplinary research? [5]
b) Write a note on 'Developments in Hydro Fluoro carbon research'. [5]
- Q7)** a) Cite the failure/risk point. Do complete risk analysis. [5]
b) Write a note on 'Industrial Research'. [5]
- Q8)** a) How a planned research be strengthened by visionary technocrats? What are the qualities to be a visionary? [5]
b) Write a note on 'Developments in Pollution free technologies'. [5]



Total No. of Questions : 8]

SEAT No. :

P4890

[Total No. of Pages : 2

[5060]-858

**M.E. (Chemical) (Environmental Engineering)
WASTEWATER TREATMENT AND DESIGN
(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 reaction kinetics in detail. [5]

b) What is gas-liquid mass transfer process. [5]

Q2) a) Explain stability of colloids. [5]

b) Discuss flocculation theory. [5]

Q3) a) Explain particle settling theory in detail. [5]

b) Discuss the design considerations in typical rectangular sedimentation tank. [5]

Q4) a) State and explain principle and mechanism of filtration. [5]

b) What is backwash hydraulics. [5]

Q5) a) Explain Freundlich and Langmuir adsorption in adsorption. [5]

b) How activated carbon is prepared and explain carbon regeneration and reactivation. [5]

P.T.O

- Q6) a)** Estimate the chlorine dose needed to disinfect a filtered secondary effluent assuming a shoulder effect exists and that the following conditions apply. [5]

Effluent total coliform count before disinfection = $10^7/100\text{ml}$.

Required summer effluent total coliform count = $23/100\text{ml}$

Required winter effluent total coliform count = $240/100\text{ml}$

Inlet effluent chlorine demand = 4mg/l

Demand due to decay during chlorine contact = 2.5 mg/l

Required chlorine contact time = 60min

- b) Explain Break through analysis and how it is helpful in the design of reactor. [5]

- Q7) a)** Discuss different types of biological treatment processes. [5]

- b) Explain conventional activated sludge process. [5]

- Q8) a)** Explain the design of clarifiers. [5]

- b) What are different types of settling, explain in brief. [5]



Total No. of Questions : 8]

SEAT No. :

P5128

[Total No. of Pages : 1

[5060] - 859

**M. E. Chemical - Environmental
SOLID WASTE MANAGEMENT
(2013 pattern)**

Time : 2Hours]

[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 indicate full marks.*
- 4) Use of logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) Assume suitable data, if necessary.*

- Q1)* What is biodegradable wastes and non - biodegradable waste? [10]
- Q2)* Differentiate between hazardous and non hazardous waste? [10]
- Q3)* How to determine the moisture content of MSW? [10]
- Q4)* What is composting? Explain in detail. [10]
- Q5)* Describe mechanical collection of solid wastes? [10]
- Q6)* Define on - site storage of solid wastes and what are the types of containers?[10]
- Q7)* MSW is generated within the community from several sources, not just the household. Classify the solid waste based on sources and types. Discuss the factors that contribute to variation in composition of solid waste. [10]
- Q8)* Write about the interrelationship of the functional elements in a solid waste management system. [10]



P.T.O.

Total No. of Questions : 8]

SEAT No. :

P5119

[Total No. of Pages : 1

[5060]-860
M.E. (Chemical-Environmental)
INDUSTRIAL WASTE TREATMENT
(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, and electronic pocket calculator and steam table is allowed.*
- 5) Assume suitable data, if necessary.*

- Q1)* Discuss the effect of industrial wastes on streams. [10]
- Q2)* Explain the different settling zones of sedimentation with neat sketches. [10]
- Q3)* Explain the treatment techniques for removal of oil and grease. [10]
- Q4)* Explain Effluent standards given by MPCB. [10]
- Q5)* Explain common Effluent treatment plant. [10]
- Q6)* Water budgeting-Explain in detail. [10]
- Q7)* Explain the characteristics of effluents from fertilizer industry. [10]
- Q8)* Describe the method of treating the waste water from paper and pulp industry. [10]



Total No. of Questions : 8]

SEAT No. :

P4891

[Total No. of Pages : 2

[5060]-862

**M.E. (Chemical) (Environmental Engineering)
REMOTE SENSING AND GIS APPLICATIONS IN
ENVIRONMENTAL ENGINEERING
(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 Remote sensing technique and its application. List out the various stages of remote sensing. **[5]**

b) Explain Active and Passive remote sensing system. **[5]**

Q2) Explain in brief the following:

a) Image classification. **[5]**

b) Indian remote sensing satellites. **[5]**

Q3) a) What is the utility of sensor in Remote Sensing & explain spatial resolution. **[5]**

b) What is the principle of Classifying Imaging sensor and what are their different types? Explain thermal sensing system. **[5]**

Q4) a) What is FCC and explain its Significance in identification of surface object? **[5]**

b) Explain Digital system of remote sensing. **[5]**

P.T.O.

- Q5)** a) What is Digital imaging processing its necessity and application? Explain the Radiometric correction method. [5]
- b) What is the necessity of image enhancement and explain contrast enhancement. [5]
- Q6)** Explain concept of G.I.S. and state any four components of G.I.S. [10]
- Q7)** State any four data sources for G.I.S. [10]
- Q8)** a) Differentiate between spatial data and non spatial data. [5]
- b) Explain Watershed management by using Remote Sensing and GIS. [5]



Total No. of Questions : 8]

SEAT No. :

P4892

[Total No. of Pages : 2

[5060]-863

M.E. (Chemical) (Environmental Engineering) (Semester - III)
INDUSTRIAL POLLUTION PREVENTION
& CLEANER PRODUCTION
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Maximum 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) Write in details how the industrialization and sustainable development can be correlated? **[5]**

b) What are the indicators of the sustainability? **[5]**

Q2) Discuss in details the methods to determine the extent to which a certain program has prevented pollution or achieved cleaner production. **[10]**

Q3) a) State the Historical evolution of pollution prevention and control. **[5]**

b) State the correlation of industries and Government policy in pollution prevention and control. **[5]**

Q4) a) Write a brief note on source reduction techniques in pollution control **[5]**

b) Explain the use of internet information for pollution prevention and cleaner production. **[5]**

Q5) Justify that the process and equipment optimization is important aspect in pollution prevention and cleaner production. **[10]**

P.T.O

Q6) State with an example, the technical and environmental feasibility analysis as well as total cost analysis of pollution prevention and cleaner production program [10]

Q7) Write short notes on: [10]

- a) Elements of life cycle assessment (LCA)
- b) Eco labeling and its awareness

Q8) a) Discuss the main elements of the planning stage of an Environmental Management system (EMS). [5]

b) Write a note on Environmental Audit. [5]



Total No. of Questions : 7]

SEAT No. :

P5099

[Total No. of Pages : 2

[5060]-871

M.E. (Petroleum Engineering) (Semester - I)

NUMERICAL SIMULATION IN PETROLEUM ENGINEERING

(2013 Pattern) (Credit System)

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) Explain and note the Well and Surface Facility Modeling in Reservoir Simulation. **[5]**
- b) Describe how process description and problem definition is carried out in modeling petroleum processes. **[5]**

- Q2)** Using Well Log data, some equations representing system parameters have been developed. Solve the following system of equations by the Gauss-Seidel method : **[10]**

$$10x_1 + x_2 + x_3 = 12$$

$$2x_1 + 10x_2 + x_3 = 13$$

$$2x_1 + 2x_2 + 10x_3 = 14$$

Compute the answers correct to four decimal places up to four iterations only.

P.T.O.

Q3) With neat flow diagram, explain Geological Modeling with its various aspects. [10]

Q4) Representation of empirical data has described following equation for the reservoir model. Find the real root of the equation by applying Newton - Raphson method at the end of fifth iteration : [10]

$$x^3 + 2x - 5 = 0.$$

Q5) For a undersaturated reservoir, all the produced gas R_p can be dissolved in the oil at reservoir conditions i.e. $R_p = R_s = R_{si}$.

The recovery in such a reservoir is expressed as : $\frac{N_p}{N} = \frac{(B_o - B_{of})}{B_o}$ Write down the material balance equations and derive the recovery expression. [10]

Q6) Two phase separator at surface facility expresses its behavior by following differential equation : $\frac{dy}{dx} = x^2 + y^2$ Solve the system equation by using fourth order Rungee - Kutta method to find y at x=0.2 and x=0.4 using h=0.2. [10]

Q7) Use Euler's method to solve the ordinary differential equation [10]

$$\frac{dy}{dx} = -2x^3 + 12x^2 - 20x + 8.5$$

I.C. : $y(0)=1$

Solve for x=0 to x=2.5 with a step size of 0.5.



Total No. of Questions : 8]

SEAT No. :

P5093

[Total No. of Pages : 2

[5060] - 872
M.E. (Petroleum Engineering)
GEOLOGY IN RESERVOIR DESCRIPTION
(2013 Pattern) (Semester - I) (Credit System)

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 side indicate full marks.*
- 4) *Assume additional data, if required.*

Q1) a) Define the following. Cementation and compaction, Dolomitization, sandy shale. **[4]**

b) Draw a diagram showing difference in the grain size during normal and reverse sedimentation. Give brief description . **[6]**

Q2) a) How diagenetic changes alter porosity permeability relationship in sand shale sequence? **[5]**

b) Write in brief Dunham scheme of classification of carbonate rocks. **[5]**

Q3) a) Describe in brief factors affecting sorting of sediments. Draw diagrams. **[5]**

b) Draw a composite failure envelope showing variation in the growth of fractures with increasing confining pressure. Give brief description in support of diagram. **[5]**

Q4) a) Porosity permeability variation with increasing depth is given in following table. Plot a graph and comment on porosity permeability variation with increasing depth. **[5]**

Depth	Porosity	Permeability	Depth	Porosity	Permeability
2200	12.30	120.00	2206	22.04	1671.87
2201	14.70	235.00	2207	25.11	703.32
2202	17.20	753.00	2208	16.37	352.78
2203	19.70	1100.00	2209	23.04	1028.44
2204	22.40	315.00	2210	25.00	1216.00
2205	22.40	1385.00			

Table 1 for Q.4 b

b) Use above table to calculate hydraulic units from the data. How many flow units can be recognized here? **[5]**

P.T.O.

- Q5)** a) Write with the help of a neat diagram volumetric description of a carbonate reservoir. [5]
- b) Why it is necessary to preserve cores at reservoir condition? Explain. [5]
- Q6)** a) Define following terms.
Dual water system, Gas slippage, petroleum system. structure contour map. passion ratio. [5]
- b) How structure contour maps are created? Draw a neat diagram to explain the same. [5]
- Q7)** a) How is following recognized using logs? Draw sketches Porosity in formation, presence of hydrocarbons. [5]
- b) Why it is necessary to use combination of logs in systematic evaluation of formation? [5]
- Q8)** a) Calculate the amount of oil present (OOIP) in a reservoir covering an area of 250 acres with an average thickness of 23ft. The average porosity is 25%. Formation Volume factor is 1.20 and water saturation is 22 %. Calculate the changes in OOIP if variation of 10 percent is considered (lower and higher value). [5]
- b) What is nugget value, sill and range in a variogram? Draw a neat sketch for explanation. [5]



Total No. of Questions : 7]

SEAT No. :

P4893

[Total No. of Pages : 2

[5060]-873

**M.E. (Petroleum Engineering)
ADVANCE DRILLING ENGINEERING
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Answer any 5 questions out of 7.*
- 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 reasons of directional drilling? [2]
b) Using following coordinate find Measured depth [8]
Slot coordinate 15.32ft N, 5.06 ft E
TVD Target 9880ft
KOP 1650ft, Build up rate 1.5deg per 100ft
- Q2)** a) Discuss different types of multilateral wells. [3]
b) Discuss Radius of curvature method. [5]
c) Write short note on Whip stock. [2]
- Q3)** a) A drill string stuck at drill collar. Drill string contains drill pipe 10,000ft, 5"OD, 4.276" ID, E grade 19.5ppf class2, drill collar 600ft of total weight 60,000lb. Make up torque 20,000 ft-lb and free point 9,900ft. Determine maximum torque. Tensile strength 311,540lb [5]
b) Draw circulation system of a drilling rig. [5]
- Q4)** a) Explain two stage cementation with suitable sketch. [8]
b) Use of top plug and bottom plug. [2]
- Q5)** a) How many sacks of lead and tail cement will be required? [5]
Casing depth 3000ft, Hole size 17-1/2", casing size 13-3/8", ID 12.6 15", shoe track 44ft.
Cement program
Lead cement = 13.8ppg 200ft, Slurry yield 1.59ft³/sack
Tail slurry 1000ft, yield= 1.15ft³/sack, Excess volume =50%
- b) Discuss tripping operation in brief. [5]

P.T.O.

