

Total No. of Questions : 10]

SEAT No. :

**P3022**

[Total No. of Pages : 3

[5872]-101

**M.E. (Civil) (Construction & Management)**  
**APPLICATIONS OF STATISTICAL METHODS**  
**IN CONSTRUCTION**  
**(2017 Pattern) (Semester - I) (501021)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8 and Q.9 or Q.10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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 allowe.*

- Q1) a)** What do you mean by sampling and what are the various types of sampling. [5]
- b) In a bolt factory machines  $M_1$ ,  $M_2$ ,  $M_3$  manufactures respectively 35,45 and 50 per cent of the total. Of their output 5, 4 and 2 per cent respectively are defective bolts. one bolt is drawn at random from the product and is found to be defective. What is the probability that it is manufactured in the machine  $M_2$ ? [5]

OR

- Q2) a)** A bin contains 5 defective (that immediately fail when put in use), 10 partially defective (that fail after a couple of hours of use), and 25 acceptable transistors. A transistor is chosen at random from the bin and put into use. If it does not immediately fail, what is the probability it is acceptable? [5]
- b) Explain different rules of probability of with different examples. [5]
- Q3) a)** Explain the regression analysis with suitable example with respect to construction industry. [5]
- b) Explain the following. [5]
- i) Binomial probability distribution.
  - ii) Normal probability distribution.

OR

*P.T.O.*

**Q4) a)** If  $r_{12}=0.98$ ,  $r_{13}=0.94$ ,  $r_{23}=0.92$ , find the partial correlation coefficient between  $x_2$  and  $x_3$ , when  $x_1$  is held constant. [5]

b) Explain queuing theory applications for optimizing the use of equipment in a RMC plant, with a proper example. [5]

**Q5) a)** Explain with example: [5]

- i) Nunally model
- ii) Failure cost profile

b) What is simulation explain with suitable example and what is significance of random numbers? [5]

OR

**Q6) a)** Write a note on analysis of variance on one way and two classification. [5]

b) Explain Griffi's model with example from construction industry. Also explain the concept of downtime cost of equipment. [5]

**Q7)** Draw the ABC curve for the data given below. [10]

Item no.	Quantity	Consumed in a year cost per unit (Rs.)
1	2	40
2	200	5
3	30	1000
4	20	20
5	4	20
6	16	2000
7	24	50
8	5	40
9	100	8
10	250	4
11	120	8
12	140	7
13	10	10
14	20	10
15	200	5

OR

**Q8)** Draw the ABC curve for the data given below. **[10]**

Item no.	Quantity	Consumed in a year	cost per unit (Rs.)
1	2		40
2	200		5
3	30		1000
4	20		20
5	4		20
6	16		2000
7	24		50
8	5		40
9	100		8
10	250		4
11	120		8
12	140		7
13	10		10
14	20		10
15	200		5

**Q9) a)** Describe in brief ABC analysis. **[5]**

b) Explain EOQ? Derive the formula for EOQ. **[5]**

OR

**Q10)a)** Explain with neat sketch earth and rock fill cofferdam with its advantages and disadvantages. **[5]**

b) Explain sensitivity analysis. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P3023**

[Total No. of Pages : 2

**[5872]-102**

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

**MANAGEMENT AND PROJECT PLANNING IN CONSTRUCTION**

**(2017 Credit Pattern) (Semester-I) (501022)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6: and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side incate 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 allwed.*

- Q1) a)** After the pandemic period, write the SWOT analysis of construction industry. **[4]**
- b)** Discuss the advantages and limitations of Line of Balance Method over Critical Path Method. **[5]**

OR

- Q2) a)** What are various modules available in ERP software. **[3]**
- b)** Explain the Precedence network diagram with suitable example. **[6]**
- Q3) a)** Following is the data of a project which needs to be crashed. State the activity to be crashed initially and by how many day? **[6]**

Name of activity	Preceding activity	Normal Druation (days)	Crash duration	Crash slope
A	---	8	6	Rs 1000/day
B	---	7	6	Rs 500/day
C	B	10	7	Rs 750/day
D	A,C	12	9	Rs 450/day
E	B	9	7	Rs 550/day
F	C	6	5	Rs 800/day
G	C,E	8	7	Rs 600/day

- b)** Explain the photography technique for work measurement on a construction site. **[3]**

OR

**P.T.O.**

- Q4) a)** Explain string diagram, What are its applications? [3]  
**b)** With the following data, draw the network diagram only. [6]

Name of activity	Preceding activity	Normal Duration (days)
A	----	8
B	A	9
C	A	4
D	A	6
E	B	8
F	C	3
G	C	10
H	B,F	11
I	B,D,F,G	9
J	B,F,D,G	7
K	E,H,I	5

- Q5) a)** Write the personal protective equipments that can be used on a construction site, State the use of each. [8]  
**b)** Write safety procedure for a concrete pump operator on site. [8]

OR

- Q6) a)** Explain in brief. : Minimum wages Act. [8]  
**b)** What are the direct and indirect costs in an accident? [8]

- Q7) a)** What is meant by Job Evaluation? Explain any one technique under it.[8]  
**b)** Write a short note on:  
 i) Artificial Neural Network [4]  
 ii) BIM in construction [4]

OR

- Q8) a)** For the project of design of water distribution system for a town, prediction of water requirement in the next 30 years is a crucial issue. Out of fuzzy logic technique, artificial neural network and genetic algorithm, which technique is most suited and why? [8]  
**b)** Write a short note on:  
 i) Genetic algorithm [4]  
 ii) Softwares for artificial intelligence techniques. [4]



Total No. of Questions : 10]

SEAT No. :

**P3024**

**[5872]-103**

[Total No. of Pages : 2

**M.E. (Civil)**

**CONSTRUCTION & MANAGEMENT**

**Construction Technology**

**(2017 Pattern) (Semester - I) (501023)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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) Explain micro tunneling explain in detail. [5]  
b) Explain Electro osmosis dewatering method. State advantages of the dewatering system. [5]

OR

- Q2)** a) Explain Electro Osmosis dewatering process in detail with its applicability. [5]  
b) Enlist the grouting materials used. Focus on cement grouting in detail. [5]
- Q3)** a) Explain underwater concreting using tremie method. [5]  
b) Explain the sequential operations involved in construction of sheet pile cofferdam for construction of bridge pier. [5]

OR

- Q4)** a) Explain in detail various types and erection methods of shuttering. [5]  
b) “Rapid Hardening Cement is suitable for under water concreting”, support this statement with conditions of under waters. [5]

**P.T.O.**

- Q5)** a) Discuss the operations involved in construction of micro piles. [5]  
b) Explain what is pumped concrete with diagram? [5]

OR

- Q6)** a) Explain construction of single wall cofferdam. [5]  
b) Which factors are considered in geotechnical investigation of caisson construction? State importance of each factor. [5]

- Q7)** a) Explain components of coffer dam with diagram. [5]  
b) Explain in detail bored - Piles. [5]

OR

- Q8)** a) Explain the methods of support during pile driving with diagram. [5]  
b) Explain with neat diagrams about pile capacity. [5]

- Q9)** a) Explain in detail precast caissons and write its advantages and disadvantages. [5]  
b) Discuss methods of construction for well foundations. [5]

OR

- Q10)** a) Explain with neat sketch earth and rock fill cofferdam with its advantages and disadvantages. [5]  
b) Explain pneumatic caissons in details. [5]

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Total No. of Questions : 8]

SEAT No. :

**P3025**

[Total No. of Pages : 2

**[5872]-104**

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

**TOTAL QUALITY MANAGEMENT IN CONSTRUCTION**

**(2017 Credit Pattern) (Semester - I) (501024)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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)** Explain with neat sketch, Evolution of TQM. **[4]**

b) Write a note on - Fishbone diagram. **[5]**

OR

**Q2) a)** Elaborate the need of TQM in construction industry. **[4]**

b) Explain Testing required for quality control of construction material used in RCC Work. **[5]**

**Q3) a)** Describe with neat sketch, Project Rework Reduction Tool (PRRT). **[4]**

b) Explain the role of quality inspection team in High Rise Building Construction. **[5]**

OR

**Q4) a)** Enlist checklist required for Concreting activity implemented by quality engineers. **[5]**

b) Write note on Quality Circle. **[4]**

**Q5) a)** Difference between ISO 9001 and ISO 9004. **[8]**

b) State and explain Eight Principles of ISO 9001. **[8]**

OR

*P.T.O.*



- Q6)** a) Explain the different Certification bodies involved in TQM. [8]  
b) Describe the Certification process for ISO 9001. [8]

- Q7)** a) Write a note on : CIDC - CQRA quality rating systems. [8]  
b) Justify - six sigma as an effective tool in TQM. [8]

OR

- Q8)** a) Explain Non Conformity reports (NCR), Give the remedial strategy for reducing NCR's. [8]  
b) Highlight the importance of third party quality audits in construction industry. [8]



Total No. of Questions : 10]

SEAT No. :

**P3026**

[Total No. of Pages : 2

[5872]-105

**M.E. (Civil) (Construction & Management)**  
**CONSTRUCTION CONTRACTS ADMINISTRATION AND**  
**MANAGEMENT**  
**(2017 Pattern) (Semester - II) (501027)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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)** Explain with examples the valid excuses for non-performance permitted in the Indian Contract Act. [5]
- b)** Explain the role of project management services in construction project? [5]

OR

- Q2) a)** Explain in details standard forms of contracts & what is the importance of comparative statement after opening the Tenders? Give format for the same. [5]
- b)** Explain Workmen's Compensation Act on construction projects with clauses. [5]

- Q3) a)** State the circumstances under which the lowest tender is rejected? [5]
- b)** Circumstances under which the contractor shall be entitled to terminate the contract. [5]

OR

- Q4) a)** Discuss the advantages of DRB over dispute resolution mechanism. [5]
- b)** Explain in detail responsibilities and duties of the Employer for contracts under Red Book. [5]

- Q5) a)** What is Construction Claims, Types of construction claims and explain settlement of claims. [5]
- b)** Explain in brief meaning/Provision for following under FIDIC conditions RED BOOK. [5]
- i) Tests on completion & Tests after completion.
  - ii) Employer's personnel & Contractor's personnel.

OR

*P.T.O.*

- Q6)** a) Explain the different types of FIDIC books commonly used in projects and its uses? [5]  
b) Explain in details Extra items and causes of claims in construction industry. [5]
- Q7)** a) Describe the clauses of escalation of cost: What is an arbitral proceeding. [5]  
Explain with example.  
i) Escalation formula for material cost  
ii) Escalation formula for Labour cost  
b) Explain in detail - Defect Liability Period. [5]
- OR
- Q8)** a) Explain in details Conciliation related to contract. [5]  
b) Explain the importance of role of various stakeholders in prevention of disputes? [5]
- Q9)** a) Procedure of appeal against the awards. [5]  
b) Explain are the various duties, power of arbitrators? [5]
- OR
- Q10)** a) Explain Conciliation and its provisions in the Act, also explain conduct of conciliation and arbitral proceedings? [5]  
b) Explain difference between Arbitration and Conciliation? [5]



Total No. of Questions : 8]

SEAT No. :

**P3027**

[Total No. of Pages : 2

**[5872]-106**

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

**PROJECT ECONOMICS AND FINANCIAL MANAGEMENT**

**(2017 Credit Pattern) (Semester-II) (501028)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 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) Discuss in brief about Factors bearing on size of firms. [4]  
b) Elaborate the process about Cash management for the small construction firm. [5]

OR

- Q2)** a) Discuss in brief about Factors Drives to growth of any firm. [4]  
b) Explain the method about managing payments to suppliers and out standings for any construction firm. [5]

- Q3)** a) Explain the Role of Lender's Engineer in any firm. [5]  
b) Write a short note on over and under capitalization. [4]

OR

- Q4)** a) Develop the cost implication for residential housing construction form with suitable justified example. [5]  
b) Write a short note on long term finance planning. [4]

- Q5)** a) Explain constituents of master budget. [8]  
b) Explain in detail with suitable example about Budgetary control system. [8]

OR

*P.T.O.*

- Q6)** a) Write a note on budget manual. [8]  
b) Discuss in details about various types of budgets. [8]