- Q6)** a) Discuss different rheological properties of drilling fluid in detail. [4]
b) Discuss different types of flow (Models) in brief. [6]

Q7) 9-5/8" production casing section depth 2,550m, Mud weight to drill this section 11ppg, Mud weight to drill next hole section 14.1 ppg, expected pore pressure gradient in next section 13 .6ppg, Influx gradient 0.1 psi/ft, fracture gradient at shoe 18.1 ppg. [10]

Cement data

1000m Lead cement slurry density = 12.8ppg, 150m Tail cement slurry density = 15.8ppg

Next hole section depth = 3,380m TVD, Liner top = 2,300m TVD, completion fluid 10.8ppg

Depth of perforation - 3,338m TVD, Packer depth= 3,300m TVD

Calculate

- i) Collapse pressure with respect to full evacuation and Plugged perforation.
- ii) Burst pressure with respect to next phase and Fracture at shoe
- iii) Green cement pressure test

Burst pressure at liner top when tubing leak



Total No. of Questions : 8]

SEAT No. :

P5084

[5060]-874

[Total No. of Pages : 2

M.E. (Petroleum Engineering)
RESEARCH METHODOLOGY
(2013 Credit Pattern) (Semester - I) (512104)

Time : 3 Hours]

[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? Explain the criteria for a good research. [4]
b) Define the term Research Methodology. Explain in brief its significance. [3]
c) Explain in brief the steps in process of research. [3]
- Q2)** a) Discuss the general characteristics of modern research. What are the criteria to be considered for selection of research topic. [4]
b) Distinguish between an experiment and survey. Explain the survey method of research. [3]
c) Examine the merits and limitations of the observation method in collecting data for your research. [3]
- Q3)** a) What is research design? Explain the different types of research designs and formulate a research design for your research problem. [4]
b) What is a research problem? Define the necessity of identifying a research problem. [4]
c) Critically examine the qualitative and quantitative research methods. [2]

P.T.O.

- Q4)** a) Make a comparative study between primary and secondary data. Evaluate the various techniques of collecting primary data. [4]
b) What is chi-square test? Explain its significance in statistical analysis. [4]
c) Distinguish between applied research and fundamental research regarding researcher's qualities. [2]
- Q5)** a) Discuss the characteristics of a good questionnaire. [4]
b) Discuss the key factors for a successful oral presentation. [4]
c) Define sampling and list different types of sampling. [2]
- Q6)** a) Explain the meaning and structure of a research report. [4]
b) Explain in brief the current trends in research by giving suitable example. [3]
c) Write a brief note on: Citation methods in Scientific Research. [3]
- Q7)** a) Give the difference between thesis writing and research paper writing. Describe various sections of research paper writing. [5]
b) Discuss the different tools and techniques of data collection and analysis used in research. Support your answer by giving suitable example. [5]
- Q8)** a) Write notes on: (Any Two) [5]
i) Intellectual Property Rights (IPR)
ii) Blog Spot Writing
iii) Ethics in Research
b) What is literature review? State Creswell's five steps to conduct literature review. Discuss the various sources of literature review. [5]



Total No. of Questions : 8]

SEAT No. :

P4894

[Total No. of Pages : 2

[5060]-876

**M.E. (Petroleum Engineering)
ADVANCED RESERVOIR ENGINEERING
(2013 Pattern) (Semester - II)**

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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain the relation between continuity and diffusivity equation. [5]
b) How does a relative permeability curve change with saturation? Explain. [3]
c) How are effective permeability, absolute permeability and relative permeability linked to each other? Explain in detail. [2]
- Q2)** a) What are the various solutions to the diffusivity equation? [5]
b) Why can't a PDE be solved as it is? Explain in detail. [3]
c) Write the diffusivity equation in both Cartesian and radial coordinates? Explain each of the terms in the equation. [2]
- Q3)** a) Draw the graph of viscosity, formation volume factor of oil, water and gas with respect to pressure. Explain the trends and give reasons for the particular trends observed in the graphs. [5]
b) Write a detailed note on thermal enhanced oil recovery. [3]
c) What do you mean by in-situ combustion? How is it different from waterflooding and what are the advantages? [2]

P.T.O

- Q4)** a) Explain the five different types of reservoir fluids, with the help of a phase diagram, with appropriate curves on the diagram. [5]
b) Explain in detail 5 fluid properties for oil, and how they vary with pressure. [3]
c) What do you mean by retrograde condensate reservoirs? How are they different from a conventional reservoir, from a production standpoint?[2]
- Q5)** a) What do you mean by interfacial tension, and how is it measured? Explain its significance in producibility from reservoirs. [5]
b) Explain the importance of reaction kinetics in an in-situ combustion process. [3]
c) What are the screening criteria for implementing a particular EOR method? [2]
- Q6)** a) In EOR, what is the difference between areal and vertical sweep efficiency? [4]
b) What is the difference between SAGD and Huff-and-puff method? Explain in detail. [4]
c) Write a short note on polymer flooding. [2]
- Q7)** Write short notes on:
a) In-Situ combustion-Its advantages, disadvantages and applications. [5]
b) Fractional flow theory. [5]
- Q8)** Explain in detail, what do you mean by:
a) Low and high temperature oxidation. [5]
b) Miscible and immiscible displacement. [5]



Total No. of Questions : 8]

SEAT No. :

P4895

[Total No. of Pages : 2

[5060]-877

M.E. (Petroleum Engineering) (Semester - II)

**ENVIRONMENTAL TECHNOLOGY IN PETROLEUM ENGINEERING
(2013 Pattern)**

Time : 3 Hours]

[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) Write a brief note on: NORM in shale. [4]
b) Explain the toxicity of petroleum products and treatment chemicals. [3]
c) Write a note on 'Clean Development Mechanism'. [3]
- Q2)** a) What is down hole oil water separator? Discuss about types and advantages of down hole oil water separator. [4]
b) What are the different chemicals used in bulk in drilling muds. How do they affect the environment? [3]
c) Describe chemical methods to prevent oil spills. [3]
- Q3)** a) Explain about offshore and onshore waste management options in oil industry. [4]
b) Explain sources of hydrocarbon release into sea. [3]
c) Write a brief note on: Waste water treatment technology in oil industry. [3]
- Q4)** a) Explain pollution due to drilling and production operations and environmental impact of discharge in the onshore and offshore areas. [4]
b) Discuss in brief different methods for oil spill control in marine environment. [3]
c) Discuss about potential impacts of oil industry on the environment. [3]

P.T.O.

Q5) Write notes on: (Any Two) [10]

- a) Methods for treatment of produced water
- b) Disaster Management
- c) Clean Development Mechanisms

Q6 a) What do you mean Environmental impact assessment? Explain in brief with suitable example. [4]

b) Explain the principle of HAZOP and HAZID. [3]

c) Write a note on “Integrated Environmental Biotechnology in Petroleum Industry”. [3]

Q7) a) What is meant by mud dispersibility? Explain how selection of mud based on environmental friendly decisions combat borehole stability problems? [5]

b) Discuss Environmental Regulations in Oil Industries. [5]

Q8) Write notes on: (Any Two) [10]

- a) Health and Safety Laws
- b) Risk Analysis and Management
- c) Role of petroleum industry in CO₂ sequestration.



Total No. of Questions : 8]

SEAT No. :

P5085

[5060]-878

[Total No. of Pages : 2

M.E. (Petroleum)

ADVANCED PRODUCTION ENGINEERING

(2013 Course) (512109) (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 logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data,if necessary.*

- Q1)** a) What is formation damage ? Discuss the causes and solution to it. [5]
b) Classify different types of artificial lift systems and write working principle of SRP and gas lifting technique. [3]
c) Explain typical IPR-VLP plot. [2]
- Q2)** a) Describe graphical method to decide depth of valve for point of gas injection in case of intermittent gas lifting system. [5]
b) Explain working of progressive cavity pumping system. [3]
c) Write in brief, detail procedure for sizing of a horizontal separator. [2]
- Q3)** a) What is nodal analysis ? What are the objectives of it? Write. [4]
b) Discuss the role of fracturing fluid and proppants in brief. [2]
c) Draw block diagram of various processes and stages of operations that take place inside a GGS. [4]
- Q4)** a) Discuss the method to investigate and decide the sizing of a horizontal heater treater. [5]
b) Discuss the objectives of stage separation for a surface production facility? [3]
c) Which separator you will recommend in following conditions? Explain the useful features of the separator, required in each of following conditions, [2]
i) Onshore facility, high P.I.,high production rate wells.
ii) Low P.I. high GOR wells.

P.T.O.

- Q5)** a) What is the role of API standards, codes and field practices in oilfield development? Explain. [4]
b) Draw neat schematic sketch and explain petroleum production system. Write inflow and outflow expressions applicable for at least three nodes. [4]
c) Draw neat schematic sketch of any one type of well completion. [2]
- Q6)** a) Write a note subsea production system. [4]
b) What is production optimization? Write various areas of applications for it. [3]
c) Write the advantages and disadvantages of hydraulic lifting system. [3]
- Q7)** a) Discuss usability of Continuous gas lift, Intermittent gas lift and SRP 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, high volume lift capability, ability to handle viscous oil and depth limits. [5]
b) Draw neat schematic sketch of subsurface components of an ESP and write functions of each in brief. [5]
- Q8)** a) Explain working of a casing pressure operated gas lift valve. [5]
b) Discuss working and design of sucker rod pumping system. [5]



Total No. of Questions : 8]

SEAT No. :

P4896

[Total No. of Pages : 4

[5060]-880

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) Which equations are used for deriving the diffusivity equation? And why? Explain the significance of each of the equation used. [5]
- b) What is the use of superposition in time, in well test interpretations? Explain with diagrams. [3]
- c) What is the difference between transient, pseudo steady state and steady state flow regime? Explain with appropriate diagrams. [2]
- Q2)** a) What do you mean by exponential integral function? Explain its significance in well testing. Draw the function and its log approximation vs. x on a semi-log plot. [5]
- b) Explain the concept of wellbore storage and its impact on solution of diffusivity equation. [3]
- c) How is gas well testing different from oil well testing? Explain in detail. [2]
- Q3)** a) Given is a dataset for a PBU test. Compute the skin factor, permeability and original reservoir pressure from the data [7]
- i) Viscosity – 0.9 cp
 - ii) $R_w = 0.3$ ft
 - iii) $C_t = 17 \times 10^{-6}$ psi⁻¹
 - iv) $P_{wf} = 1175$ psi

P.T.O.