- Q7)** a) Explain in detail CIDC-IRA grading of construction entities. [8]  
b) Describe how venture capital financing made impact on any business entity. [8]

OR

- Q8)** a) Write a note on SEBI regulation. [8]  
b) What is the part of financing institutes in Construction? Explain in detail. [8]



Total No. of Questions : 8]

SEAT No. :

**P3028**

[Total No. of Pages : 3

[5872]-107

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

**OPERATIONS RESEARCH**

**(2017 Pattern) (Semester - II) (501029)**

**Time : 3 Hours]**

**[Max. Marks : 50**

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 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) What are the applications of Optimization Techniques in Civil Engineering? **[4]**

b) Maximize  $Z = 10x_1 + 12x_2$  **[5]**

Subject to  $12x_1 + 16x_2 \leq 100$

$16x_1 + 8x_2 \leq 80$

$x_1, x_2 \geq 0$

OR

**Q2)** a) Check whether the given functions are convex, concave or neither **[4]**

i)  $F(x) = x - x^2$

ii)  $F(x) = x^3 + 6x^2 + 8x$

b) What is meant by primal and dual functions? Explain with the help of suitable examples. **[5]**

**P.T.O.**

- Q3)** a) Determine optimum solution by using Column minima and least cost method for following transportation problem. [6]

		Destination					
		1	2	3	4	5	Supply
Origin	A	2	4	5	2	8	7
	B	5	6	3	5	5	8
	C	6	7	8	4	2	9
demand		4	5	3	7	5	

- b) Discuss the multistage decision process adopted for optimization of problems. Also, elaborate its applications in Construction Industry. [3]

OR

- Q4)** a) Solve the following assignment problem to minimize the cost. [5]

	1	2	3	4
A	21.75	21.25	17.75	12.25
B	22.75	22.25	18.75	13.25
C	28.25	27.75	24.25	18.75
D	9.25	8.75	5.25	23.75

- b) Describe the method of optimization using Dichotomous Search method. Use suitable example. [4]

- Q5)** a) Differentiate between constrained and unconstrained problem with the help of suitable examples. [6]

- b) Solve the following NLP with Lagrangian Multiplier technique. [10]

$$\text{Minimize } Z = x_1^2 - 10x_1 + x_2^2 - 6x_2 + x_3^2 - 4x_3$$

Subject to

$$x_1 + x_2 + x_3 = 7$$

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

OR

- Q6)** a) Solve the following two variables unconstrained nonlinear problem using gradient search method for two iterations. [8]

$$\text{Maximize } f(x) = 2x_1x_2 + x_2 - x_1^2 - 2x_2^2$$

- b) Explain the steps to be followed to solve an NLP using Newtons Method. [8]

- Q7) a) Interarrival and service time in a waiting line problem have the following frequency distribution based on 100 such iterations. [8]

Interarrival time (min)	3	6	9	12	15	18
Frequency	6	9	25	37	16	7

Random numbers: 15, 19, 61, 49, 54, 73, 85, 96, 31, 22

Service time (min)	4	6	8	10	12
Frequency	4	10	18	44	24

Random numbers: 9, 11, 90, 64, 37, 29, 43, 78, 87, 56

Calculate average waiting time and average idle time.

- b) Find the value of game as given below: [8]

		B			
		10	-2	-6	8
		-5	-2	-7	0
A		4	9	-8	-7
		9	5	-9	7

OR

- Q8) a) Find the sequence that minimizes the total elapsed time to complete the following jobs in the order AB. [8]

Jobs (processing times in minutes)

		1	2	3	4	5	6	7
machines	A	5	6	10	3	7	2	8
	B	9	8	7	4	5	7	3

Find total elapsed time.

- b) A firm is considering replacement an excavator, whose cost price is Rs. 10,20,200 and the scrap value is Rs. 20,000. The running (maintenance and operating) costs are found from experience to be as follows:

Year	1	2	3	4	5	6	7	8
Running Cost	20,000	50,000	80,000	1,20,000	1,80,000	2,50,000	3,20,000	4,00,000

When should the machine to be replaced?





Total No. of Questions : 10]

SEAT No. :

**P3029**

[Total No. of Pages : 2

[5872]-108

**M.E. (Civil) (Construction & Management)**  
**ENVIRONMENT AND ENERGY FOR SUSTAINABLE**  
**CONSTRUCTION**  
**(2017 Pattern) (Semester - III) (601033)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8 and Q.9 or Q.10.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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 allowe.*

- Q1)** a) Explain the concept of environment. What are the different Environmental impact factors to be considered when construct the Airports? [5]  
b) Explain the steps involved in EIA Process. [5]

OR

- Q2)** a) Enlist basic steps involved in Socio economic assessment. [5]  
b) Explain in details on “Fiscal Impacts Analysis”. Write down its importance. [5]

- Q3)** a) Enlist the different types of Environment and Pollution control Laws in India. Explain any one in detail. [5]  
b) Explain the role of financial institutions and corporate banks energy efficient projects. [5]

OR

- Q4)** a) Explain the outline of basic steps in performing the socio economic assessment for post COVID. [5]  
b) Explain in details on COP? [5]

- Q5)** a) Explain in details on differed payment financing? [5]  
b) Explain the ESCOs and their role in development of energy efficient projects. [5]

OR

*P.T.O.*

- Q6)** a) Explain the different kinds of Energy Efficient services provide on construction site for saving energy. [5]  
b) Explain HVAC Systems? How can it is beneficial for energy saving. [5]

- Q7)** a) Explain power factor? comment on energy saving in pumps. [5]  
b) Explain the ESCOs and their role in development of energy efficient projects. [5]

OR

- Q8)** a) Explain the energy can be saved in lighting and ventilation system adopted now days? [5]  
b) Explain what is Air Cooling systems with diagram. [5]

- Q9)** a) Explain Thermal Comfort. [5]  
b) Explain a short note on Energy Management of Electrical Equipment. [5]

OR

- Q10)**a) Explain down the application of Air-Conditioning System. [5]  
b) Explain advantages of energy management. [5]



Total No. of Questions : 8]

SEAT No. :

**P6775**

[Total No. of Pages : 2

**[5872]-109**

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

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - III) (601034)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q. 5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) How do you define a research problem? Give three examples to illustrate your answer. [5]
- b) Write short note on objectives of literature survey and different sources of literature. [5]

OR

- Q2)** a) Describe any two types of research. [5]
- b) Write short notes on styles of literature survey and strategies of literature survey. [5]

- Q3)** a) Explain the criteria of goodness of a measurement scale. [5]
- b) What is hypothesis? The procedure of testing hypothesis requires a research to adopt several steps. Describe in brief all such steps. [5]

OR

- Q4)** a) Differentiate collection of data through questionnaires and schedules.[5]
- b) What are the basic concepts concerning testing of hypothesis? [5]

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

- Q5)** a) Write a note on the usage of ANOVA in linear regression analysis. Why do we use t-test in linear regression analysis? [8]
- b) What is the meaning of discrimination between groups? Compare regression analysis with discriminant analysis? [7]

OR

- Q6)** a) Differentiate descriptive statistics and inferential statistics. [8]
- b) How many discriminant functions would you obtain in a 4 group discriminant analysis and why? What do you mean by misclassification in discriminant analysis? [7]

- Q7)** a) Write short notes on the techniques of writing report and characteristics of a good research report. [8]
- b) Write a short note on Documentation in the context of a research report. Explain the significance of a research report. [7]

OR

- Q8)** a) Describe in brief, the structure of report. What do you mean by plagiarism? [8]
- b) Discuss - Report writing is more an art that hinges upon practice and experience. Write a short note on Documentation in the context of a research report. [7]



Total No. of Questions : 8]

SEAT No. :

**P3030**

[Total No. of Pages : 2

[5872]-111

**M.E. (Civil) (Environmental Engineering)**  
**ENVIRONMENTAL LEGISLATION AND**  
**MANAGEMENT SYSTEMS**  
**(2017 Pattern) (Semester - I) (501061)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the 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.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Assume necessary data.*
- 5) *Use of scientific calculators is allowed.*

- Q1) a)** Write provisions for closure/directions in apprehended pollution situation in Water (P&CP) Act 1974. **[4]**
- b) Write legal sampling procedures for ambient air quality analysis. **[5]**

OR

- Q2) a)** Write and explain principles and elements of environmental Management plan. **[4]**
- b) Write objective and advantages of ISO 14001-Environmental management Systems. (EMS) standard. **[5]**

- Q3) a)** Explain relevant provision in indian forest act. **[4]**
- b) Explain coastal zone regulations for siting of industry. **[5]**

OR

- Q4) a)** Explain any one case study of Supreme Court Judgments in landmark cases. **[4]**
- b) Write rules and regulations for siting an industry. **[5]**

- Q5) a)** Explain role of SPCB in implementation of various notifications issued by Central Govt. under environment (Protection) Act, 1986 **[8]**
- b) Write and explain provision about collection, transportation and disposal of hazardous waste mentioned in Hazardous waste (Management and handling) Rules, 1989. **[8]**

OR

*P.T.O.*

**Q6) a)** Write and explain the notifications issued by Govt. of Maharashtra for the protection and improvement of environment. **[8]**

b) Write important powers and functions of the MPC board under both the water and air acts. **[8]**

**Q7) a)** Write responsibilities of generators and role of Pollution Control Boards in hazardous waste management. **[8]**

b) Explain role of NGO in Nature conservation with an example. **[8]**

OR

**Q8) a)** Write and explain responsibilities of pollution control boards under Hazardous waste rules. **[8]**

b) Explain the procedure of public hearing for obtaining Environmental Clearance with any case study. **[8]**



Total No. of Questions : 8]

SEAT No. :

**P3031**

[Total No. of Pages : 2

[5872]-112

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

**ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY**

**(2017 Pattern) (Semester-I) (501062)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6: Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state the same.*
- 5) *Use of an electronic pocket calculator is allowed.*

**Q1) a)** Enlist the classes of colloidal dispersion. Explain the significance of colloids in environmental engineering. **[5]**

b) Write a short note on: **[2+2=4]**

i) Greenhouse effect

ii) Ozone depletion

OR

**Q2) a)** Enlist various health hazards due to Lead poisoning. **[4]**

b) Explain in brief about the broad classification of pesticides Also describe the effects of DDT. **[5]**

**Q3) a)** Explain in detail; biodegradation of surfactants. **[5]**

b) What are the adverse effects of polymer-based materials on the environment? **[4]**

OR

**Q4) a)** What are the ill effects of chemical based consumer goods? Explain with suitable examples. **[5]**

b) What is Chromatography and Explain Gas Chromatograph in detail. **[4]**

*P.T.O.*

- Q5) a)** Explain in detail the microbial cell structure with figure. [8]  
b) Explain in detail: Importance of Biodegradation Processes wrt Indian Climatic Conditions. [8]

OR

- Q6) a)** Explain the importance of Biological processes of wastewater treatment. [8]  
b) Biological processes of waste water treatment are preferred over Chemical processes. Explain in detail, with suitable examples. [8]

- Q7) a)** Explain following terms [4+4=8]  
i) Seeding  
ii) Microbiology in TF  
b) Explain working of an anaerobic digester wrt microbiology involved in it. [8]

OR

- Q8) a)** Compare following wrt microbiology involved: [4+4=8]  
i) Suspended & Attached Growth Systems  
ii) Aerobic and Anaerobic Treatment Methods  
b) Compare use of Aerobic v/s Anaerobic Digesters used for sludge digestion in modern urban STPS. [8]





Total No. of Questions : 16]

SEAT No. :

**P3032**

**[5872]-113**

[Total No. of Pages : 3

**M.E. (Civil - Environmental Engineering)**  
**PHYSICO - CHEMICAL PROCESS FOR WATER AND**  
**WASTEWATER TREATMENT**  
**(2017 Pattern) (Semester - I) (501063)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9, Q.10 or Q.11, Q.12, Q.13, Q.14 or Q.15, Q.16.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Your answers will be valued as a whole.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Write short note on **[5]**  
a) Continuous process (Flow process)  
b) Semi - batch process

OR

**Q2)** It is required to prepare 1270 kg of a solution composed of 13 wt. % ethanol and 87 wt.% water. Two solutions are available, the first contains 5 wt.% ethanol and the second contains 25 wt. % Ethanol. How much of each solution are mixed to prepare the desired solution? **[5]**

**Q3)** Give short note on **[5]**  
a) Repulsive and Attractive Potentials.  
b) Destabilization of Colloids.

OR

**Q4)** Explain in details about Electrical relations at surfaces of colloids. **[5]**

**Q5)** A layer of crushed anthracite with a sphericity of 0.70 and a density of 1.50 is to rest on a layer of sand with a sphericity of 0.80 and a density of 2.65. Find the maximum ratio of the diameter of the coarsest anthracite to the finest sand that will ensure both equal expansion and equal settling of the two materials at the common boundary. Assume that the density of the water is 1.00. **[5]**

OR

**P.T.O.**

**Q6)** What is the purpose of disinfection? Discuss the properties of disinfectants. [5]

**Q7)** Draw and discuss the flow diagram of Activated Sludge Process. [5]

OR

**Q8)** Estimate the capacity of the components of a small trickling-filter plant treating 3 MLD of domestic wastewater from 8,000 people, assuming the following:

[5]

- a) Sewage flow production - 378 Lpcd
- b) Two primary settling tanks with a depth of 13.1 m
- c) Two sludge digestion tanks with a storage requirement of 0.057 m<sup>3</sup> per capita
- d) Four sludge drying beds with an area requirement of 0.093 m<sup>2</sup> per capita
- e) One trickling filter with a loading of 0.0028 ML/m<sup>2</sup>/d.