- v) $B = 1.35 \text{ rb/stb}$
- vi) Porosity = 20 %
- vii) Flowrate, $q = 400 \text{ stb/d}$
- viii) Net pay = 25ft
- ix) $T_p = 5 \text{ days}$

Shut-in-time, Del-t (hr)	pws (psia)
0	1150
2	1794
4	1825
8	1857
16	1875
24	1895
48	1910

- b) What do you mean by DST? Explain with its different time phases. [3]

- Q4)**
- a) What is the difference between isochronal and modified isochronal test? [5]
 - b) Explain the various flow regimes which can be encountered during the interpretation of a typical well test data, along with figures and the slopes that are encountered for the respective flow regime. [3]
 - c) Explain what is meant by pseudo pressure. [2]

- Q5)**
- a) Following data was given for a drawdown test on a well, along with the pressure data given in the table: [7]
 - i) Viscosity – 0.7 cp
 - ii) $R_w = 0.175 \text{ ft}$
 - iii) $C_t = 15 \times 10^{-6} \text{ psi}^{-1}$
 - iv) $P_i = 4000 \text{ psi}$
 - v) $B = 1.121 \text{ rb/stb}$
 - vi) Porosity = 22 %
 - vii) Flowrate, $q = 150 \text{ stb/d}$
 - viii) Net pay = 60ft

t (hours)	Pwf (psia)
0	4412
0.12	3717
1.94	3633
2.79	3622
4.01	3611
4.82	3605
5.78	3600
6.94	3594
8.21	3580
9.95	3575
14	3570
17.3	3567
20.7	3561
24.9	3555
30	3549
36	3544
43.5	3535
51.5	3532
61.8	3526
74	3520

Find the permeability and skin from the above data.

- b) Explain how the pseudo-pressure function behaves with pressure, with the help of a graph. **[3]**

- Q6)** a) What slopes are observed in a pressure derivative plot of a fractured horizontal well? [4]
- b) What do you mean by Nodal Analysis? What is its use, and its application in the oil and gas industry? [4]
- c) What happens when you change the node position in Nodal Analysis? Explain with graphs. [2]

- Q7)** a) A new oil well produced 400 stb / day for $2 \pm$ days; then it was shut-in for a pressure buildup test, during which the data in Table below were recorded. The other data were: $B_o = 1.25$ rb/stb, $A = 20$ fi, $\theta = 0.20$, $r_w = 0.29$ ft, $c = 19.5 \times 10^6$, and $\mu_o = 1.1$ cP. From these data, estimate the formation permeability, k , p_i , and skin factors. [7]

Shut-in time, Del-t (hr)	Horner Time Ratio	pws (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

- b) Write short notes on Fetkovich and Blasingame decline curves. [3]

Q8) Explain in detail, what do you mean by :

- a) Type curves and its usage in well testing. [5]
- b) Bourdet derivative and its impact on pressure transient analysis. [5]



Total No. of Questions : 7]

SEAT No. :

P4897

[Total No. of Pages : 3

[5060]-881

M.E. (Petroleum Engineering)

ADVANCE WELL CONTROL

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Write any 5 questions out of 7 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) Well is shut in gas kick. After pressure stabilization, both the pressure are found to be rising 100 psi in every 10 min. calculate the gas migration rate. TVD = 11,000ft, Mud weight =12.3 ppg, SIDPP=350psi, Gas gradient = 0.115 psi/ft. **[4]**

b) Explain leak off test in detail. **[6]**

Q2) a) Discuss soft shut in procedure while drilling as per API RP 59. **[4]**

b) A well has been drilled to 11,000ft and pulling out was started for bit change. **[3]**

Mud density 10ppg What shall be the effect on bottom hole pressure after pulling out 10 stands (90ft each) of 5", ID 4.276"

Material displacement of 5" drill pipe = 0.0080 bbl/ft

9-5/8" casing shoe = 1,000ft, Casing capacity= 0.0717 bbl/ft, annular volume 5" x9-5/8" 0.0475 bbl/ft

c) Discuss wait and weight method in detail. **[3]**

Q3) a) Discuss any three unusual situations in well control. **[6]**

b) Discuss well control in multilateral wells. **[4]**

P.T.O.

- Q4) a)** A 18-3/4" subsea stack having two 5M annular preventers, 4 ram preventers and six fail safe valves, requiring 1.1 gallons fluid to open or close each valve. [5]

A 3000psi working pressure BOP control unit is used to operate BOP. 50% safety factor.

Annular preventer to close = 48.16 gallons,

Annular preventer to close = 37.61 gallons,

Ram preventer to close = 17.10 gallons,

Ram Preventer to open = 15.60 gallons

- b) Discuss snubbing operation in detail. [5]

- Q5) a)** Discuss volumetric method in detail. [5]

- b) Write short note on pressure test of BOP. [5]

- Q6) a)** Accumulator bottle capacity = 10 gallons [4]

Number of bottles = 20

Maximum operating pressure = 3000psi

Minimum operating pressure = 1200psi

Pre charge pressure = 1000psi

During BOP function the pressure on accumulator bottle bank drops from 3000psi to 1900psi. How many gallons of fluid did that function use?

- b) Write short note on i) Gas hydrate ii) MAASP [6]

Q7) Hole size = 8.5"

[10]

Hole TVD = 12,860ft

Casing 9-5/8" = 10,205ft

Drill pipe capacity = 0.0178 bbl/ft

HWDP = 558' long, capacity = 0.0088 bbl/ft

Drill collar = 722ft long, capacity 0.006 bbl/ft

Mud density = 16.8ppg

SCR = 600 psi at 30 spm

Mud pump out put = 0.107bbl/stroke

SIDP = 450psi, SICP = 680 psi

Calculate: Kill mud weight, ICP, FCP, Initial MAASP

Surface to bit stroke.



Total No. of Questions : 8]

SEAT No. :

P4898

[Total No. of Pages : 4

[5060]-891

M.E. (Polymer Engineering)

MATHEMATICAL AND STATISTICAL METHODS

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

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) Solve the following systems of equations using Gauss - seidel method.[5]

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

$$2x_1 + 20x_2 - 2x_3 = -44$$

$$-2x_1 + 3x_2 + 10x_3 = 22$$

b) Use Power method to determine the largest eigen value and the corresponding eigen vector of the following matrix A. [5]

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

choose initial vector $\bar{x} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

P.T.O.

Q2) a) Find Z transform of the following (any two) : [6]

i) $2^k + 3^k, k \geq 0$

ii) $e^{-ak} \sin bk, k \geq 0$

iii) $K5^k, k \geq 0$

b) Find inverse Z - transform of the following (any one) : [4]

i) $\frac{z^2}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{3}\right)}, \frac{1}{3} < |z| < \frac{1}{2}$

ii) $\frac{10z}{(z-1)(z-2)}$ using inversion integral method.

Q3) a) Solve the difference equation

$12f(k+2) - 7f(k+1) + f(k) = 0, k \geq 0$ given $f(0) = 0, f(1) = 3$. [5]

b) Evaluate $\int_{-1}^1 \sqrt{x+2}$ using Gauss quadrature three point formula. [5]

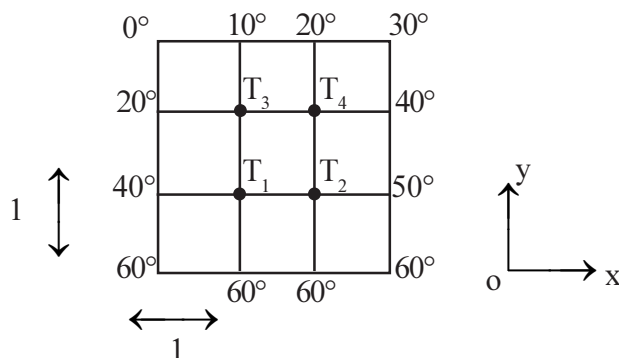
Q4) a) Use Runge, Kutla fourth order formulae to find y at $x = 0.4$.

Given $\frac{dy}{dx} = \frac{1}{(x+y)}, y(0) = 1, h = 0.2$ [5]

b) The steady state two dimensional heat flow in a metal plate is given by

$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$. Given the boundary conditions as shown in the

following figure, find temperatures T_1, T_2, T_3 and T_4 . [5]



Q5) a) Solve the boundary value problem using finite difference scheme : **[5]**

$$y'' - 64y + 10 = 0, y(0) = y(1) = 0, h = 0.2 .$$

b) Explain explicit finite difference scheme to solve one dimensional heat flow equation. Discuss the stability of the method. **[5]**

Q6) a) Find the extremal of $\int_0^1 \left[\left(\frac{dy}{dx} \right)^2 + 12xy \right] dx$ with $y(0) = 0, y(1) = 1$. **[5]**

b) Apply Galerkin's method to the boundary value problem to solve for y :

$$y'' - y + x = 0, (0 \leq x \leq 1), y(0) = y(1) = 0 . \text{ Assuming the approximate solution is } \bar{y}(x) = 4c x (1 - x) . \quad \mathbf{[5]}$$

Q7) a) Reduce the following matrix into tridiagonal form using Householder's method. **[5]**

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

b) Solve the following system of equations using LU Decomposition method: **[5]**

$$x_1 + 2x_2 + 3x_3 = 14$$

$$2x_1 + 3x_2 + 4x_3 = 20$$

$$3x_1 + 4x_2 + x_3 = 14$$

- Q8) a)** The demand for a particular spare part in a factory was found to vary from day to day. In a sample study the following information was obtained: **[5]**

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Number of parts demanded	1124	1125	1110	1120	1126	1115

Test the hypothesis that the number of parts demanded does not depend on the day of the week. Given $\chi_{5,0.05}^2 = 11.07$

- b) The mean life time of a sample of 100 light bulbs produced by a company is computed to be 1570 hrs. with a standard deviation of 120 hrs. The company claims that the average life of the bulbs produced by it is 1600 hrs. Using the level of significance of 0.05, is the claim acceptable? Use t-distribution.

Given at 0.05 level of significance, $t = 1.96$ **[5]**



Total No. of Questions : 8]

SEAT No. :

P4899

[Total No. of Pages : 2

[5060]-892

M.E. (Polymer Engineering) (Semester - I)

PRINCIPLES OF MANAGEMENT

(2013 Pattern) (Credit System)

Time : 3 Hours]

[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) Define functional organization. State its merits and demerits. [4]
b) Differentiate between administration and organization. [3]
c) What are the objectives of good plant layout? [3]
- Q2)** a) Explain time study and motion economy. [4]
b) Define manpower planning. Discuss its importance. [4]
c) Write any two definitions of management. [2]
- Q3)** a) Suppose total fixed cost is Rs.20,000 , product price Rs.7 and average variable cost is Rs.5. Calculate break even output. What is the “ average contribution margin”? [4]
b) Write a brief note on marketing mix. [4]
c) Define importance of employee training. [2]

P.T.O.

- Q4)** a) What is the role of R&D department in polymer industry? [4]
b) Write a note on deterministic and probabilistic model. [4]
c) Explain role of personnel manager. [2]
- Q5)** a) What is technology forecasting? [4]
b) Explain “Break Even Analysis”. [4]
c) Give the importance of product labeling and packing. [2]
- Q6)** a) What is process layout? Give its importance. [4]
b) Explain two handed process chart. [4]
c) What is industrial fatigue? [2]
- Q7)** a) A fixed asset having a useful life of 5 years is purchased on 1 January 2013. Cost of the asset is \$7,000 whereas its residual value is expected to be \$1,750. Calculate depreciation expense for the years ending 30 June 2013 and 30 June 2014. [5]
b) What is mean by inventory control? How it plays a role in operation research? [5]
- Q8)** a) Write notes on : (Any Two) [5]
i) Authority and responsibility
ii) Trade unions - Industrial relations
iii) Objectives of technological forecasting.
b) What is Product life cycle? Explain its significance. [5]



Total No. of Questions : 8]

SEAT No. :

P4900

[Total No. of Pages : 2

[5060]-893

M.E. (Polymer Engineering) (Semester - I)

ADVANCED POLYMER 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) Write a note on polybenzimidazoles. Give two examples of monomer pairs and their structures involved in its synthesis. **[5]**

b) What are hydrogels? Explain the structural requirements for a polymer to show hydrophilicity. **[5]**

Q2) a) Explain living cationic polymerization in detail. **[5]**

b) Write a note on polymers in lithography. **[5]**

Q3) Discuss ATRP and RAFT. Compare. **[10]**

Q4) a) Write a note on polymers from renewable resources. **[5]**

b) Write a note on acrylic rubber and give its synthesis and properties. **[5]**

P.T.O.

- Q5)** a) Explain the role of polymers as catalyst with suitable examples. [5]
b) What do you understand by polymer supported reactions? Explain with one example. [5]
- Q6)** a) Explain the concept of self-assembly with suitable examples. [5]
b) Write a note on photo-responsive polymers. [5]
- Q7)** a) Elaborate on crystalline melting temperature and glass transition temperature and its characterization. [5]
b) Explain metathesis polymerization. [5]
- Q8)** a) Write a note on fire and heat resistant polymers. [5]
b) Write a note on Flory-Huggin's equation and its significance. [5]



Total No. of Questions : 8]

SEAT No. :

P4901

[Total No. of Pages : 4

[5060]-894

M.E. (Polymer Engineering) (Semester - I)

RESEARCH METHODOLOGY

(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 Calculator is allowed.*
- 6) *Students are permitted to use standard statistical tables having normal distribution area, F-test data, χ^2 test data etc.*

- Q1)** a) Explain in detail with diagram different steps in “Research Methodology.” [6]
- b) What are different types of research? Give examples for each. [4]
- Q2)** a) What is inductive method and deductive method in research? Explain with flow chart. [4]
- b) Discuss the criteria for choice of topic of research. [3]
- c) Explain the importance of review of literature, different sources of literature. [3]
- Q3)** a) How to collect data and represent it in different forms. Which is best suited for engineering research. [4]
- b) How do you estimate mean deviation? Sum of squares between samples and sum of squares within sample? [3]
- c) What is degree of freedom? There are values grouped in 6 columns and 4 rows. What are the different degrees of freedom? [3]

P.T.O.

Q4) a) Explain how to carry out linear regression analysis using computer program. What is the significance of R^2 value. [4]

b) Explain the term covariance. Give examples with diagram for variants which are strongly covariant, negative covariant and not covariant. [3]

c)

X	2	4	6	8	10
Y	4.5	9.2	13.5	17.9	23.0

Estimate the covariance between X and Y values given in the above table. What does the covariance value indicate? [3]

Q5) a) Define ANOVA and one way and two way methods. Where do you use two way ANOVA. [3]

b) Set up the ANOVA table for following example. Four grades of UV stabilizer was used in HDPE and accelerated test UV test was carried out with the hours before failure given in the table below. From ANOVA, find if there is any significant change in the different grades of stabilizer. Use the critical Factor table for 5%. [7]

UV Stabilizer	Accelerated test hours				
1	1600	1610	1650	1680	1700
2	1580	1640	1640	1700	1750
3	1450	1550	1600	1620	1640
4	1510	1520	1530	1570	1600

Q6) a) Explain the different sections / formats in a project proposal. [4]

b) What are the agencies for submitting the project proposal? [3]

c) How do you estimate the budget for the proposed project? [3]

- Q7)** a) Write a note on different forms of reporting the research results. [4]
b) Explain the difference in journal publications, conference paper and short communication. [4]
c) Explain Impact Factor of a journal. [2]
- Q8)** a) Explain the term IPR. Which are different categories of IPR. [4]
b) Explain the different steps involved in obtaining patent. [4]
c) Explain the difference between Product patent and Process patent. [2]

$F_{\alpha; \nu_1, \nu_2}$

ν_2	Degrees of Freedom for the Numerator (ν_1)																			∞
	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120		
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3	
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50	
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53	
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63	
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36	
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67	
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23	
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93	
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71	
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54	
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40	
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30	
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21	
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13	
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07	
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01	
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96	
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92	
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88	
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84	
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81	
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78	
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76	
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73	
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71	
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69	
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67	
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65	
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64	
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62	
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51	
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39	
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.55	1.43	1.35	1.25	
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00	

Degrees of Freedom for the Denominator (ν_2)

Total No. of Questions : 8]

SEAT No. :

P4902

[Total No. of Pages : 2

[5060]-896

M.E. (Polymer Engineering)

POLYMER PROCESSING AND TESTING

(2013 Pattern) (Semester - II)

Time : 3 Hours]

[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) Explain the terms pressure flow, drag flow and leakage flow in extruder. Analyze the drag flow in a single screw extruder. [4]
- b) Write a note on residence time distribution in extrusion. [3]
- c) List the types of products made by the process of thermoforming. [3]
- Q2)** a) Write a detailed note on flood starve feeding during extrusion and its advantages and disadvantages. [5]
- b) Discuss the test method used for determination of flexural properties.[3]
- c) Explain the significance of studying barrier properties of plastic products. [2]
- Q3)** a) Write a note on dispersed melting model. [5]
- b) Write a note on pressure forming process variant of thermoforming with neat figures. [3]
- c) List various applications of reactive extrusion. [2]

P.T.O.

- Q4)** a) Explain the process of injection molding of thermosets in details. [4]
b) Discuss in details construction of positive and flash compression molds. [3]
c) Explain the calendaring process with neat sketches. [3]
- Q5)** a) Explain the terms dielectric constant, volume resistivity and surface resistivity, breakdown voltage and power factor. [4]
b) Write a detailed note on reaction injection molding. [3]
c) What is an extensometer? Explain the test method used for determining tensile strength and modulus. [3]
- Q6)** a) Discuss the complete line for sheet extrusion in details with neat figures.[5]
b) Explain the Charpy and Izod impact test methods in details. [3]
c) Explain the test method for determining accelerated ageing test for plastics. [2]
- Q7)** a) Explain the process of extrusion blow molding in details with neat figure. [5]
b) Explain the process of transfer molding in details with neat figures. [5]
- Q8)** a) Explain injection blow molding process in details with neat figures. [5]
b) Explain the ultrasonic test and acoustic emission test in details. [5]



Total No. of Questions : 8]

SEAT No. :

P5135

[Total No. of Pages : 2

[5060]-897

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 5 questions from total 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) Along with working principle of DSC, explain its applicability in finding out percent crystallinity of polymer. **[5]**

b) Explain in detail the Universal calibration curve and its relevance in GPC. **[5]**

Q2) a) Estimate the solubility parameter for LDPE with density 0.92 g/cc and molar. attraction constant for - CH₂ as 131.5 cal.cm³/mol. **[5]**

b) Write short note on Thermal degradation of polymers. **[5]**

Q3) a) With respect to molecular interaction in dilute polymer solutions, what is theta solution at Flory temperature? **[2]**

b) Explain the difference in the scratch resistance of LDPE, HDPE and PP. **[3]**

c) Discuss about Hilderbrand and Scott equation. Explain terms in it. **[5]**

Q4) a) "Polymeric solution properties change in very dilute, semi-dilute and concentrated solutions". Explain the statement. **[4]**

b) Derive an expression for dynamic creep compliance for a linear viscoelastic material using the kelvin - voigt model. **[6]**

P.T.O.

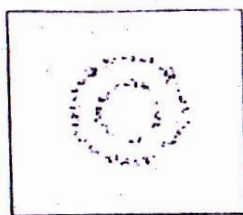
- Q5) a)** Write a short note on Dynamic Mechanical Analysis characterization technique. **[4]**
- b) Explain the peculiar properties of polymer solution. **[6]**

- Q6) a)** With suitable examples explain the terms conformation and configuration. **[4]**
- b) Estimate composition of the HDPE/PP blend using following DSC data. **[6]**

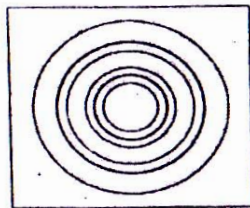
Peak Area (mj)	Transition temperature (°C)	Enthalpy of fusion, ΔH (J/g)
126	170	100 for PP
1663	130	18 for HDPE

- Q7) a)** Elaborate working principle of FTIR and NMR techniques. **[5]**
- b) Explain the following terms - Shear flow, Elongational flow, storage modulus, loss modulus, Dynamic Viscosity. **[5]**

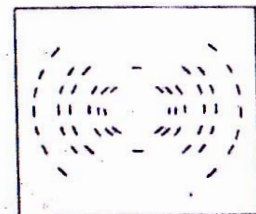
- Q8) a)** Following are the XRD patterns of polymers having different morphologies. Identify the morphological states and give at least one example of polymer or polymer product having these types of morphologies. **[5]**



(a)



(b)



(c)

- b) Write a short note on optical microscopy technique. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4903

[Total No. of Pages : 2

[5060]-898

M.E. (Polymer Engineering)

POLYMER STRUCTURE AND PROPERTIES

(2013 Pattern) (Semester - II)

Time : 3 Hours]

[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 is tacticity? Tacticity affects morphology of PP, and thereby, properties. Do agree with the statement? Justify your answer. **[6]**

b) With suitable examples explain the concept of Configuration and Conformation. **[4]**

Q2) a) With reference to PET and PBT, explain the effect of chain flexibility on thermal properties. **[4]**

b) Although glass transition temperature of PE is less than room temperature why is it not in rubbery state? **[3]**

c) Comment on the structural features which resist internal rotation. **[3]**

Q3) a) Comment on structural requirements for fiber forming polymers. **[5]**

b) Requirement of molecular weight is same for injection moulding and extrusion processes. Do you agree? Justify answer. **[5]**

P.T.O.

- Q4)** a) What are fibrillar crystals and globular crystals? Explain mechanism of spherulite formation in polymer. [4]
- b) With respect to injection moulding process explain how processing parameters affects properties. [6]
- Q5)** a) Explain how polymer chain orientation plays an important role in fiber field. [4]
- b) Comment on effect of molecular level factors on different transitions in polymers. [6]
- Q6)** a) Enlist various types of carbon nano-tubes. Explain their effect on various properties. [6]
- b) Write a short note on hyperbranched polymers. [4]
- Q7)** a) Explain how various chemical groups affect adhesion properties. [5]
- b) Discuss about molecular structure requirement for processing by rotational moulding technique. [5]
- Q8)** a) Elaborate the role of various additives in defining polymer properties. [6]
- b) Write a short note on dendrimers and their applications. [4]



Total No. of Questions : 8]

SEAT No. :

P4904

[Total No. of Pages : 2

[5060]-900

M.E. (Polymer Engineering)

POLYMER RHEOLOGY

(2013 Pattern)

Time : 3 Hours]

[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) Explain the construction and working of a capillary rheometer. **[5]**

b) Discuss dynamic rheological experiments in details. Explain the terms storage modulus, loss modulus and loss tangent. **[5]**

Q2) a) Derive an expression relating apparent viscosity to the geometry of a cone and plate rheometer. **[5]**

b) Discuss Ellis model in details. **[5]**

Q3) a) Write a detailed note on WLF equation. **[5]**

b) Derive an expression for velocity profile and shear rate at wall for a laminar fluid through a circular cross section. **[5]**

Q4) a) Discuss Doi-Edwards theory of molecular relaxation in details. **[5]**

b) Discuss poisson's ratio, elastic modulus, bulk modulus and shear modulus in details. **[3]**

c) What are Bingham fluids? **[2]**

P.T.O.