**Q9)** Draw and discuss the schematic diagram of typical UASB. [7]

**Q10)** What are the design considerations for good performance of the UASB? [7]

OR

**Q11)** Assuming suitable design criteria and following characteristics of domestic wastewater, design a UASB reactor system to treat an average 5.0 MLD flow of wastewater. Assume up flow velocity of 0.5m per hour. Given data - [9]

- a) Influent BOD = 320 mg/l
- b) Influent COD = 850 mg/l
- c) Influent TSS = 400 mg/l
- d) Influent VSS = 300 mg/l
- e) Desired effluent BOD = 100mg/l or less

**Q12)** Determine the specific gravity of total solids of a 10% sludge which has 25% solids as fixed minerals with specific gravity 2.5 and 75% solids as volatile matter with specific gravity 1.0. Assume suitable data if required. [5]

**Q13)** Discuss the types of adsorption and factors influencing to it. [8]

**Q14)** Give note on. [8]

- a) Granular Activated carbon.
- b) Exchange Isotherm.

OR

**Q15)** How the performance of RO process can be measured? Discuss in details. [8]

**Q16)** Give note on. [8]

- a) Adsorption kinetics.
- b) Adsorption isotherms.

\*\*\*

Total No. of Questions : 12]

SEAT No. :

P6795

[Total No. of Pages : 2

[5872]-114

**M.E. (Civil) (Environmental Engineering)**  
**501064 : ENVIRONMENTAL SANITATION**  
**(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Your answer will be valued as a whole.*
- 3) *Assume suitable data, if necessary.*

*Q1)* Discuss the potential epidemiology applications. [5]

OR

*Q2)* How discharges of intestines communicated the diseases? [5]

*Q3)* Explain the followings- [5]

- a) Prevention of fly breeding
- b) Insecticides

OR

*Q4)* Give detail note on any two disinfectants. [5]

*Q5)* What are the important points to considered for sanitation of public buildings? [5]

OR

*Q6)* Discuss the vibrations and shocks in details. [5]

*Q7)* What are the issues associated with water supply and sanitation in rural area?[5]

OR

*P.T.O.*

**Q8)** Give note on low cost excreta disposal systems. [5]

**Q9) a)** Explain the One-Pipe System and Two pipe system in detail. [7]

b) What are the factors to be consider for design of Water supply in buildings? Discuss. [7]

OR

**Q10) a)** Give note on Break pressure tank system and Hydro-pneumatic system. [7]

b) Discuss the steps involved in Design of Water pipes. [7]

**Q11) a)** Discuss with suitable sketches about Gully Traps and Intercepting Traps. [8]

b) Discuss the working of Flushing Cistern, Wash Basin, Lavatory Basin.[8]

OR

**Q12) a)** Give detail note on principles governing design of building drainage.[8]

b) Discuss the Drainage design of high rise buildings. [8]



Total No. of Questions : 12]

SEAT No. :

**P3033**

[Total No. of Pages : 2

[5872]-115

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

**INDUSTRIAL WASTE WATER TREATMENT AND MANAGEMENT**

**(2017 Pattern) (Semester - II) (501067)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *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, Q.11 or Q.12.*
- 2) *Figures to the right indicate full marks.*
- 3) *Your answers will be valued as a whole.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of electronic pocket calculator and steam table is allowed.*

**Q1)** Discuss the Toxicity and Bioassay test. **[5]**

OR

**Q2)** Give short note on the followings. **[5]**

- a) Equalization and Neutralization.
- b) Flotation and Precipitation.

**Q3)** Discuss in detail Nitrification and De-nitrification process. **[5]**

OR

**Q4)** Give detail note on Wet Air Oxidation. **[5]**

**Q5)** Suggest and comment on the treatment & disposal method of effluent from dairy industry in detail. **[5]**

OR

**Q6)** Suggest and comment on the treatment & disposal method of effluent from food processing industry. **[5]**

**Q7)** Enlist the Characteristics and composition of effluent from Mineral Processing Industry. **[5]**

OR

**Q8)** Discuss how the manufacturing process of Pharma industry is differ than the petroleum industry. **[5]**

**P.T.O.**

- Q9)** a) What are the common problems encountered in management of CETP. Discuss in detail. [7]  
b) Explain with suitable example about the importance of Zero effluent discharge system. [7]

OR

- Q10)** a) What are the general design considerations and principles involve in of CETP? [7]  
b) Why it is important to reuse the waste water? How industries play their role in reuse? [7]

- Q11)** a) What is treatment with polymer coagulation? How it is differ from other methods? [8]  
b) Enumerate the major design components required for waste water treatment plant for Petroleum industry. Comment on its suitability. [8]

OR

- Q12)** a) Discuss the effluent standards for Dye stuff and dye manufacturing industries. [8]  
b) What is an adsorption isotherm? Describe Freundlich adsorption isotherm and Langmuir adsorption isotherm. [8]



Total No. of Questions : 8]

SEAT No. :

**P3034**

[Total No. of Pages : 2

[5872]-116

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

**AIR POLLUTION AND CONTROL**

**(2017 Pattern) (Semester - II) (501068)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures wherever necessary.*

**Q1) a)** What do you understand by stability conditions? Explain its significance in air quality study. **[4]**

b) What is the significance of wind rose diagram in air pollution studies?**[5]**

OR

**Q2) a)** Draw a figure showing four major layers of the atmosphere along with the temperature profiles. **[4]**

b) A power plant is emitting SO<sub>2</sub> with exhaust rate of 127 g/s through a stack that has effective height of 75m. The atmospheric conditions are moderately to slightly stable. The wind velocity at the top of the stack is 6 m/s. Determine the ground level concentration at a distance of 3 km downwind at the centreline of the plume.  $\sigma_y = 280\text{m}$  and  $\sigma_z = 170\text{m}$ . **[5]**

**Q3) a)** How does sulphur dioxide is reduced from flue gas? **[4]**

b) Explain in brief about the control of pollution by process modification and change of raw materials. **[5]**

OR

**Q4) a)** Differentiate between bag house filter and ESP. **[4]**

b) What are the various NO<sub>x</sub> control technologies? **[5]**

**P.T.O.**



- Q5) a)** Write in a tabular form annual and 24 hrs National Ambient Air Quality Standards (NAAQS) for  $\text{SO}_2$ ,  $\text{NO}_2$ ,  $\text{PM}_{10}$ ,  $\text{PM}_{2.5}$  specified by Central Pollution Control Board. [8]
- b) Explain in brief National Air Quality Monitoring Programme. [8]

OR

- Q6) a)** What are modifications in revised Environmental guidelines for siting of Industries? Explain the purpose of providing revised guidelines. [8]
- b) Explain with neat sketch the determination of ambient  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  using particulate dust sampler. [8]
- Q7) a)** What are the causes of indoor air pollution? Explain the measures to be taken to control it. [8]
- b) What are the major air pollutants emitted from vehicular sources? What are the measures taken to control it in Delhi? [8]

OR

- Q8) a)** What are the sources of the odours produced in chemical, tanneries, fertilizer and food industries? [8]
- b) What is air cleaning system for control of indoor air pollution? Explain the method of mechanical ventilation. [8]



Total No. of Questions : 10]

SEAT No. :

**P3035**

[Total No. of Pages : 1

[5872]-117

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

**SOLID WASTE AND HAZARDOUS WASTE MANAGEMENT**

**(2017 Pattern) (Semester - II) (501069)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Solve question 1 or 2, 3 or 4, 5 or 6, 7 or 8, 9 or 10.
- 2) Each question carries equal marks.
- 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 detailed note on physical and chemical properties of MSW. [5]  
b) Discuss in detail, Stationary container collection system. [5]

OR

- Q2)** Explain in detail, the functional elements of Solid Waste Management. [10]

- Q3)** Describe in detail, the Thermal technologies and air emissions and its control in detail. Explain the following: (i) Pyrolysis (ii) Refuse derived fuel (iii) Incinerator. [10]

OR

- Q4)** Explain in detail, the different methods of landfilling. [10]

- Q5)** Discuss in detail, magnetic separation and density separation in details. [10]

OR

- Q6)** Explain in detail, the various methods for disposal of Nuclear and Radioactive waste. [10]

- Q7)** Explain in detail about drop off center and buy back center. [10]

OR

- Q8)** What are the different techniques used for handling of Hazardous waste management? Explain in detail. [10]

- Q9)** Explain in detail, the significance of Hazardous waste management. [10]

OR

- Q10)** Write a detailed note on TCLP test. [10]



Total No. of Questions : 8]

SEAT No. :

**P3036**

[Total No. of Pages : 2

[5872]-118

**M.E. (Civil) (Environmental Engineering)**  
**ENVIRONMENTAL IMPACT ASSESSMENT**  
**(2017 Pattern) (Semester - III) (601073)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt 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.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Assume necessary data.*
- 5) *Use of scientific calculators is allowed.*

- Q1) a)** What kind of documentation and selection process required for EIA?[4]
- b) What are the different methods used in life cycle assessment. Explain any one method. [5]

OR

- Q2) a)** Explain sensitive area criteria matrices with respect to any construction project. [4]
- b) Explain interaction matrix method. [5]
- Q3) a)** How to identify the type and quantity of air pollutant produced in cement industry. [4]
- b) Explain mitigations for soil and ground water contamination for the landfill site. [5]

OR

- Q4) a)** How to predict of noise levels for any processing industrial areas. [4]
- b) Write different water quality standards and their permissible limits. [5]
- Q5) a)** Explain the role of socioeconomic factors in prediction and assessment of environmental impact? [8]
- b) Write and explain techniques for conflict management and dispute resolution. [8]

OR

*P.T.O.*

- Q6)** a) Write regulatory requirements for EIA and their importance. [8]  
b) Explain resettlement and rehabilitation for any dam project. [8]

- Q7)** a) Write public hearing to be carried out for any express highway. [8]  
b) Write and explain general structure of EIA document. [8]

OR

- Q8)** a) Write procedure for environmental Clearance for any industry. [8]  
b) Explain post environmental monitoring for any industry. [8]



Total No. of Questions : 8]

SEAT No. :

**P3037**

[Total No. of Pages : 2

**[5872]-119**

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

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester-III) (601074)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attemp Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6: and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*

- Q1)** a) Enlist steps involved in a Research Process. [5]  
b) Write short note on different sources of literature. [4]

OR

- Q2)** a) Define Research and describe any two types of research. [5]  
b) Explain the importance of review of literature in Research. [4]

- Q3)** a) Explain the meaning of analysis of variance. Describe briefly the technique of analysis of variance. [5]  
b) Explain the criteria of goodness of a measurement scale. [4]

OR

- Q4)** a) Explain the different types of report. [5]  
b) Distinguish factor analysis and cluster analysis [4]