- Q5)** a) Discuss dilatant and pseudoplastic fluids in details. [4]
b) Discuss the effect of molecular weight. [3]
c) Discuss the effect of molecular weight distribution on polymer melt rheology. [3]
- Q6)** a) Analyze creep and stress relaxation behavior of viscoelastic materials using Maxwell model. [5]
b) Discuss thixotropic and rheopectic fluids with examples. [5]
- Q7)** a) Derive an expression for velocity profile and shear rate at wall for a power law fluid through a rectangular cross section. [4]
b) Explain the term normal stress. [3]
c) Discuss the phenomena attributed to second normal stress difference.[3]
- Q8)** a) Discuss the effect of plasticizers on polymer melt rheology. [3]
b) Discuss the effect of fillers on polymer melt rheology. [3]
c) Discuss time-temperature superposition in details. [4]



Total No. of Questions : 8]

SEAT No. :

P4905

[Total No. of Pages : 2

[5060]-900-A

M.E. (Polymer)

TRANSPORT PHENOMENON IN POLYMERS

(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) *Assume Suitable data if necessary.*

Q1) a) Explain the application of transport phenomena in polymers with suitable example. **[5]**

b) Explain strain tensors. **[5]**

Q2) a) Draw shear stress-strain diagram for polymer solution. Explain different rheological regions. **[5]**

b) Derive the necessary expression for velocity profile of two immiscible polymeric fluids. **[5]**

Q3) a) Explain in detail with expression the heat conduction with viscous heat source. **[5]**

b) Explain with neat diagram the diffusion in stagnant gas film. **[5]**

Q4) a) Explain the permeation through polymers. **[5]**

b) Explain the design factors for multistage tray tower. **[5]**

P.T.O.

- Q5)** a) Derive the stress distribution equation for flow through an annulus cylinder. [5]
b) Explain the importance of heat and mass transfer in polymeric fluids. [5]
- Q6)** a) Explain the temperature distribution in rectangular cooling fin. [5]
b) Explain in short about Polymeric Membranes. [5]
- Q7)** a) Explain the term RTD in mixing. [5]
b) Explain the extraction with reflux equipment. [5]
- Q8)** a) A polymeric fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at pipe wall is 210 N/m^2 . Find Pressure gradient and average velocity. [5]
b) Write a short note on Ion-Exchange resins. [5]



Total No. of Questions : 5]

SEAT No. :

P4906

[Total No. of Pages : 2

[5060]-901

M.E. (Printing Engineering Graphics Communication)
PROBABILITY, STATISTICS AND REGRESSION ANALYSIS
(2013 Pattern)

Time : 3 Hours]

[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.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Use of electronic pocket calculator is allowed.*

Q1) A random variable X has the following probability distribution. **[10]**

X	-2	-1	0	1	2	3
F(x)	0.1	K	0.2	2k	0.3	3k

Find

- i) value of K
- ii) Evaluate $P(X < 2)$ and $P(-2 < X < 2)$
- iii) Find the cumulative distribution of X
- iv) Evaluate the mean of X

Q2) A box contains 5 red and 4 white balls. Two balls are drawn successively from the box without replacement and it is noted that the second one is white. What is the probability that the first is also white? **[10]**

Q3) Write Short Note on **[10]**

- i) Quality
- ii) X bar Chart
- iii) U chart
- iv) C Chart
- v) P Chart

P.T.O.

Q4) The monthly demand for Allwyn watches is known to have the following probability distribution. **[10]**

Demand	1	2	3	4	5	6	7	8
Probability	0.08	0.12	0.19	0.24	0.16	0.10	0.07	0.04

Determine the expected demand for watches. Also compute the variance.

Q5) Explain about Planning an experiment with flow chart. **[10]**



Total No. of Questions : 6]

SEAT No. :

P4907

[Total No. of Pages : 2

[5060]-902

M.E. (Printing) (Semester - I)

PRINTING TECHNOLOGY MANAGEMENT

(2013 Pattern)

Time : 3 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 production model structure for a newspaper printing business in terms of production, supply and service. **[9]**

b) Explain different types of packaging products where outsourcing of specific costly operations need to be done. **[9]**

OR

Q2) Explain with help of flowchart process for shopfloor management for a CTP. **[18]**

Q3) a) What is the need for a Quality Program for any organization. **[8]**

b) Describe a continuous quality improvement plan for a newspaper production system. **[8]**

OR

Q4) Explain activities of a quality assurance department in flexo plate making section. **[16]**

P.T.O.

Q5) Explain following :

[16]

- a) Quality costs
- b) Failure costs

OR

Q6) Differentiate between chance variation and assignable cause variation. Explain with example for production by offset process. **[16]**



Total No. of Questions : 3]

SEAT No. :

P4908

[Total No. of Pages : 1

[5060]-903

M.E. (Printing Engineering & Graphic Communication)

MODERN TRENDS IN PRINTING

(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 in detail different unit configurations of a gravure press. **[18]**

OR

Explain in detail unit configuration of offset press.

OR

Explain in detail flexo plate parameters.

OR

Explain the parameters that affect flexo printability.

Q2) Explain the working of Shaft-less technology for a web press. **[16]**

OR

Explain the effect of impression roller hardness on printability.

Q3) Mention the care and maintenance for offset plates. **[16]**

OR

Explain the effect of moisture on ink.



Total No. of Questions : 5]

SEAT No. :

P4909

[Total No. of Pages : 1

[5060]-904
M.E. (Printing Engineering)
RESEARCH METHODOLOGY
(2013 Pattern)

Time : 3 Hours]

[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.*
- 4) Neat diagrams must be drawn wherever necessary.*
- 5) Use of electronic pocket calculator is allowed.*

Q1) Explain in details the types of research. **[10]**

Q2) Write the comparison Between Research methodology and research methods. **[10]**

Q3) Write Short Note on : **[10]**

- i) Research Problem
- ii) Motivation in research

Q4) Explain hypothesis in details. State the qualities of good hypothesis. **[10]**

Q5) State the significance of research. **[10]**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :1

P5086

[5060]-906

M.E. (Printing)

COLOR SCIENCE

(2013 Course) (End Semester) (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.*

Q1) Explain the following with neat diagrams: **[10]**
Image formation by eye.

OR

Q2) What is simultaneous contrast and retinal image? Explain. **[10]**

Q3) What chromatic aberration of the eye? Explain. **[8]**

OR

Q4) Compare and contrast between perceptibility and acceptability. **[8]**

Q5) Describe color matching functions of normal trichromates. **[16]**

OR

Q6) What is metamerism; explain in greater details. **[16]**

Q7) What are the types of ICC profiles. **[16]**

OR

Q8) Explain the concept of color due to molecules in details. **[16]**



Total No. of Questions : 3]

SEAT No. :

P4910

[Total No. of Pages : 1

[5060]-907

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 right indicate full marks.*

Q1) Explain in detail stroboscope system used on a web press. **[18]**

OR

Explain the corona treatment required on the substrate.

OR

Explain in detail circumferential registration control system for a press.

OR

Explain the role of load cells on a web press.

Q2) Explain in detail edge guiding system for a press. **[16]**

OR

Explain in detail balancing of rollers.

Q3) Explain the importance of transport rollers on a web press. **[16]**

OR

Explain the importance of lead-in and lead-out rollers.



Total No. of Questions : 5]

P4911

SEAT No. :

[Total No. of Pages : 1

[5060]-908

M.E. (Printing Engineering)

SUBSTRATE & INK

(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) How would you improve print transfer on polymeric substrates? **[10]**

Q2) What is surface energy? State methods of surface energy measurement. **[10]**

Q3) Comment on substrate physical and surface properties and their impact on print quality. **[10]**

Q4) Comment on printing ink formulation for Gravure and Flexographic printing process. **[10]**

Q5) Explain the term 'Viscosity' and its importance in printing. Also explain any one method of determining the printing ink viscosity in detail. **[10]**



Total No. of Questions : 3]

SEAT No. :

P5087

[5060]-910

[Total No. of Pages : 1

M.E.(Printing Engineering and Graphic Communication)

PRINTED ELECTRONICS AND RFID

(2013 Course) (Semester-III) (608101)

Time :3Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Neat diagram must be drawn wherever necessary.*
- 2) Assume suitable data wherever necessary.*
- 3) Figures on right indicate marks.*

Q1) a) Comment on Printed electronics and its scope in near future? [6]

b) Discuss functional inks and substrates for use in printed electronics. [6]

c) What are the traditional methods for electronics manufacturing? Explain one of them in detail. [6]

Q2) Explain in detail RFID working. Why RFID will replace barcodes in supply chain? [16]

Q3) Discuss various applications of Printed Electronics. [16]



Total No. of Questions : 3]

SEAT No. :

P4912

[Total No. of Pages : 1

[5060]-911

M.E. (Printing Engineering & Graphic Communication)

ADVANCES IN CONVERTING AND PACKAGING

(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) State the security features in packaging. **[18]**

OR

Explain the converting process for a product. **[18]**

OR

Explain in detail varnishing process. **[18]**

OR

Explain in detail wet lamination technique. **[18]**

Q2) Explain the wrapping techniques used in packaging. **[16]**

OR

Explain in detail Bag- in - Box for liquid products. **[16]**

Q3) Explain in detail aseptic packaging. **[16]**

OR

Explain in detail boil-in - bag packaging. **[16]**



Total No. of Questions : 8]

SEAT No. :

P4913

[Total No. of Pages : 2

[5060]-921

**M.E. (Production) (CAD/CAM)
COMPUTERAIDED DESIGN
(2013 Pattern)**

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 Grover's Model of Product life Cycle for Selection of CAD/CAM. **[5]**

OR

Q2) Discuss applications of computers for design. **[5]**

Q3) What is Homogeneous Co-ordinate system? Explain the necessity of Homogeneous co-ordinate system for transformation of geometric entities using suitable examples. **[5]**

OR

Q4) 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]**

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 is Z-buffer algorithm for B-REP and CSG model? [8]
b) What sweep representation scheme used for representation of a solid? [7]

Q8) Write short note on any three: [18]

- a) Parametric programming
- b) Virtual Realism
- c) Shading algorithms
- d) Feature based segmentation



Total No. of Questions : 6]

SEAT No :

P5088

[5060]-922

[Total No. of Pages : 1

**M.E.(Production) (CAD/CAM)
COMPUTERAIDED MANUFACTURING
(2013 Pattern) (511302) (Semester - I)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer Q1 or Q2; Q3 or Q4; and Q5 & Q6 are compulsory.*
- 2) *Assume suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Differentiate NC and CNC machine tools. [5]

b) Explain concept of virtual machining. [5]

OR

Q2) What do you mean Offset? Explain Wear & Geometrical Offset. [10]

Q3) a) Explain CNC-CMM module in detail. [5]

b) Explain working principle of automatic press with block diagram. [5]

OR

Q4) a) Explain various equipment's used in automated material handling. [5]

b) Explain use of robot in ASRS system. [5]

Q5) a) Write short note on automatic identification. [7]

b) Explain contact and non-contact method of inspection. [8]

Q6) a) What is digital manufacturing? [8]

b) What is impact of automated factory on society? [7]

☆ ☆ ☆

Total No. of Questions : 6]

SEAT No. :

P4914

[Total No. of Pages : 2

[5060]-923

M.E. (Production) (CAD/CAM)
ADVANCED MATHEMATICS AND STATISTICS
(2013 Pattern) (Semester - I)

Time : 3 Hours]

[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) Reduce the quadratic from $x^2 + 3y^2 + 3z^2 - 2yz$ to the canonical form by an orthogonal reduction and discuss its nature. Write also rank. **[8]**

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. **[8]**

OR

Q2) a) Prove that $A = \frac{1}{2} \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$ is a unitary matrix. **[8]**

b) Solve the boundary value problem $y'' - xy' + e^x y = 4$ ($0 \leq x \leq 1$), $y(0) = 1$, $y'(0) = 4$ by Galerkin's method. Compare your solution with the exact solution. **[8]**

Q3) a) Solve by the method of laplace transform the equation $y''(t) + y(t) = \sin 3t$ with $y(0) = y'(0) = 0$. **[5]**

b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for, **[8]**

$0 < x < 1, 0 < y < 1$, given that

$$u(x, \infty) = u(0, y) = u(1, y) = 0, u(x, 0) = x(1-x)$$

c) Solve the integral equation: **[4]**

$$\int_0^\infty f(x) \sin \lambda x dx = \begin{cases} 1 - \lambda, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases}$$

P.T.O.

OR

Q4) a) Solve $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ [8]

i) $u(x,t)$ is finite,

ii) $u(0,t) = 0$,

iii) $u(l,t) = 0$,

iv) $u(x,0) = u_0$. $0 < x < l$

b) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ [5]

c) Apply convolution theorem to evaluate. [4]

$$L^{-1} \left\{ \frac{1}{(s+1)(s^2+1)} \right\}$$

Q5) a) For a chi-square distribution with n.d.f. establish the following recurrence relation between the moments.

$$\mu_{r+1} = 2r(\mu_r + n\mu_{r-1}), r \geq 1. \text{ Hence find } \beta_1 \text{ \& } \beta_2. \quad [9]$$

b) Discuss the state variable model and its advantages over differential equation model. [8]

OR

Q6) 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 $p[|x-2| < 2]$. [9]

b) Describe in brief types of simulation approaches. [8]



Total No. of Questions : 6]

SEAT No. :

P5089

[5060]-924

[Total No. of Pages : 1

M.E. (Production) (CAD/CAM)
Design of Experiments & Research Methodology
(2013 Pattern) (Semester - I) (511304)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer Q1 OR Q2, Q3 OR Q4, and Q5 & Q6 are compulsory.*
- 2) *Assume suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Explain various types of research proposals. **[5]**

b) Briefly describe the different steps involved in a research process. **[5]**

OR

Q2) Explain following in brief: **[10]**

a) Group problem solving techniques.

b) Creative problem solving process.

Q3) a) Explain classification of research models. **[5]**

b) Explain process of formulation of model based on simulation. **[5]**

OR

Q4) Write short notes on: **[10]**

a) Guidelines for designing experiments.

b) Errors in Experiments.

Q5) a) What do you mean by process optimization? Explain it in brief. **[8]**

b) Explain two factor factorial design. **[7]**

Q6) Write short notes on: **[15]**

a) Format for report writing.

b) Oral presentation.

c) Non parametric tests.



Total No. of Questions : 8]

SEAT No. :

P4915

[Total No. of Pages : 2

[5060]-926

**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 components of PLM software? Explain. **[5]**

OR

Q2) What are the different levels of Integration against evolution of CIM? Explain. **[5]**

Q3) What are the benefits of GT to the manufacturing industry? **[5]**

OR

Q4) What is a relational database? Describe the architecture of database management system. **[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 communication interfaces used in computer-to computer communication? Explain in brief. What are the commonly used interface cards? **[8]**

b) What are the components of small local area network in CIM setup? Explain. **[7]**

P.T.O.

Q8) Write short note on any three:

[18]

- a) ASRS
- b) Data associated with FMC
- c) ESPRIT - CIM OSA model
- d) GKS implementation in a CAD workstation.



Total No. of Questions : 6]

SEAT No. :

P4916

[Total No. of Pages : 3

[5060]-927

M.E. (Production) (CAD/CAM Engineering)
FINITE ELEMENT ANALYSIS
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. 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 principle of minimum potential energy? [5]
b) Discuss shape function. State the convergence requirement of shape function. [5]

OR

- Q2)** a) State the significance of node numbering on the assembled stiffness matrix? [5]
b) Explain the properties banded or skyline matrix. [5]
- Q3)** a) Derive expression for elemental stiffness matrix for 3-noded 2-D bar elements. [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 $E = 150\text{GPa}$. [6]

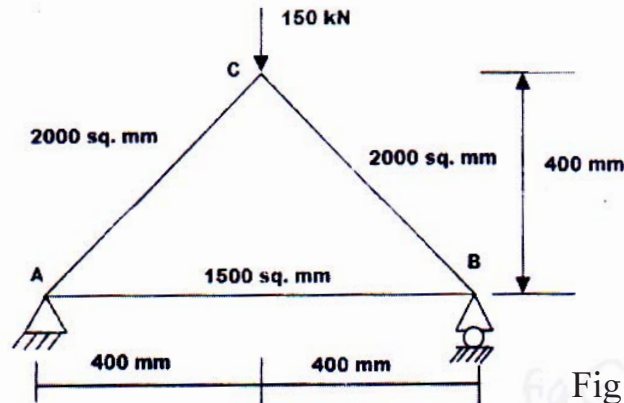
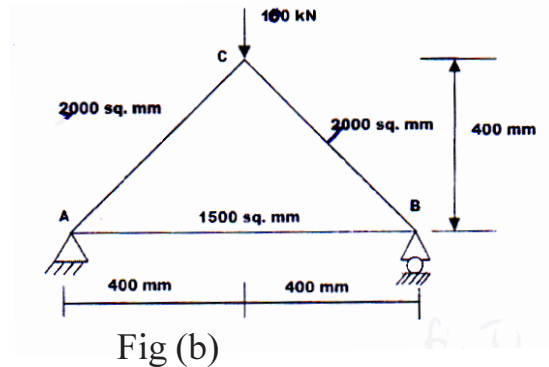


Fig (a)

P.T.O.

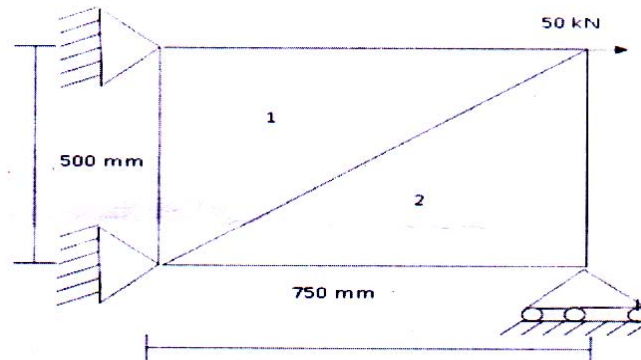
- Q4) a)** For the three-bar truss shown in figure below. Determine the nodal displacement and stress in each member. Find the support reactions also. Take $E = 150\text{GPa}$. [6]



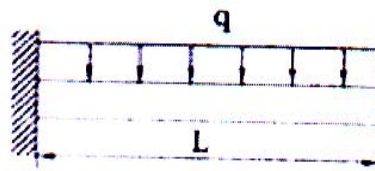
OR

- b) Using natural coordinate system, derive expression for elemental stiffness matrix for 2-D bar element. [4]

- Q5) a)** Find the nodal displacements and element stresses in the propped beam shown in figure below. Idealize the beam into two CST elements as shown in figure. Assume plane strain condition. Take $\mu = 0.26$, $E = 1.5 \times 10^5 \text{ N/mm}^2$, thickness = 10mm. [8]



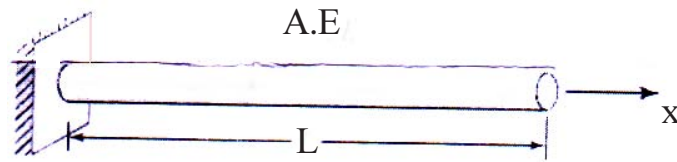
- b) Using Rayleigh-Ritz method, determine the expression for deformation of cantilever beam subjected UDL. Take $E =$ modulus of Elasticity, $I =$ moment of area. [7]



Q6) a) Derive expression for load vector for frame element. [8]

b) Explain Hamilton's principle along with derivation for equilibrium. [7]

Using two equal length finite elements, determine the natural circular frequencies of the solid circular shaft fixed at end as shown in figure below.



Total No. of Questions : 6]

SEAT No. :

P4917

[Total No. of Pages : 2

[5060]-928

**M.E. (Production) (CAD/CAM)
OPTIMIZATION TECHNIQUES
(2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 & Q6 are compulsory.*
- 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) State and explain the various methods available for solving a multivariable optimization problem with equality constraints. **[5]**

b) Explain single variable & multivariable optimization techniques. **[5]**

OR

Q2) a) Find the value of X in the interval (0, 1) which minimizes the function $F = X(X-1.5)$ to within 0.05 by Fibonacci method. **[6]**

b) Explain steps for golden section method for one dimensional minimization problem. **[4]**

Q3) Write short note on any two: **[10]**

a) Simplex search method.

b) Pattern search method.

c) Newton's method.

OR

Q4) a) What is the difference between the interior and extended interior penalty function method? **[6]**

b) What is exterior penalty? Explain it with suitable example. **[4]**

P.T.O.

Q5) Write short note on any two

[15]

- a) Genetic Algorithm.
- b) Artificial Neural Network.
- c) Simulated Annealing.

Q6) a) Explain nine principles of OPT.

[8]

b) Discuss five focusing steps of TOC.

[7]



Total No. of Questions : 6]

SEAT No. :

P4918

[Total No. of Pages : 2

[5060]-930

M.E. (Production Engineering) (CAD/CAM)

ADVANCED STRESS ANALYSIS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Question no. 5 & 6 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 and non-programmable electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) Define an octahedral plane. Write an expression of normal shear component of stress tensor on this plane. **[10]**

OR

Q2) 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) Explain with sketch an experimental stress analysis using Brittle coat method. **[10]**

OR

Q4) 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. **[10]**

$$\sigma_x + \sigma_y = 2(\gamma(z) + \overline{\gamma(z)}) = 2(A + \bar{A}) + 4\text{Re} A = 4A_R$$

$$\sigma_y - \sigma_x = 2i\tau_{xy} = 2(\bar{z}\gamma''(z) + \psi'(z)) = 2B = 2(B_R + iB_I)$$

P.T.O.

- Q5)** a) Explain how conformal mapping provides a convenient means to find elasticity solutions to interior and exterior problems of complex shape. **[10]**
b) Write note on brittle coat method. **[5]**
- Q6)** a) 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.
b) Write note on fatigue crack initiation and propagation. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4919

[Total No. of Pages : 2

[5060]-931

**M.E. (Production) (CAD/CAM)
COMPUTER AIDED PRODUCTION PLANNING
(2013 Pattern)**

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 different measures of forecast errors. **[5]**
OR

Q2) Explain ALDEP use in facility planning. **[5]**

Q3) Discuss use of quadratic assignment model adding new machines to existing facility. **[5]**
OR

Q4) Discuss GT benefits and limitations. **[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		
	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) Software for ERP
- b) CDS algorithm for sequencing
- c) Random number generation
- d) MRPII
- e) Gantt chart



Total No. of Questions : 8]

SEAT No. :

P4920

[Total No. of Pages : 3

[5060]-933

M.E. (Production) (Manufacturing and Automation) (Semester - I)

MATHEMATICS AND STATISTICS

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any 5 questions out of 8 questions.*
- 2) *Neat diagrams should be drawn whenever necessary.*
- 3) *Figures to the right 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) a) Show that the function $w = \log z$ is analytic, also find it's derivative. [5]

b) Evaluate, $\int_C \frac{z^2 + z + 1}{z^2 - 7z + 12} dz$ where C is the ellipse $4x^2 + 9y^2 = 1$ $|z|=3$. [3]

c) State cauchy's Residue theorem. [2]

Q2) a) Using variational method find the plane curve of fixed perimeter and maximum area. [5]

b) Find the extremals of functional. $\int_{x_0}^{x_1} \frac{y'}{x^3} dx$ [3]

c) State the Lagrange's equation in generalized co-ordinates. [2]

Q3) a) Explain the standard 5-point formula to solve the Laplace equation. [3]

$$\nabla^2 u = 0$$

b) Write-down the General second order partial differential equation. in two independent variables and then classify it. [2]

c) Find the solution of parabolic equation $u_{xx} = 2u_t$ when [5]

$$u(0,t) = u(4,t) = 0$$

$u(x,0) = x(4-x)$ taking $h=1$. compute the values to 5 levels.