- Q5)** a) What are the primary sources of data collection and explain any two?[8]  
b) Distinguish between Research Methods and Research Methodology.[8]

OR

*P.T.O.*

- Q6)** a) What are the merits and demerits of collection of data through questionnaires? [8]  
b) Define Multi-dimensional Scaling (MDS). Differentiate metric & non-metric approach of MDS with an example. [8]
- Q7)** a) Explain various steps involved in writing a research paper also explain how to search journal for paper publication. [7]  
b) State how to check plagiarism? Justify with an example of any one tool for plagiarism checking. [5]  
c) Explain procedure of Obtaining patents. [4]

OR

- Q8)** a) State the need of research report writing and state various steps involved in writing a report. [7]  
b) Enlist different factors to be considered for effective presentation with an example. [5]  
c) List out the steps involved in publishing a research article in journal. [4]



Total No. of Questions : 12]

SEAT No. :

**P3038**

[Total No. of Pages : 2

[5872]-121

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

**ADVANCE SOIL MECHANICS**

**(2017 Pattern) (Semester - I) (501121) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8. Q.9 or Q.10, Q.11 or Q.12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data, if necessary and mention it clearly.*
- 5) *Use of non--programmable calculator is allowed.*

**Q1)** Derive an equation for vertical pressure at a depth considering an infinitely long line load of intensity 'q' per unit length acting on the surface of a semi infinite elastic medium. **[4]**

OR

**Q2)** What is Stress-strain relationship in soil? **[4]**

**Q3)** State and explain effective stress principle. **[4]**

OR

**Q4)** Define soil failure. Briefly explain the various types of theories of soil failures related to strength. **[4]**

**Q5)** Using Rankine's theory of earth pressure, draw the active earth pressure diagrams for the following cases of Cohesionless Soil: **[4]**

- a) Dry horizontal backfill
- b) Backfill with uniform surcharge.
- c) Submerged backfill
- d) Inclined backfill

OR

*P.T.O.*

**Q6)** Briefly explain lateral earth pressure in braced cuts. [4]

**Q7)** What is “smear zone” in sand drain? Explain the case of free-strain consolidation with no smear with suitable sketches. [4]

OR

**Q8)** Describe three dimensional consolidation with suitable diagram. [4]

**Q9) a)** What are various types of machine foundation? Explain them in detail. [6]

b) Discuss the use of single degree freedom system in the analysis of machine foundations. What are its limitations? [6]

c) Explain the terms: [4]

i) Frequency

ii) Resonance

OR

**Q10)a)** Explain elastic half space method. [6]

b) Write a note on free vibration in machine foundations. [6]

c) How do you determine mass spring constant and damping factor for a vibrating system. [4]

**Q11)a)** Explain two dimensional resonant method for the design of foundations of rotary machines. [6]

b) Write a short note on:  
Isolating materials & properties [6]

c) How would you determine the natural frequency of a machine foundation system. [6]

OR

**Q12)a)** Explain “physical separation method” in vibration isolation with neat sketches. [6]

b) List out and describe the properties of any two vibration isolating materials. [6]

c) Describe the need of vibration isolation in machine foundations. [6]





Total No. of Questions : 8]

SEAT No. :

**P3039**

[Total No. of Pages : 2

**[5872]-122**

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

**GROUND IMPROVEMENT TECHNIQUES**

**(2017 Credit Pattern) (Semester-I) (501122)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures 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) Write note on clay water relations. [4]**  
b) State the methods of chemical stabilisation and explain any one. [5]

OR

- Q2) a) Explain cation exchange. [5]**  
b) Granular stabilization. [4]
- Q3) a) Explain mechanism of cement stabilisation. [4]**  
b) Write a note on Electro kinetic stabilization. [5]

OR

- Q4) a) Write short note on design of lime mixture. [5]**  
b) Explain electro-osmosis. [4]
- Q5) a) How is bearing capacity of lime group determined? [8]**  
b) Describe the technique of sand drains. [8]

OR

*P.T.O.*

- Q6)** a) What are lime columns? Explain the design criteria for the same. [8]  
b) Write short note on Total and differential settlement. [8]

- Q7)** a) Which are the various types of grouts? [8]  
b) Describe the grouting equipment and quality control for grouting. [8]

OR

- Q8)** a) Explain the design of soil grouting program. [8]  
b) How is the quality control and testing for grouting conducted? [8]



Total No. of Questions : 8]

SEAT No. :

**P3040**

**[5872]-123**

[Total No. of Pages : 2

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

**ROCK MECHANICS**

**(2017 Credit Pattern) (Semester - I) (501123)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions from the 8 questions.*
- 2) *Figures 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 suitable data if necessary.*
- 5) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) What are the different index properties of rock mechanics? Explain any one in detail. [5]  
b) Write a note on classification of rock masses for engineering purpose. [5]
- Q2)** a) Write a note Rock anchoring technique. [6]  
b) Explain Rock Blasting. [4]
- Q3)** a) State and explain the stresses around circular opening with sketch. [6]  
b) Write a note on Over coning. [4]
- Q4)** a) List out and explain the different modes of rock failure. [6]  
b) Explain the Mohr Coulomb failure criteria for rocks. [4]
- Q5)** a) What are the factors affecting the rupture behavior of rock. [5]  
b) Write a note on rock failure in compression. [5]

**P.T.O.**

- Q6)** a) Write a note on analysis of general slip surface. [5]  
b) Explain structural discontinuities in rock masses. [5]
- Q7)** a) What are the failure mechanisms of rock foundations? [5]  
b) Write a note on allowable bearing pressure for rock foundations. [5]
- Q8)** a) Write a note on rock slopes. [5]  
b) Write a note on review of design methods of tunnels [5]



Total No. of Questions : 8]

SEAT No. :

**P3041**

[Total No. of Pages : 2

**[5872]-124**

**M.E. (Civil) (Geotechnical Engineering)  
GEO-ENVIRONMENTAL ENGINEERING  
(2017 Credit Pattern) (501125) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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) Enlist the different characteristics of solid waste and describe any one. [4]  
b) Discuss the effects of pollutants on soil properties. [5]

OR

- Q2)** a) Explain different characteristics of solid waste. [5]  
b) Discuss in brief design aspects of de-watering. [4]

- Q3)** a) State the points to be considered while site selection for disposal of solid waste. [4]  
b) Enlist the different types of barrier materials used in land fill? Explain any two in brief. [5]

OR

- Q4)** a) State the advantages and disadvantages for incineration of refuse. [5]  
b) What is Leachate? Explain how it is collected. [4]

- Q5)** a) Discuss the different engineering properties of solid waste. [8]  
b) Describe in detail. "Reclamation of old solid waste dumps". [8]

OR

*P.T.O.*

- Q6)** a) Discuss on “Geotechnical reuse of solid waste”. [8]  
b) Explain different engineering properties of solid waste. [8]

- Q7)** a) State the application of “Geosynthetics in waste disposal design”. [8]  
b) Discuss “construction quality control and performance monitoring” in land fill. [8]

OR

- Q8)** a) Describe “Single and Double lined landfill” with the help of sketch. [8]  
b) Explain the different steps to be considered in landfill construction. [8]



Total No. of Questions : 8]

SEAT No. :

**P6538**

[Total No. of Pages : 2

[5872]-125

**M.E. (Civil) (Geotechnical Engineering)**  
**ADVANCED FOUNDATION ENGINEERING**  
**(Semester-II) (2017 Pattern) (Credit) (501127)**

*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 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume Suitable data, if necessary.*
- 4) *Use of electronic pocket calculator is allowed in the examination.*
- 5) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Discuss how to fix depth of exploration. **[4]**

b) Explain in detail footing with eccentric loading. **[5]**

OR

**Q2) a)** Explain in detail cone penetration test. **[4]**

b) A 30 cm square bearing plate settles by 8mm in the plate load test on cohesion less soil, when the intensity of loading is 180kN/m<sup>2</sup>. Estimate the settlement of shallow foundation of 1.6 m square under the same intensity of loading. **[5]**

**Q3) a)** Write a note on design of anchors. **[4]**

b) Explain in detail what modulus of subgrade reaction and its determination is **[5]**

OR

**Q4) a)** Explain in detail analysis of rigid raft. **[4]**

b) What will be the net allowable bearing capacity of a mat foundation with dimensions of 15m × 10m constructed on sand deposit and here D<sub>f</sub>=2m, allowable settlement 25 mm average penetration number N<sub>60</sub>=10. **[5]**

**P.T.O.**

- Q5) a)** Write a note on vertical piles subjected to lateral loadings. [8]
- b) A square group of 25 piles extended between depth of 1m and 11m in a deposit of 20m thick stiff clay overlying rock. The piles are 0.5m in diameter and are spaced at 1m c/c in a group. The undrained shear strength of the clay at the pile base level is 170 kPa and the average value of undrained shear strength over the depth of the pile is 100 kPa. The adhesion factor is 0.45. Estimate the capacity of pile group considering the overall FOS 3 against shear failure. Corresponding  $N_c$  is 9. [8]

OR

- Q6) a)** Explain IRC 78 considerations for pile socketing and termination depth.[8]
- b) 200 mm diameter, 8m long piles are used as foundation for a column in a uniform deposit of medium clay ( $UCS=110 \text{ kN/m}^2$  and adhesion factor=0.8). There are nine piles arranged in a square pattern of  $3 \times 3$ . For a group efficiency=1.0, find the spacing between the piles (neglect bearing). [8]

- Q7) a)** Write a note on types of cellular cofferdams. [8]
- b) Discuss lateral stability of well foundation. [8]

OR

- Q8) a)** State components their functions and different shapes of well foundation with neat sketch. [8]
- b) Discuss IRC method for the analysis of well foundation. [8]





Total No. of Questions : 8]

SEAT No. :

**P3042**

**[5872]-126**

[Total No. of Pages : 2

**M.E. (Civil - Geotechnical Engineering)**  
**CONSTRUCTION METHODS IN GEOTECHNICAL**  
**ENGINEERING**  
**(2017 Pattern) (Semester-II) (501128)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side 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) Explain in detail different pile drivers with their suitability. [4]  
b) Describe the procedure for predredging inside cofferdams with the tools used. [5]

OR

- Q2)** a) Write down in detail pile raft foundation and its application. [4]  
b) Describe the procedure of setting and driving of sheet piles. [5]

- Q3)** a) Explain Tremic method for construction of seal of cofferdam. [4]  
b) Describe the procedure of construction of pneumatic caisson with sketch. [5]

OR

- Q4)** a) Explain the procedure of seal construction of grout intrusion method. [5]  
b) How is the fabrication and launching of a caisson carried out? [4]

- Q5)** a) Enlist various drilling equipment and explain any one in detail. [8]  
b) Write down the selection criteria of explosives for rock excavations. [8]

OR

**P.T.O.**

- Q6)** a) Explain in detail evaluation and planning required for rock excavation. [8]  
b) Write notes on over brake control and pre-splitting. [8]

- Q7)** a) Explain how is tunneling in moderately firm rocks and ground carried out? [8]  
b) Differentiate between the classical and mining methods. [8]

OR

- Q8)** a) Discuss multistage classical method of tunnelling. [8]  
b) What is sinking caisson method? Write down its merits and demerits. [8]



Total No. of Questions : 8]

SEAT No. :

**P3043**

[Total No. of Pages : 2

[5872]-127

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

**STABILITY OF SLOPES AND EARTH DAM**

**(2017 Pattern) (501129) (Semester - II)**

**Time : 3 Hours]**

**[Max. Marks : 50**

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures 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) Explain short term and long term stability criteria for slopes. [4]  
b) State and explain criteria for design of components of earth dam. [5]

OR

- Q2)** a) Discuss the Bishop's Method for stability of slope with sketch. [5]  
b) Which factors influence the design of earth dam? [4]

- Q3)** a) Explain seepage pressure and quick sand condition with sketch. [4]  
b) What are the design considerations in seismic region for construction of earth dam? [5]

OR

- Q4)** a) How is flow net influenced by the Entry and exit conditions? [5]  
b) Explain design consideration for stability of earth dam in steady seepage condition. [4]

**P.T.O.**

**Q5)** a) Which are the different types of piezometers used in dam instrumentation? Explain any two. [8]

b) Describe the distributed fibre optics temperature instrument and joint meter. [8]

OR

**Q6)** a) Write note on objectives of instrumentation for earth dam and explain the working principle of inclinometer. [8]

b) State and explain the criteria for selection of instruments for earth dam and explain any instrument for settlement measurement. [8]

**Q7)** a) Explain the criteria for design of railway embankments for high speed trains. [8]

b) Which measures are adopted for stability of embankments of soft soil and explain the criteria for material selection as railway ballast. [8]

OR

**Q8)** a) Write notes on shotcreting and soil nailing with design criteria. [8]

b) State the various functions of geosynthetics and discuss its use as reinforcement for slopes. [8]



Total No. of Questions : 8]

SEAT No. :

**P3044**

[Total No. of Pages : 2

**[5872]-128**

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

**GEOTECHNICAL EARTHQUAKE ENGINEERING**

**(2017 Pattern)(Semister III)(601133)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q5 or Q6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate 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) What is continental drift and how does it relate to plate tectonics. [06]  
b) Explain two lab tests, for measurement of Dynamic soil properties. [07]

OR

- Q2)** a) Explain the steps for strong motion recording with the help of seismographs. [06]  
b) Explain 1-d ground response analysis. [07]

- Q3)** a) Discuss 'Effect of local site conditions' on ground motion. [06]  
b) What areas are Susceptible to liquefaction? [06]

OR

- Q4)** a) Discuss 'Development of design parameters' for ground motion. [06]  
b) Explain evaluation of liquefaction hazards. [06]

**P.T.O.**

- Q5)** a) Discuss Ground Response Analysis. [06]  
b) Explain 'Seismic slope Stability'. [06]

OR

- Q6)** a) Explain Development of deformation analysis by Goodman. [06]  
b) Describe types of earthquake which induced landslides. [06]
- Q7)** a) Explain Seismic pressure on retaining walls, with the help of diagram. [07]  
b) Discuss 'Seismic Design of Retaining wall'. [06]

OR

- Q8)** a) What are the factors affecting stability of the dam? [06]  
b) Explain Development of deformation analysis by seed approach. [07]



Total No. of Questions : 8]

SEAT No. :

**P6776**

[Total No. of Pages : 2

**[5872] - 129**

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

**RESEARCH METHODOLOGY**

**(2017 Credit Pattern) (Semester - III) (601134)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to right side indicates full marks.*
- 4) *Assume suitable data if necessary and clearly state.*

**Q1) a) Discuss elements and objectives of literature survey. [5]**

b) How do you define a research problem. Give three examples to illustrate your answer. [4]

OR

**Q2) a) Write short notes on styles of literature survey and strategies of literature survey. [5]**

b) What do you mean by research? Describe the different types of research. [4]

**Q3) a) What is hypothesis? The procedure of testing hypothesis requires a research to adopt several steps. Describe in brief all such steps. [5]**

b) What are the merits and demerits of collection of data through questionnaires? [4]

OR

**Q4) a) What are the basic concepts concerning testing of hypothesis? [5]**

b) Explain the criteria of goodness of a measurement scale. [4]

**P.T.O.**

- Q5)** a) Discuss factor analysis and discriminant analysis. [8]  
b) Write a note on the usage of ANOVA in linear regression analysis. Why do we use t-test in linear regression analysis? [8]

OR

- Q6)** a) What are the several multidimensional scaling techniques? Write short notes on significance of multidimensional scaling. [8]  
b) Differentiate descriptive statistics and inferential statistics. [8]
- Q7)** a) Discuss - Report writing is more an art that hinges upon practice and experience. Write a short note on Documentation in the context of a research report. [8]  
b) What is research paper and how to write it? [8]

OR

- Q8)** a) Explain the different steps involved in obtaining patent. Explain the difference between product patent and process patent. [8]  
b) Write short notes on the techniques of writing report and characteristics of a good research report. [8]





Total No. of Questions : 8]

SEAT No. :

**P6539**

[Total No. of Pages : 2

**[5872]-131**

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

**FLUID MECHANICS**

**(2017 Pattern) (Semester-I) (501041)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or 4, Q.5 or 6, Q.7 or Q.8.*
- 2) *Figures to the right in bracket indicate full marks.*
- 3) *Assume suitable data.*

**Q1) a)** Derive the continuity equation for one dimension flow along a stream line. **[5]**

b) Explain solution of Laplaces equation by graphical method. **[4]**

OR

**Q2) a)** Determine if flow is rotational. Determine the expression for the velocity potential in case of irrotational flow,  $u = xy^2$  and  $v=x^2y$ . **[5]**

b) Write equation of continuity in polar and cylindrical coordinates in fluid kinematics. **[4]**

**Q3) a)** Shear stress at a point 40 mm from axis of pipe is 28 pa. find wall shear stress and the rate of flow if a pipe diameter is 36 cm and viscosity of flowing fluid is 40 poise (flow is laminar) **[5]**

b) Explain boundary layer separation its effect and measures adopted to reduce the same. **[4]**

OR

**Q4)** Obtain the values of  $\frac{\delta^*}{\delta}$  and  $\frac{\theta}{\delta}$  for velocity distribution  $\frac{u}{U} = 2\eta - \eta^2$  where

$\eta$  is  $\frac{y}{\delta}$ . **[5]**

*P.T.O.*

- Q5)** a) Explain the Reynold's equation in turbulent flow. [6]  
b) Describe the statistical theory of turbulence. [6]  
c) Water flows through a rough pipe of 25 mm. [6]

The centre line velocity and velocity at radial distance of 6.25 mm and 2.3 m/s and 2.1 m/s respectively. Find the discharge and pipe roughness.

OR

- Q6)** a) Rough plastic pipe has diameter of 0.75 m and length of 500m carries water with velocity of 2.5 m/s. This pipe has a absolute roughness of 0.30mm. Determine the head lost if the flow through pipe is turbulent Take viscosity  $10^{-6} \text{m}^2/\text{s}$ . [6]  
b) Distinguish between isotropic turbulence and homogenous turbulence.[6]  
c) Explain the probability density function. [6]

- Q7)** a) Explain density and pressure in terms of Mach number. [8]  
b) What are governing equations in compresible flow ? write with usual notations. [8]

OR

- Q8)** a) Compare laminar and turbulent flow and state the energy equation with assumptions. [8]  
b) Explain the normal shock in compressible flow. Give example of compressible flow. [8]



Total No. of Questions : 8]

SEAT No. :

**P3045**

[Total No. of Pages : 2

**[5872]-132**

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

**IRRIGATION & DRAINAGE ENGINEERING**

**(2017 Credit Pattern) (Semester-I) (501042)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6: and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicates full marks.*
- 4) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Classify the irrigation methods and state the factors affecting the choice of irrigation methods. [6]
- b) Explain the following. [6]
- i) Factors affecting irrigation scheduling?
  - ii) Irrigation efficiencies for economical use of water.

OR

- Q2)** a) How to do cost benefit analysis for micro irrigation? [6]
- b) Write short notes on [6]
- i) Method widely used in India for the computation of consumptive use?
  - ii) Soil moisture and crop water relationship.

- Q3)** a) What do you mean by sprinkler irrigation? Describe the components of sprinkler irrigation systems. [8]
- b) Explain benefits and limitations of drip irrigation systems. [6]

OR

- Q4)** a) Describe in brief the following. [8]
- i) Elements, general concepts of lift Irrigation schemes, its advantages, and disadvantages.
  - ii) Operations and maintenance of drip irrigation system.

**P.T.O.**

- b) Explain sprinkler system considering the following points: [6]
- i) Criteria for system layout
  - ii) Selection of sprinkler and its spacing
  - iii) Discharge capacity of the pump
  - iv) Hydraulic design of sprinkler head
  - v) Main and
  - vi) Lateral pipe sizes

- Q5)** a) Illustrate the various soil conservation techniques, what factors would you consider to apply specific techniques for specific cause? [6]
- b) Compare water erosion and wind erosion. [6]

OR

- Q6)** a) Explain following: [6]
- i) Reclamation of saline and alkaline soils
  - ii) leaching and salinity control of soil
- b) How soil conservation is achieved by following methods. [6]
- i) Constructing Dams
  - ii) Changing Agricultural Practices.

- Q7)** a) Describe water logging of agricultural lands. [6]
- b) Explain the following: [6]
- i) Transient designs of surface drainage systems
  - ii) Drainage by wells

OR

- Q8)** a) What are the reasons of soil erosion and what the measures of its conservation [6]
- b) Illustrate the following;
- i) Need and purpose of drainage
  - ii) Difference between surface and sub-surface drainage systems. [6]



Total No. of Questions : 8]

SEAT No. :

**P6540**

**[5872]-133**

[Total No. of Pages : 3

**M.E. (Civil) (Hydraulics Engineering)**  
**PLANNING AND MANAGEMENT OF WATER RESOURCES**  
**(2017 Pattern) (Semester - I) (501043)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *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 - how surface water and ground water resources are estimated in India. **[5]**

b) Explain spatial and temporal scales for planning and management of water resources. **[4]**

OR

**Q2) a)** Write a short note on - Reclamation and Reuse of Water. **[5]**

b) Explain aspects of water resources planning and management with reference to - **[4]**

- i) Technical aspect,
- ii) Economical and financial aspect,
- iii) Institutional Aspects

**Q3) a)** Explain in brief different methods of sediment yield determination. **[5]**

b) Explain in detail how to estimate the ground water runoff from a watershed. **[4]**

OR

**Q4) a)** Explain - general approach for capacity estimation of an impounding reservoir. **[5]**

b) Write a short note on-single purpose multi reservoir system. **[4]**

**P.T.O.**

- Q5) a)** Three alternative plans for expanding a water resource project are given in the following table. Each plan has a project life of 30 years. [8]

Plan	Initial investment (Rs)	Annual OMR cost (Rs)
A	12,000,000	2,800,000
B	16,000,000	2,400,000
C	29,000,000	1,000,000

Using present worth method, select the economically optimum plan for a discount rate of 8%.

- b) Explain how to compute water demand for: [8]
- i) Community water use
  - ii) Agricultural water use
  - iii) Industrial water use

OR

- Q6) a)** Write a short note on - cost allocation in multipurpose projects. [8]

- b) Solve Q.5 a using annual worth method. [8]

- Q7) a)** Flood protection can be achieved by constructing storage reservoirs, by improving flood carrying capacity of the channel, or by constructing levees. The initial costs, OMR costs, and annual benefits for all these methods of their combinations are given in the following table: [9]

Details of different flood control measures

Flood control measure	Initial cost (Rs)	OMR cost (Rs/yr.)	(Annual benefits) (Rs/Yr.)
Reservoir (A)	50,000,000	500,000	5,000,000
Channel improvement (B)	20,000,000	2,000,000	4,000,000
Levees (C)	30,000,000	3,000,000	3,000,000
A+B	-	-	10,000,000
B+C	-	-	8,500,000
C+A	-	-	9,000,000
A+B+C	-	-	14,000,000

The costs are mutually exclusive at each site. Assuming the project life of 50 years and an interest rate of 3%; using the benefit-cost ratio method, rank the projects or combinations in order of preference.

- b) Explain following discounting factors: [7]
- i) Single payment factors
  - ii) Uniform annual series factors
  - iii) Uniform gradient-series factors

OR

- Q8)** a) An irrigation system has three alternative designs. Each design consists of a pump and pipes. The pump has an expected life of 10 years and no salvage value. The piping system has an expected life of 30 years and no salvage value. The optimum alternative depends on the amount of water pumped each year to irrigate the land. Cost estimates for the three alternative system designs are given in the following table. Determine the range in the amount of water pumped for which each alternative would be economically optimum, based on a discount rate of 8%. [9]

Details of three alternative design for an irrigation system.