P.T.O.

Q4) a) IF $P_n(x)$ is a legendre polynomial of first kind prove that. [4]

$$(2n+1)P_n(x) = P'_{n+1}(x) - P'_{n-1}(x)$$

b) By using series expression for $J_n(x)$ prove that [4]

$$J_{5/2}(x) = \sqrt{\frac{2}{\pi x}} \left\{ \frac{3-x^2}{x^2} \sin x - \frac{3}{x} \cos x \right\}$$

c) State Rodriguez's formula and prove that. [2]

$$P_2(x) = \frac{1}{2}(3x^2 - 1)$$

Q5) a) The following table gives the number of accidents that took place in an industry during various days of a particular week. [5]

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
No. of Accidents	4	9	7	8	10	12	6

Test if the accidents are uniformly distributed over the week.

Given χ^2 at 5% level for 5 degree of freedom. is 11.07

b) An I.Q. test was administered to 5 persons before and after they were trained.

The results are given below. [5]

	I	II	III	IV	V
I Q before training	110	120	123	132	125
I Q after training	120	118	125	136	121

Test whether there is a change in I.Q. after the training programme.

[use 1% level of significance]. Given $t_{0.005,4} = 4.604$

Q6) a) Consider the transformation. [4]

$W = e^z$ determine the region in the w-plane corresponding to the region parallel to the coordinate axis in the z-plane.

b) Find the moment generating function of the exponential distribution. [4]

$$f(x) = \frac{1}{c} e^{-\frac{x}{c}}, 0 \leq x < \infty, c > 0.$$

c) Define a stochastic process. [2]

Q7) a) Fit a poisson distribution to the set of observations: **[5]**

x:	0	1	2	3	4
f:	57	41	28	8	1

b) Prove that the following function.

$$u = y^3 - 3x^2y \text{ is harmonic.}$$

Also find the conjugate function v and corresponding analytic function $u+iv$. **[5]**

Q8) a) In sampling a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2. out of 1000 such samples, how many would be expected to contain at least 3 defective parts. **[5]**

b) Find the mean recurrence time for each state of the following Markov chain. **[5]**

$$P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.5 & 0.4 \end{bmatrix}$$



Total No. of Questions : 8]

SEAT No. :

P4921

[Total No. of Pages : 3

[5060]-934

M.E. (Production -Manufacturing & Automation)

INDUSTRIAL AUTOMATION

(2013 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

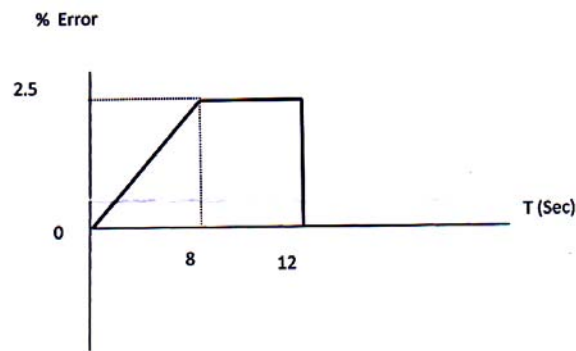
- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Explain with neat sketch principal of working of proportional flow control valve. **[4]**
- b) For a meter in hydraulic circuit, calculate the pump pressure required to achieve 40 bar pressure at full bore end of cylinder if the pressure loss across various elements is as below: Flow control valve =15 bar, direction control valve (both side) = 3bar, filter = 5 bar. **[4]**
- c) List two examples of positive displacement and non-positive displacement pump each. **[2]**
- Q2)** a) In a certain process, pneumatic cylinder A is used to operate furnace door and cylinder B is used to push part into furnace. Draw suitable pneumatic circuit to operate following sequence: **[4]**
- i) Retract cylinder A to open door of furnace
 - ii) Extend cylinder B to push part into furnace
 - iii) Retract cylinder B
- b) Draw a pneumatic circuit to operate following expression: $y = (a.b) + (\bar{b}.c)$ **[4]**
- c) What is difference between position step diagram and travel time diagram used for pneumatic circuit design? **[2]**

P.T.O.

Q3) a) Write a program segment to input 25 bytes of data from input port DATA and store them in a memory starting from address BUF. Use DO-WHILE structure. **[4]**

b) A PI controller has $K_p = 6, K_i = 2s^{-1}$. The controller output for no error $P(0) = 25\%$. Plot the controller output as a function of time for an error given by Figure shown below. K_p and K_i are proportional gain and integral gain respectively. **[4]**



c) Draw a ladder diagram to actuate a motor control relay. When the motor is 'ON' a red lamp glows and when the motor is 'OFF' green lamp glows. **[2]**

Q4) Write short notes on:

- a) Open and close loop control system. **[5]**
- b) Time delay valve in pneumatic system. **[5]**

Q5) a) A feeder-selector device at one of the stations of an automated assembly machine has a feed rate of 30 parts per minute and provides a throughput of one part in four. The ideal cycle time of the assembly machine is 20 sec. The low level sensor on the feed track is set at 10 parts, and the high level sensor is set at 32 parts. **[4]**

- i) How long will it take for the supply of parts to be depleted from the high level sensor to the low level sensor once the feeder-selector device is turned off?
- ii) How long will it take for the parts to be resupplied from the low level sensor to the high level sensor, on average, after the feeder-selector device is turned on?
- b) Differentiate between Single- and Dual-command Cycle Times for unit load AS/RS. **[4]**
- c) Write formula to calculate efficiency of a material handling system. **[2]**

- Q6)** a) Explain robot technology applications in press working. [4]
b) A single link robot with rotary joint is motionless at 25° . It is desired to move the joint in a smooth manner to 60° in 2.5 seconds. Determine the coefficients of a cubic polynomial that accomplishes this motion and brings the manipulator to rest at goal. [4]
c) What is redundant manipulator? What are its applications? [2]
- Q7)** a) What is need of modeling of manufacturing system? [4]
b) Explain use of artificial intelligence techniques in automated manufacturing systems. [4]
c) What is significance of hidden layer in neural network? [2]
- Q8)** Write short notes on:
- a) Vision guided AGV's. [5]
b) Transfer mechanisms. [5]



Total No. of Questions : 8]

SEAT No. :

P4922

[Total No. of Pages : 2

[5060]-935

M.E. (Production Engineering) (Manufacturing & Automation)

ADVANCED MANUFACTURING PROCESSES

(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 electronic pocket calculator and logarithmic tables is allowed.*
- 5) *Assume Suitable data, if necessary*

- Q1)** a) How mechanism of melting and solidification of pure metals differs than alloys. **[4]**
- b) How simulations of mold filling help to improve performance casting process? **[4]**
- c) Which features of non-conventional machining processes attract to use them? **[2]**
- Q2)** a) How Laser Beam machining (LBM) take place? **[4]**
- b) What do you mean by non-destructive testing of weld joints. **[4]**
- c) Which thermal defects in casting must be reduced? **[2]**
- Q3)** a) How Electro Chemical machining (ECM) differs from Chemical machining (CM). **[4]**
- b) What are the causes and remedies related to mould filling sand casting defects? **[4]**
- c) How destructive testing of welds differ from non-destructive testing. **[2]**

P.T.O.

- Q4)** a) Which are the advantages and limitations of Electro discharge Machining. [5]
b) Explain various welding defects with their causes and remedies. [5]
- Q5)** a) A rod of 10 mm diameter is to be reduced to wire of 4 mm diameter. The die angle is 10° and the coefficient of friction at dies and wire interface is 0.5. The flow stress of wire material is 340 N/mm^2 . Determine drawing stress and drawing load if the drawing speed is 0.7 m/s. [4]
b) Explain important steps in sheet metal stretch forming with neat sketch. [4]
c) Classify the high energy rate forming (HERF) processes. [2]
- Q6)** a) What do you mean by super plasticity? How super plastic forming (SPF) process work. [4]
b) What do you mean by electromagnetic forming. [4]
c) Differentiate between hot forging and cold forging. [2]
- Q7)** a) Explain important process parameters of explosive forming process. [4]
b) A tube of 25 mm external diameter and 2 mm thickness is to be reduced to 20 mm external diameter and 1 mm thickness. The die angle is 24° and plug angle is 16° . 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 N/mm^2 . The tube drawing is carried at a speed of 0.4 m/s. Calculate the fixed plug. [4]
c) What is high speed blanking? [2]
- Q8)** a) Which are the various strategies to reduce roll force? [5]
b) What is the use of forming limit diagram? [5]



Total No. of Questions : 8]

SEAT No. :

P4923

[Total No. of Pages : 3

[5060]-936

M.E. (Production- Manufacturing & Automation)

RESEARCH METHODOLOGY

(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) Explain quantitative verses qualitative research. [4]
b) Explain significance of research. [4]
c) Draw flow chart of research process. [2]

- Q2)** a) Explain basic principles of experimental design. [4]
b) The effect of four factors A, B, C, and D (three level each) on response R (three trial runs for each experiment) for 9 experiments is shown in Table. [4]

Determine the factor having maximum effect on the response R.

Experiment Number	A	B	C	D	R		
					Trial 1	Trial 2	Trial 3
1	1	1	1	1	87.3	82.3	70.7
2	1	2	2	2	74.8	70.7	63.2
3	1	3	3	3	56.5	54.9	45.7
4	2	1	2	3	79.8	78.2	62.3
5	2	2	3	1	77.3	76.5	54.9
6	2	3	1	2	89	87.3	83.2
7	3	1	3	2	64.8	62.3	55.7
8	3	2	2	3	99	93.2	87.3
9	3	3	1	1	75.7	74	63.2

- c) Define the terms with respect to respect design: [2]
i) Control
ii) Treatment

P.T.O.

- Q3)** a) Explain case study method for qualitative analysis of data. [4]
 b) Explain factors affecting selection of appropriate method of data collection. [4]
 c) Write note on: Depth interviews [2]

- Q4)** a) Write short notes on: [10]
 i) Taguchi quality loss function
 ii) Research objectives.

- Q5)** a) Determine the size of the sample for estimating the true weight of the castings having population size of 6000. The variance of the weight is 5Kg and the estimate should be within 0.8 Kg of the true average weight with 96% probability. The areas under standard normal curve are as shown in Table. Assume linear interpolation for values in between. [4]

Z	0.5	1	1.5	2	2.5	3
Area under Curve	0.1915	0.3413	0.4332	0.4772	0.4938	0.4987

- b) For the following data, determine the correlation coefficient between factors x_1 and x_2 [4]

x_1	2	4	3	1	5
x_2	10	8	7	6	12

- c) Write note on: Use of statistical methods in research. [2]

- Q6)** a) Explain the steps of Graph theory and matrix approach for multi-criteria decision making [4]
 b) Determine the weights of the four criteria for which matrix of relative importance 'A' shown below: [4]

$$A = \begin{bmatrix} 1 & 1 & 0.5 & 2 \\ 1 & 1 & 4 & 0.333 \\ 2 & 0.25 & 1 & 2 \\ 0.5 & 3 & 0.5 & 1 \end{bmatrix}$$

- c) What is significance of mutation operator in genetic algorithm? [2]

- Q7)** a) Discuss the general outline of a technical report. [4]
b) Explain the techniques and importance of oral presentation of a research findings. [4]
c) What is significance of writing research report? [2]

- Q8)** Write short notes on: [10]
a) Simulated annealing
b) Tournament selection method in genetic algorithm



Total No. of Questions : 8]

SEAT No. :

P4924

[Total No. of Pages : 2

[5060]-938

**M.E. (Production- Manufacturing & Automation)
COMPUTER INTEGRATED MANUFACTURING
(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) Find the condition that a cubic Bezier curve degenerates to a straight line connecting P_0 and P_3 . [4]
- b) Find the minimum distance between a point in space and a plane surface. [4]
- c) What are the practical applications of B - spline and Bezier curves? [2]

- Q2)** a) Explain the meaning of the following statements in APT

P1 = POINT/3.0,2.0,-1.0

P2 = POINT/6.0,5.0,3.0

LI = LINE/P1, P2

C1 = CIRCLE/CENTER, P1, RADIUS, 1.5 [4]

- b) Compare NC, CNC and DNC. What are the advantages of combining CNC and NDC? [4]
- c) What is the difference between conventional process planning and computer aided process planning? [2]

P.T.O.