Alternative	A	B	C
Initial pump cost (Rs)	75,000	150,000	300,000
Initial piping cost (Rs)	150,000	150,000	225,000
Annual maintenance cost (Rs/yr.)	60,000	45,000	30,000
Pumping cost per 1000 m <sup>3</sup> (Rs)	60	45	30

- b) Write a short note on: [7]
- i) Appraisal criteria,
  - ii) Inter-basin transfer of water



Total No. of Questions : 6]

SEAT No. :

**P6541**

[Total No. of Pages : 2

**[5872]-134**

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

**DAMENGINEERING**

**(2017 Pattern) (Semester - I) (501044)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) With help of equations, write design steps to design gravity dam. [8]  
b) Derive the equation for most optimum angle for an arch dam to have minimum volume of concreting. [8]

OR

- Q2)** a) With the help of neat figure of a flow net, derive the equation for seepage from flow net of an earthen dam. [8]  
b) What is rockfil dam? In what aspects, it is different than earth dam? With the help of figure, explain principal parts of rockfill dam. [8]

- Q3)** a) What are different key levels and different types of heads associated with design of spillway? Explain with help of neat sketch and equations. [8]  
b) Explain in detail : How the hydrostatic pressure is distributed by radial gate? [8]

OR

- Q4)** a) Differentiate between Chute Spillway and Ogee Spillway on the basis of site condition, energy dissipation, hydraulic design and relative advantages. [8]  
b) When the buckets are preferred as energy dissipation device? What are the different types of buckets? [8]

*P.T.O.*



- Q5) a)** What is structural Health Monitoring of dam? How it is achieved? [9]  
b) Explain various instrument data systems in dam instrumentation. [9]

OR

- Q6) a)** What are the parameters to be considered while selection of dam instruments? [9]  
b) Explain function & working principle of distributed fiber optics temperature tool. Also, draw a sketch. [9]



Total No. of Questions : 8]

SEAT No. :

**P3046**

[Total No. of Pages : 2

[5872]-135

**M.E. (Civil) ( Hydraulics)**  
**OPEN CHANNEL HYDRAULICS**  
**(2017 Pattern) (Semester - II) (501047)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *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) Write short note on: [5]**

- i) Specific energy.
- ii) Critical flow and conditions.

**b) Derive equation for hydraulic jump in slopping rectangular channel. [4]**

OR

**Q2) a) For a constant specific energy of 2.1 N.m/N, calculate the maximum discharge that may occur in a rectangular channel 5 m wide. [4]**

**b) Discuss classification of hydraulic jump based on tail water depth. [5]**

**Q3) a) Draw M3, S1 and S2 profiles and discuss them in detail. [5]**

**b) State assumptions and derive spatially varied flow with decreasing discharge. [4]**

OR

**Q4) a) Explain in detail standard step method in gradually varied flow analysis.[4]**

**b) A mountainous stream carries a discharge of 8 m<sup>3</sup>/s. At a location where the cross-section is rectangular with a depth of 0.2 m and width of 14 m, a Trench weir type intake is proposed to divert the flow. The rack is made of circular bars with diameter to spacing ratio of 1.04 giving an opening ratio of 0.49. The rack is of longitudinal parallel-bar-rack type. Estimate the minimum length of the rack required to completely divert the flow. A blockage by debris to an extent of 50% of rack opening can be assumed. [5]**

**P.T.O.**

- Q5) a)** Explain in detail concept of uniformly progressive wave. [8]  
**b)** A negative wave of height 0.75 m is produced in a rectangular channel due to the sudden lifting up of a gate. The initial dept upstream of the gate is 3.0 m. [8]  
 i) Determine the discharge per unit width through the gate and the profile of the negative wave at 4.0 s after the gate is opened.  
 ii) What will be the discharge if the gate is lifted up by 2.0 m?

OR

- Q6) a)** A sluice gate in a rectangular channel of width B is suddenly raised from a closed position. A negative wave produced by this action travels upstream. If  $h_0$  = drawdown at the gate any  $y_1$  = initial depth upstream of the gate, show that the discharge  $Q_0$  through the gate is given by:

$$\frac{Q_0}{B\sqrt{gy^3}} = 2 \left[ 1 - \frac{h_0}{y_1} \right] \left( 1 - \sqrt{1 - \frac{h_0}{y_1}} \right) \quad [9]$$

- b)** A rectangular channel carries a discharge of 1.5 m<sup>3</sup>/s per mere width at a depth of 0.75 m. If the sudden operation of a sluice gate at an upstream section causes the discharge to increases by 33 per cent, estimate the height and absolute velocity of the positive surge in the channel. [7]
- Q7) a)** Define the problem of level pool routing. Describe a commonly used method of reservoir routing. [8]  
**b)** Route the following flood hydrograph through a river reach for which Muskingum coefficients  $K = 8 h$  and  $x = 0.25$ . [8]

Time (h)	0	4	8	12	16	20	24	28
Inflow (m <sup>3</sup> /s)	8	16	30	30	25	20	15	10

OR

- Q8) a)** Explain briefly: [7]  
 i) Isochrone,  
 ii) Time of concentration,  
 iii) Linear reservoir,  
 iv) Linear channel.
- b)** A small reservoir has the following storage elevation relationship. [9]

Elevation (m)	55	58	60	61	62	63
Storage (10 <sup>3</sup> m <sup>3</sup> )	250	650	1000	1250	1500	1800

A spillway provided with its crest at elevation 60.00 m has the discharge relationship  $Q=15H^{3/2}$ , where H = head of water over the spillway crest. When the reservoir elevation is at 58.00 m a flood as given below enters the reservoir. Route the flood and determine the maximum reservoir elevation, peak outflow and attenuation of the flood peak.

Time (hr)	0	6	12	15	18	24	30	36	42
Inflow (m <sup>3</sup> /s)	5	20	40	60	50	32	22	15	10

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Total No. of Questions : 8]

SEAT No. :

**P3047**

[Total No. of Pages : 2

[5872]-138

**M.E. (Civil) (Hydraulic Engineering)  
Optimization Techniques  
(2017 Credit Pattern) (Semester-III) (601051)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures 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 Non programmable electronic pocket calculator is allowed.*

**Q1)** Use the Two-phase Simplex method to,

**[14]**

$$\text{Maximize } Z = 3x_1 + 2x_2 + 2x_3.$$

$$\text{Subject to } 5x_1 + 7x_2 + 4x_3 \leq 7,$$

$$-4x_1 + 7x_2 + 5x_3 \geq -2,$$

$$3x_1 + 4x_2 - 6x_3 \geq 29/7,$$

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

OR

**Q2)** Solve by dual simplex method the following problem.

**[14]**

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

$$2x_1 + 3x_2 + 5x_3 \geq 2, \quad 3x_1 + x_2 + 7x_3 \leq 3, \quad x_1 + 4x_2 + 6x_3 \leq 5, \quad x_1, x_2, x_3 \geq 0.$$

**Q3)** Solve the non-linear programming problem given below:

**[12]**

$$\text{Optimize } Z = x_1^2 + x_2^2 + x_3^2,$$

$$\text{subject to } x_1 + x_2 + 3x_3 = 2,$$

$$5x_1 + 2x_2 + x_3 = 5,$$

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

OR

**P.T.O.**

**Q4)** Minimize

$$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1 \cdot x_2 + x_2^2$$

starting from the point  $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ . Use Newtons Method. [12]

**Q5) a)** Explain in detail characteristics of Dynamic Programming. [6]

b) Discuss the procedure adopted in the analysis of Dynamic programming problems. [6]

OR

**Q6)** Use the Dynamic programming to solve the following L.P.P. [12]

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

$$\text{subject to } x_1 \leq 4,$$

$$x_2 \leq 6,$$

$$3x_1 + 2x_2 \leq 18,$$

$$x_1, x_2 \geq 0.$$

**Q7)** There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing time in hours are given as:

Job	1	2	3	4	5	6	7
Machine A	3	12	15	6	10	11	9
Machine B	8	10	10	6	12	1	3

Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machines A and B. [12]

OR

**Q8)** Reduce the following game by dominance and find the game value. [12]

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8



Total No. of Questions : 8]

SEAT No. :

**P3048**

[Total No. of Pages : 2

[5872]-139

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

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester-III) (601052)**

*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 or Q.8.
- 2) Figures to the right side indicate full marks.

**Q1) a) Explain various types of research. [5]**

b) What is the need of literature survey? Explain. [4]

OR

**Q2) a) Explain the process of research. [5]**

b) What are the sources of literature in research? Explain [4]

**Q3) a) Write a note on data collection for research. [5]**

b) Explain variance technique. [4]

OR

**Q4) a) What are the methods of data collection? Explain. [5]**

b) What do you mean by testing of hypothesis? [4]

**Q5) a) Explain with an example Correlation and regression analysis. [8]**

b) Explain multidimensional measurement and factor analysis. [8]

OR

*P.T.O.*

**Q6) a)** What do you mean by discriminant analysis? Explain. [8]

b) What do you mean by Cluster analysis? Explain. [8]

**Q7) a)** Explain the need of effective documentation and report writing. [8]

b) Explain the points to be considered in writing, presenting and publishing of a research paper. [8]

OR

**Q8) a)** Write a note on plagiarism and presentation styles. [8]

b) Write a note on elements of effective presentation and impact of presentation. [8]



Total No. of Questions : 8]

SEAT No. :

**P3049**

[Total No. of Pages : 2

[5872]-141

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

**Theory of Elasticity and Plasticity  
(2017 Pattern) (Semester-I)(501001)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right bracket indicate full marks.
- 4) Assume suitable data, if necessary and clearly state.

**Q1) a)** Obtain the strain displacement relations for the six independent strain components in an elastic body. **[05]**

b) Obtain differential equations of equilibrium in polar coordinates. **[04]**

OR

**2) a)** Show that the differential equation of equilibrium in polar coordinates for a two dimensional (2D) plane stress problem are **[05]**

$$\frac{\partial \sigma_r}{\partial r} + \frac{1}{r} \frac{\partial \sigma_{r\theta}}{\partial \theta} + \frac{\sigma_r - \sigma_\theta}{r} = 0$$

$$\frac{1}{r} \frac{\partial \sigma_\theta}{\partial \theta} + \frac{\partial \tau_{r\theta}}{\partial r} + \frac{2\tau_{r\theta}}{r} = 0$$

b) Define plane stress and plane strain. Find the strain components for plane strain in polar coordinates. **[04]**

**Q3) a)** Obtain the differential analogous methods used for solving torsion problems. Explain Prandtl's Theory of solid sections. **[05]**

b) Explain with examples the axisymmetric problems. Hence write down the corresponding basic equations of equilibrium, compatibility and strain displacement relations. **[04]**

OR

*P.T.O.*



**Q4) a)** Derive the St. Venant's formula of general torsion for non circular section. where  $\gamma_{xy} = -ky$  and  $\gamma_{yz} = kx$ . Assume St. Venant's warping function as  $\psi(x, y)$  and displacement components w is independent of z. [05]

b) State the membrane analogy for torsion of a thin walled structures. [04]

**Q5) a)** Explain Mohr's theory of yielding and Tresca's associated flow rule. [08]

b) Explain in brief Prandtl-Reuse equation and Saint Venant-Von Mises equations. [08]

OR

**Q6) a)** State the comparison of maximum shear and distortion - energy theories for plane stress. [08]

b) State the uniqueness theorem for small plastic-elastic deformations. [08]

**Q7) a)** Discuss the phenomena of stress concentration, and also explain the successive stages of plastic yielding of rectangular beams. [08]

b) Derive the equation of radial and tangential stress in plastic zones for thick walled cylinders under internal pressures considering elasto-plastic behavior. [08]

OR

**Q8) a)** Prove that for thick walled cylinders subjected to internal and external pressure as per Lamé's theory under plane stress conditions. [08]

$$\sigma_r = \frac{p_a \cdot a^2 - p_b \cdot b^2}{b^2 - a^2} - \frac{a^2 b^2}{r^2} \cdot \frac{p_a - p_b}{b^2 - a^2}$$

$$\sigma_\theta = \frac{p_a \cdot a^2 - p_b \cdot b^2}{b^2 - a^2} + \frac{a^2 b^2}{r^2} \cdot \frac{p_a - p_b}{b^2 - a^2}$$

Where  $\sigma_r$  and  $\sigma_\theta$  are radial and tangential stress respectively, a and b is the internal and external radius respectively, and  $P_a$  and  $P_b$  is the internal and external pressures respectively.

b) write a short note on ideally plastic solids of ductile and brittle materials with an suitable diagram. [08]



Total No. of Questions : 8]

SEAT No. :

**P3050**

[Total No. of Pages : 2

[5872]-142

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

**STRUCTURAL DYNAMICS**

**(2017 Pattern) (Semester-I) (501002)**

*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 or Q.8.
- 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)** Explain with suitable examples the different types of damping. How are they modelled? **[9]**

OR

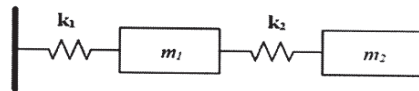
**Q2)** Derive the equation for logarithmic decrement. **[9]**

**Q3)** A SDOF system is subjected to a forced excitation. Derive the solution considering damping present in the system. **[9]**

OR

**Q4)** What is force transmissibility? Derive the expression for it. **[9]**

**Q5) a)** Determine the mode shapes for the system shown in Fig1. **[8]**



**Fig. 1**

**b)** What are Eigen values and Eigen vectors? Explain with a suitable example. **[8]**

OR

*P.T.O.*

**Q6) a)** Derive the expression for Eigen vectors for a three-storied building subjected to base excitation. [8]

b) Plot the mode shapes for the system shown in Fig. 2. [8]

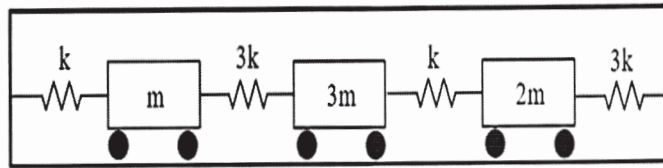


Fig. 2

**Q7) a)** Derive the equation of motion for transverse vibration of beam. [8]

b) Find the natural frequencies and the free-vibration solution of a bar fixed at both ends. [8]

OR

**Q8) a)** Derive the expression for natural frequency for a beam element using Rayleigh's method. [8]

b) Determine the fundamental frequency of a cantilever beam using the Rayleigh's method. [8]



Total No. of Questions : 8]

SEAT No. :

**P3051**

**[5872]-143**

[Total No. of Pages : 2

**M.E. (Civil) (Structure)**

**ADVANCED DESIGN OF STEEL STRUCTURES**

**(2017 Pattern) (Semester - I) (501003)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *IS : 800 - 2007, IS : 800 - 1984, IS:801, IS:802, IS:811, SP-34 and Nonprogrammable calculator.*

- Q1)** a) Write down the guideline for web openings and stiffeners for castellated beams. **[3]**
- b) The design factored forces coming in member of a hording structure are 200 kN tensile force, and 150 kN compressive force. Design a double unequal angle section back to back on opposite faces of 8 mm thick gusset plate with M20 black bolt of 4.6 grade of steel. Take length of member as 3m c/c. Draw the design sketch. **[6]**

OR

- Q2)** a) Write a short note on Connection for tabular members. **[3]**
- b) A tabular column hinged at both ends has the outside diameter of the tube 129.1 mm and is of heavy gauge (i.e @31 kg/m). The length of the column is 4.5m. Determine the safe load the column can carry if the column is of IS 1161grade ST 32 steel. **[6]**
- Q3)** a) Draw figures and explain XBX bracings, K bracings and W bracings. **[3]**
- b) Define stiffened element, flat-width ratio and effective design width for cold formed light gauged section. **[6]**

OR

**P.T.O.**

- Q4)** a) Define tower and state difference between Transmission tower and Microwave tower. [3]
- b) A light gauge steel rectangular box section 200mm×100mm×2.0mm is used for a column. The effective length of column is 3.6m. Determine the safe load carrying capacity of the section. Take basic design stress  $\sigma_b$  as 125N/mm<sup>2</sup>. [6]
- Q5)** a) Explain how the height and other dimensions of a steel chimney are determined. [8]
- b) What forces act on the base plate of steel chimney? Explain the design procedure of base plate. [8]

OR

- Q6)** a) How is stability analysis carried out for a steel chimney? [8]
- b) A steel chimney of 65 m height and cylindrical diameter 2.5m is to be erected in Pune. Determine the diameter of flared portion, height of flared portion and design the plates for the steel chimney. [8]
- Q7)** a) A steel chimney of 72 m height and the diameter of cylindrical shell is 3m. The moment at the base of chimney is 8830kNm and the weight of chimney shell is 756kN. It has a 100mm thick lining brick lining. Design base Plate and Anchor bolt. [8]
- b) State and explain different lining materials for chimney. [8]

OR

- Q8)** a) Explain step-by-step design procedure of base plate and anchor bolts for a chimney. [16]



Total No. of Questions : 8]

SEAT No. :

**P3052**

[Total No. of Pages : 3

[5872]-144

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

**NUMERICAL METHODS IN STRUCTURAL ENGINEERING**

**(2017 Pattern) (Semester - I) (501004)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

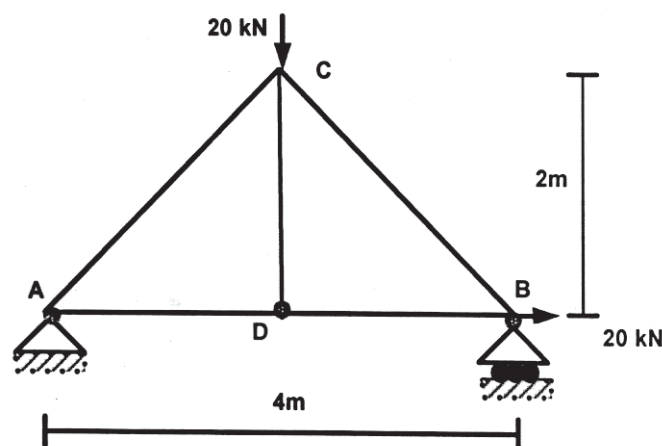
- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *If necessary, assume suitable data and indicate clearly.*
- 4) *Use of electronic pocket calculator is allowed.*

**Q1) a)** Analyse a fixed beam of span 6m subjected to uniformly distributed load of 6kN/m along with a central point load of 20 kN. Use stiffness method for analysis. **[5]**

b) Write short note on Choleski's factorization method. **[4]**

OR

**Q2) a)** Using Direct Stiffness method, analyze the truss shown in the Figure. Find the joint displacements and support reactions. Take  $AE = 4000$  kN for vertical members and 5000 kN for remaining members. **[5]**



b) Explain the partial pivoting technique in Gauss Elimination method. **[4]**

*P.T.O.*

**Q3) a)** Explain the one point and two Gauss Quadrature rule of Integration. Integrate  $f(x) = 4x^3 - 4x - 5$  from  $-2$  to  $5$  using Gauss Quadrature formula. [5]

b) A pair of simultaneous equations are given as follows [4]

$$dy/dx = z ; y(0) = 0$$

$$dz/dx = y * z + x^2 + 1 ; z(0) = 0$$

Find  $y(0.2)$ ,  $z(0.2)$  using numerical method of your choice.

OR

**Q4) a)** Given  $dy/dx = x^2 - y + 2$ . At  $x = 0$ ,  $y = 1$ . Calculate the value of  $y$  at  $x = 0.1$  and  $0.2$  using an interval of  $0.1$ . Use Euler method. [5]

b) When the values of  $y$  at values of  $x$  at uniform interval are known, state how the area under the curve is to be calculated using Simpson's rule and Gauss Quadrature. [4]

**Q5) a)** For the fixed beam shown in figure, apply central difference formula dividing the beam in four equal parts and find the deflection at nodal points, and moment at fixed ends. [8]



b) A simply supported uniform square plate of length  $1.5$  m supports a central point load of  $12$  kN along with uniformly distributed load  $3$  kN/m<sup>2</sup> over the entire plate. Using finite difference method, estimate the deflection at the nodal points of the grid, dividing the plate into nine parts. [8]

OR

**Q6) a)** Using finite difference method, estimate the buckling load of a pin ended column of length  $L$  and uniform cross section. Consider four subinterval and compare the approximate value obtained with the exact value given by Euler's critical load theory. [8]

b) Explain in detail (step wise) the finite difference technique to obtain the maximum deflection of simply supported square plate of size 'a' subjected to a central point load. [8]

**Q7) a)** Find the least square linear fit for the given data. [8]

x	1.5	1	2.8	0.4	1.3	2.0
y	4.0	3.3	6	2.4	3.3	5

b) Write a short note on curve fitting techniques. [8]

OR

**Q8) a)** Find a quadratic polynomial that fits the following data. [8]

x	-4	-2	0	2	4
y = f(x)	2	1	1	1	2

b) Find the cubic splines for the following table of values [8]

x:	1	2	3	4
y:	1	4	12	6

Hence evaluate  $y(1.5)$  and  $y(3)$ .





Total No. of Questions : 8]

SEAT No. :

**P6542**

[Total No. of Pages : 2

[5872]-145

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

**FINITE ELEMENT METHOD**

**(2017 Pattern) (Semester-II) (501007)**

*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 or Q.8.
- 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) a)** Solve using collocation method, the differential equation governing a physical phenomenon as **[5]**

$$\frac{d^2 y}{dx^2} + 4y = 12 \text{ for } 0 \leq x \leq 1, \text{ boundary conditions are } y(0)=2.1 ; y(1)=1.1$$

Assume trial function :  $y=3-2x-a(x^2-x)$ . Use Collocation point as  $1/3$  and find the answer at  $x=2/3$ .

b) Explain the variational approach for formulation of element stiffness matrix for truss. **[4]**

OR

**Q2) a)** Write a note on significance of strong and weak formulation in Finite element analysis. **[4]**

b) A CST element has coordinates (10, 08), (30, 08), and (30, 32). Hence derive the shape functions and hence strain displacement matrix for CST element using area coordinates. **[5]**

**Q3) a)** What is Lagrangian Polynomial? Using this, determine and plot the shape functions of four noded rectangular element in natural coordinate system. **[4]**

b) For a quadrilateral element for plane stress condition the strain displacement matrix is found to be **[5]**

$$B = \frac{1}{2} \begin{bmatrix} -0.4 & 0 & 0.4 & 0 & 0.4 & 0 & -0.4 & 0 \\ 0 & -1 & 0 & -1 & 0 & 1 & 0 & 1 \\ -3 & -1 & -3 & 1 & 3 & 1 & 3 & -1 \end{bmatrix},$$

and the displacements of an quadrilateral element is found primarily as  $u=[0 \ 0 \ 0.002 \ 0 \ 0.005 \ 0.006 \ 0 \ 0]^T$  in m.

Determine the elemental stresses, if  $E=200$  GPa,  $\mu=0.3$

OR

**P.T.O.**

**Q4)** a) A four noded element has coordinates (1,1), (3,0) (3.5, 2.5) (2,3)  
Determine the Jacobian matrix and its value at (1.3, 1.5) [5]

b) For a plane elasticity problem, derive the strain displacement matrix for the rectangular 2D-6 noded serendipity element. [4]

**Q5)** a) State the salient features shear deformation theory with reference to finite element analysis. Explain shear locking phenomenon. [8]

b) Explain the Mindlin's plate element and briefly explain the formulation of stiffness matrix. [8]

OR

**Q6)** a) Explain the convergence requirements of displacement functions. Write a note on conforming and non-conforming elements with reference to plate elements. [8]

b) Derive the stiffness matrix for ACM or BFS plate bending element [8]

**Q7)** a) For axisymmetric element, write constitutive relations and hence obtain the element stiffness matrix for a typical triangular element for its application in solving a problem of cylinder subjected to internal pressure. [8]

b) How will you differentiate shell element in comparison with plate element. Write the strain displacement matrix for the curved shaped element. [8]

OR

**Q8)** a) Explain how axi-symmetric problems can be analyzed using axi-symmetric elements in Finite element method. [8]

b) i) Explain in detail 'Flat elements' in Finite element analysis. [8]

ii) Write the displacement field for 4 noded degenerated shell element.