- Q3)** a) Obtain buckling formulation for a plane frame element oriented arbitrarily in a two dimensional plane. [4]
 b) Derive element stiffness matrix for a curved axisymmetric shell. [4]
 c) How can FEM be used for simulating injection molding? [2]
- Q4)** a) Write a note on automatic mesh generation with an illustrative example. [5]
 b) Explain in detail the variant approach in CAPP. [5]
- Q5)** a) Explain functions and features of Product Data Management (PDM). [4]
 b) What are the benefits of using PDM? [4]
 c) Explain various users of DBMS in brief. [2]
- Q6)** a) Discuss the need and importance of shop floor data collection systems. [4]
 b) What is materials requirement planning (MRP)? Explain Independent demand and dependent demand in relation to MRP. [4]
 c) Describe the features of flexible inspection system. [2]
- Q7)** a) Explain the Siemens model of CIM. [4]
 b) Explain various layout configurations in FMS. [4]
 c) What are the benefits of using FMS? [2]
- Q8)** a) Apply the rank order clustering technique to the part- machine incidence matrix in the following table to identify logical part families and machine groups. [5]

Machines ↓	A	B	C	D	E
1	1				
2		1			1
3	1			1	
4		1	1		
5				1	

- b) Explain various architectures in DBMS. [5]



Total No. of Questions : 8]

SEAT No. :

P4925

[Total No. of Pages : 3

[5060]-939

M.E. (Manufacturing & Automation)

TOOL AND DIE DESIGN

(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 settings of tool and cutter grinder for grinding of milling cutter. [4]
- b) Determine the shear plane angle in orthogonal machining with a 7° positive rake angle for annealed commercially pure copper. For annealed copper yield strength = 80 MPa and tensile strength = 170 MPa. [4]
- c) Explain effect of rake angle on tool life. [2]
- Q2)** a) Explain with suitable example, procedure to determine the number of clamping points required for complete restraining of the workpiece. [4]
- b) Explain box jig with suitable example. [4]
- c) Explain 3:2:1 principle of location. [2]
- Q3)** a) Draw the set up for fine blanking and explain its working. [4]
- b) What is spring-back in bending? How it is estimated and compensated? [4]
- c) Write the formula to calculate force required in deep drawing operation. [2]

P.T.O.

- Q4)** a) Explain with neat sketch ORS and ASA system of tool signature. [5]
 b) Derive the expression for determining the width of the diamond pin. [5]

Q5) Design the forging die for the component shown in Fig. 1. Density of material is 7.85 g/cm^3 . [10]

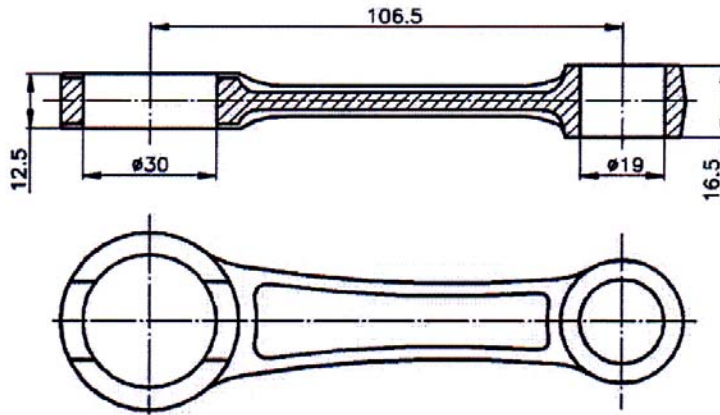


Fig. 1.

Q6) Following data applies to the component shown in figure 2.

- Material: PVC with density 1.38 g/cm^2
- Shrinkage 0.96% spatial
- Modulus of elasticity: $3 \times 10^3 \text{ MPa}$
- Number of impressions :4

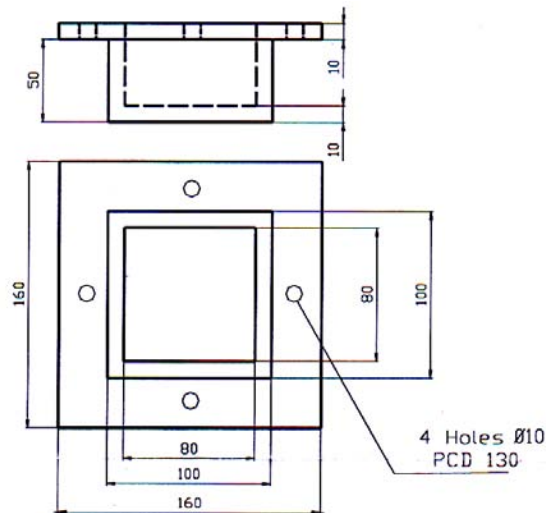


Fig.2

- Calculate the mold opening force. [2]
- Calculate the ejection force and the dimensions of the ejection element. [2]
- Determine the gate dimensions, runner dimensions, and runner layout. [3]
- Sketch the assembly of the mold. [3]

- Q7)** a) Explain Simulation based die casting die design. [4]
b) What are the design rules in die casting process with respect to wall thickness, corners, drafts, and undercuts. [4]
c) What are lifters in die casting dies? [2]
- Q8)** a) Derive expression for determining the length of finger cam used in injection mold. [5]
b) Write note on: Computer aided forging die design. [5]



Total No. of Questions : 8]

SEAT No. :

P4926

[Total No. of Pages : 2

[5060]-940

M.E. (Production- Manufacturing & Automation)

ADVANCED JOINING PROCESSES

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *Black 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) Discuss in brief the principal forms of arc welding processes that are differing in the manner of weld shielding against exposure to atmospheric air. [4]
- b) Describe the general procedure for selecting a welding process for a specific application. [4]
- c) Write the equations used in the strength analysis of welds. [2]
- Q2)** a) Explain with a neat sketch the working principle of Plasma Arc Welding (PAW) process. [4]
- b) State the important features of Ultrasonic Welding process. [4]
- c) Enumerate specific applications of Laser Beam Welding. [2]
- Q3)** a) Which are the different factors that causes the Arc Blow during welding? [4]
- b) Why standard specimens are used for testing of welds? State the basic considerations in choosing a test for testing the mechanical properties of weldment. [4]
- c) Explain with neat sketches the faulty weld profiles on a butt and fillet welds. [2]

P.T.O.

- Q4)** a) Discuss the need and role of fixtures in holding the workpieces during the welding operations. [5]
b) Explain in brief the popular technique used in welding of pipeline. [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 mm². Heat required to melt steel may be taken as 10 J/mm³ and heat transfer efficiency is 0.85. [4]
b) Explain briefly the stress relieving methods used for welds. [4]
c) Give the specific reason why spray metal transfer is more superior to globular metal transfer. [2]
- Q6)** a) Explain the common thermal treatment methods that are carried out on welds. [4]
b) Discuss in brief the time, temperature, and isothermal transformations during welding of steel. [4]
c) What do you understand by heat affected zone (HAZ) in welding? [2]
- Q7)** a) Briefly explain the hot air welding technique used for welding of PVC plastics. [4]
b) Describe the friction welding process with a specific application. [4]
c) Draw a neat sketch of a test specimen with a butt joint in-order to find out the strength of plastic sheets. [2]
- Q8)** a) List down the methods used to control the contamination of welds and explain any one method in detail. [5]
b) Explain clearly why cast irons are more difficult to weld than steels. [5]



Total No. of Questions : 8]

SEAT No. :

P4927

[Total No. of Pages : 2

[5060]-942

M.E. (Production- Manufacturing & Automation)

ADVANCED ROBOTICS

(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.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary*

- Q1)** a) Explain with a neat sketch the basic robot configurations. [4]
- b) Discuss workplace design considerations for safety in robot operations. [4]
- c) State the laws of robotics. [2]
- Q2)** a) How is mapping of rotation and translation done? Derive the homogeneous transformation matrix. [4]
- b) If $a_{xyz} = (4, 3, 2)^T$ and $b_{xyz} = (6, 2, 4)^T$ are the coordinates with respect to the reference coordinate system, determine the corresponding points a_{uvw} and b_{uvw} with respect to the rotated OUVW coordinate system if it has been rotated 60° about OZ axis. [4]
- c) State the basic rotation matrices for rotation about X axis by α and Y axis by ϕ . [2]
- Q3)** a) A piston is to be designed to exert an actuation force of 120 lb on its extension stroke. The inside diameter of the piston is 2.0 in. and the ram diameter is 0.375 in. What shop air pressure will be required to provide this actuation force? Use a safety factor of 1.3 in your computations. [4]
- b) Describe the architecture of hybrid position / force control. [4]
- c) What are the limitations of friction based grippers? [2]

P.T.O.

- Q4)** a) Explain the magnetic and adhesive grippers used in robots. [5]
b) How are robots useful in material handling application? Explain. [5]
- Q5)** a) Describe the typical features of a teach pendant. [4]
b) What is lead-through programming? Explain. [4]
c) Discuss advantages and disadvantages of offline programming. [2]
- Q6)** a) How can potentiometer be used to sense position in robot? Explain. [4]
b) Write a note on LVDT. [4]
c) Name some contact and non contact type sensors. [2]
- Q7)** a) What problems will be encountered if the frames are arbitrarily assigned to develop the forward kinematic model of a manipulator? [4]
b) Explain the factors on which the number of solutions to given inverse kinematic model depend? [4]
c) What is Jacobian of a manipulator? [2]
- Q8)** a) What tasks can be performed by a robotic vision system? Explain. [5]
b) Explain commands used for sensor operations in robot language. [5]



Total No. of Questions : 8]

SEAT No. :

P4928

[Total No. of Pages : 2

[5060]-943

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

SURFACE ENGINEERING

(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.*
- 5) *Use of electronic pocket calculator and logarithmic tables is allowed.*

- Q1)** a) What is Surface Engineering? Describe mechanism of surface degradation. **[4]**
- b) Which are the important surface dependent engineering properties of materials? **[4]**
- c) How to prevent metal corrosion. **[2]**
-
- Q2)** a) How mechanical cleaning differs from chemical cleaning of industrial parts. **[4]**
- b) Write short notes on: **[4]**
- i) Hot Dipping
 - ii) Metal cladding
- c) Differentiate between diffusion and ion implantation. **[2]**
-
- Q3)** a) Write short notes on:
- i) Carburising **[4]**
 - ii) Carbo-nitriding **[4]**
- b) Which are the surface hardening techniques of industrial parts? **[2]**

P.T.O.

- Q4)** a) Which factors control the corrosion rate of metal parts? [5]
b) What you mean by fatigue life of industrial part? List out the factors which affect the fatigue life. [5]
- Q5)** a) Explain following with sketch:
i) Physical Vapor Deposition (PVD) [4]
ii) Chemical Vapor Deposition (CVD) [4]
b) What is Sol-Gel Processes? [2]
- 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) Which are the desirable requirements for high temperature metallic coatings? [4]
b) How oxidation/corrosion resistant coating differs from thermal barrier coating? [6]
- Q8)** a) Describe any two methods of measuring coating hardness. [5]
b) Write note on: 'Thermal degradation of metallic coatings during oxidation'. [5]