Total No. of Questions : 8]

SEAT No. :

**P3053**

**[5872]-146**

[Total No. of Pages : 2

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

**THEORY OF PLATES AND SHELLS  
(2017 Pattern) (Semester-II) (Credit) (501008)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side 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) Explain the classification of plate according to the aspect ratio. Also draw the detail sketch of bending moment, axial force and torsional moment acting on plate. [5]
- b) Differentiate Navier's and Levy's method for the analysis of thin plate. [4]

OR

- Q2)** a) Explain small deflection theory of thin plates assumptions. [5]
- b) Describe in brief shear deformation theory and write the displacement function of Reissener - Mindlin theory. [4]

- Q3)** a) Derive the governing differential expression for circular plate using the first principal in polar coordinate. [5]
- b) State and explain classification of shells on geometry with suitable sketches. [4]

OR

- Q4)** a) Derive the equilibrium equation for  $N_x$ ,  $N_\phi$  and  $N_x \phi$  in circular cylindrical shell using membrane theory. [5]
- b) State and explain moment curvature relations for circular plate. [4]

- Q5)** a) Derive equilibrium equation for circular cylindrical shell using membrane and bending theory. [8]
- b) Differentiate membrane and bending theory for circular cylindrical shell. [8]

OR

*P.T.O.*

- Q6)** a) State the application of membrane theory to pipe and hence derive an expression for  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$ . [8]  
b) State and explain various boundary conditions for circular cylindrical shells. [8]

- Q7)** a) Explain in brief beam method of analysis for cylindrical shells and applications to cylindrical roof shells. [8]  
b) Explain in details arch analysis for cylindrical shells. [8]

OR

- Q8)** a) State and explain Lundgren's beam theory with its application to analysis of shells. [8]  
b) Explain in details beam analysis for cylindrical shells. [8]



Total No. of Questions : 8]

SEAT No. :

**P3054**

[Total No. of Pages : 2

[5872]-147

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

**ADVANCE DESIGN OF CONCRETE STRUCTURES**

**(2017 Pattern) (Semester - II) (501009)**

**Time : 3 Hours]**

**[Max. Marks : 50**

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use IS 456, IS 1343, IS 1893, IS 3370 and Non-programmable calculator.

- Q1)** a) Explain Assumptions in Yield line Theory. **[4]**  
b) Design a grid slab for a floor of hall 12m×15m having a square grid of 1.5m. Use M20 and Fe 415 steel. Take live load 6kN/m<sup>2</sup> and floor finish load 1.4kN/m<sup>2</sup>. **[5]**

OR

- Q2)** a) Draw yield line pattern for: An Equilateral triangular slab fixed at two sides and unsupported at third side. **[4]**  
b) Design a grid slab for a floor of Auditorium hall 14m×16m having square grid of 2m. Take live load 5kN/m<sup>2</sup> and floor finish load 1.3kN/m<sup>2</sup>. Use M20 and Fe 415. **[5]**

- Q3)** a) Enlist the advantages and disadvantages of flat slab. **[4]**  
b) An open square tank 6m×6m×3m deep and supported 6m above the ground level on beams and columns. Design the beam and column of a tank. Use M20 and Fe 500 steel. **[5]**

OR

- Q4)** a) Explain in detail wind load analysis of column for a water tank supported on four identical columns with their lower end fixed to the base and braced at intermediate level. **[4]**  
b) Design a interior panel of flat slab for flexure with panel size 5.75m×5.75m in dimensions. Take live load of 5 kN/m<sup>2</sup> and floor finish load of 1.3kN/m<sup>2</sup>. Use M20 and Fe 500. **[5]**

**P.T.O.**

- Q5)** a) Design a circular bunker to store 50 tons of coal for the following. Density of coal =  $16 \text{ kN/m}^3$ , angle of repose is  $29^\circ$ . Use M25 and Fe 500 steel. Draw the details of reinforcement in side wall and hopper. [8]
- b) A concrete bin is  $3.5\text{m} \times 3.5\text{m}$  and contains wheat weighing  $9.45\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.43 and the coefficient of friction between grain and concrete is 0.41. If the depth of wheat is 5m, determine the lateral pressure per meter run of the bin wall. [8]

OR

- Q6)** a) Design a square bunker to store 500kN furnace slag. Unit weight of slag is  $8500 \text{ N/m}^2$ . Angle of repose is  $22^\circ$ . Use M25 and Fe 500. Draw reinforcement details for side walls and hopper bottom. [8]
- b) A concrete bin is  $4\text{m} \times 4\text{m}$  and contains wheat weighing  $10\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.45 and the coefficient of friction between grain and concrete is 0.38. If the depth of wheat is 4m, determine the lateral pressure per meter run of the bin wall. [8]
- Q7)** a) A group of 30 piles are arranged in 6 rows and 5 in each row. The piles are 300mm in diameter and spaced 0.9m center to center. Each pile can carry 300kN load if it can act independently. Determine the carrying capacity of the pile group. [8]
- b) Design a formwork for a slab of  $4\text{m} \times 4\text{m}$  having thickness of 180mm. It is proposed to deposit concrete in one stage. [8]

OR

- Q8)** a) In a group of 16 piles of diameter 350mm and center to center spacing of pile being 1m. The piles are arranged in square area. Each pile is 12m long and taking  $m= 0.7$  and  $c=50\text{kN/m}^2$ . Ascertain whether the failure will occur with the piles acting individually or as a group. Also specify the failure load. [8]
- b) Design a raft foundation for the following center to center distance of column in both directions is 2.2m. Taking column size as  $350\text{mm} \times 350\text{mm}$ , working load on each column is 500kN. The depth of strata is 1.4m. Use M25 and Fe500, SBC  $120\text{kN/m}^2$ . Draw reinforcement details. [8]



Total No. of Questions : 8]

SEAT No. :

**P3055**

[Total No. of Pages : 2

[5872]-148

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

**RESEARCH METHODOLOGY**

**(2017 Pattern)(Semester-III)(601013)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

**Q1)** a) Discuss in brief the need of a research report. [4]

b) Explain the technique in defining a research problem. [5]

OR

**Q2)** a) Explain why research is important to decide a economic system of a country. [4]

b) Identify the ethical issues related to interpretation and reporting a research problem. [5]

**Q3)** a) Enlist different types of sample designs and explain probability sampling. [4]

b) why should the data collected for research must be checked for reliability, suitability and adequacy? [5]

OR

**Q4)** a) Explain the importance of good literature review. [4]

b) Write a note on “Rating scales as a Sampling technique” with example. [5]

**Q5)** a) Enlist different hypothesis testing methods. Explain any two methods. [8]

b) Write a detail note on “Agglomerative clustering: Combining Clusters and using SPSS” with suitable example. [8]

OR

*P.T.O.*

- Q6)** a) What is Chi-Square test? Discuss the important characteristic of Chi-Square test. [8]
- b) What is T-test? When it is used and for what purpose? Explain with examples. [8]
- Q7)** a) Write down the characteristics of good Abstract, Introduction, Research Methods and Research Methodology. [8]
- b) Write a research proposal for a suitable research problem (For 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 context of: Current status, objectives, methodology, year-wise plan. [8]

OR

- Q8)** a) Discuss the important points to be considered during presenting a research idea. Also write a note on how to do patenting of a research idea. [8]
- b) Write a research proposal for a suitable research problem (For any problem related to Structural 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 context of: Current status, objectives, methodology, year-wise plan. [8]





Total No. of Questions : 8]

SEAT No. :

**P3056**

[Total No. of Pages : 3

[5872]-149

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

**ANALYSIS AND DESIGN OF EARTHQUAKE RESISTANT  
STRUCTURES**

**(2017 Pattern) (Semester-III) (601014)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4. Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side 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. is 1893 is allowed.

- Q1)** a) Can earthquakes be predicted? [5]  
b) Describe with neat figure. [4]  
i) Seismic waves  
ii) Epicenter  
iii) Hypocenter of Focus

OR

- Q2)** a) What is the relationship between volcanoes and earthquakes? [5]  
b) Explain concept of stiffness, flexibility and ductility in earthquake design.[4]

- Q3)** a) Explain effects of irregularity and architectural planning for earthquake resistant design. [5]  
b) Describe with neat figure oceanic-continental convergence. [4]

OR

- Q4)** a) What is mean duration of earthquake? [5]  
b) Describe with neat figure divergent boundaries. [4]

- Q5)** a) Define code based procedure for seismic analysis. [9]  
b) Explain detailing of beams as per IS code provisions. [7]

OR

*P.T.O.*

- Q6) a)** The shear wall is of length 4.16m and thickness 250 mm. it is subjected to the following forces. Design the shear wall. Take  $F_{ck}=25 \text{ N/mm}^2$ ,  $f_y=415 \text{ N/mm}^2$  [10]

Loading	Axial force (kN)	Moment(kN-m)	Shear (kN)
DL+LL	2340	720	24
Seismic loading	300	5760	840

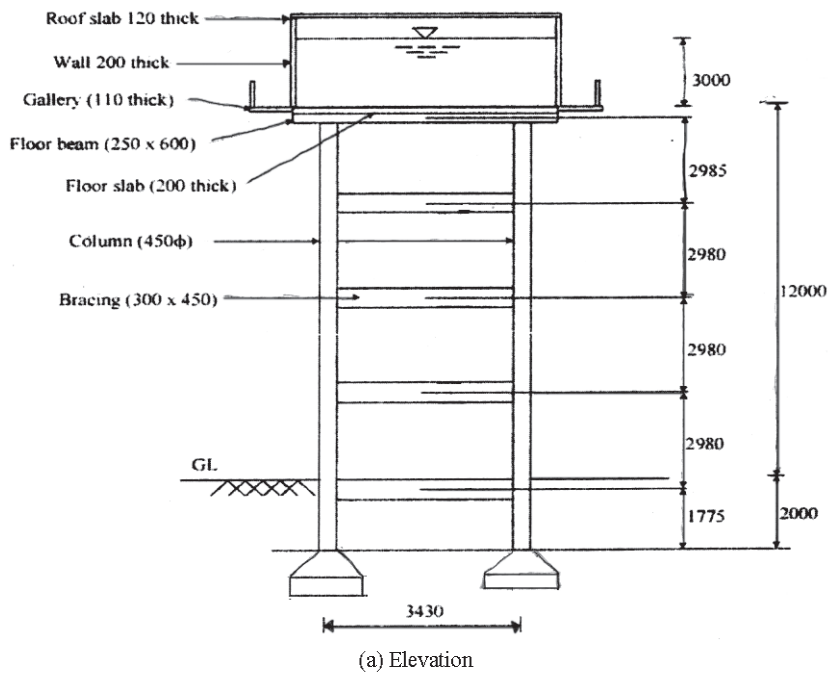
- b) Explain methods of seismic retrofitting. [6]

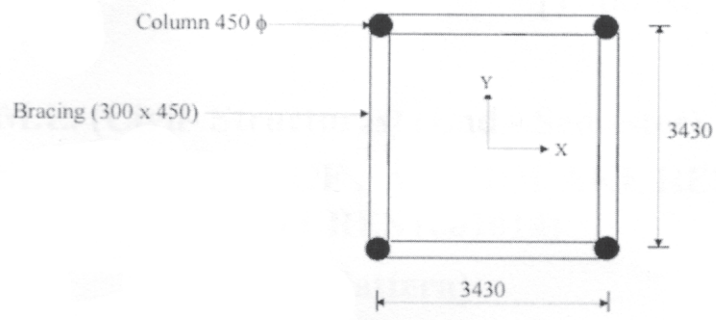
- Q7) a)** Determination of base shear formulas as per earlier IS 1893-1970, IS 1893-1975, and IS 1893-1984. [10]

- b) Discuss the concept of flanged shear wall. [6]

OR

- Q8)** A RC circular water container of  $50 \text{ m}^3$  capacity has internal diameter of 4.65 m and height of 3.3 m (including freeboard of 0.3 m). It is supported on RC staging consisting of 4 columns of 450 mm dia with horizontal bracings of  $300 \times 450 \text{ mm}$  at four levels. The lowest supply level is 12m above ground level. staging conforms to ductile detailing as per IS 13920. Staging columns have isolated rectangular footings at a depth of 2m from ground level. Tank is located on soft soil in seismic zone II. Grade of staging concrete and steel are M20 and Fe415, respectively. Density of concrete is  $25 \text{ kN/m}^3$ . Analyze the tank for seismic loads. [16]





(b) Plan

(All dimensions in mm)



Total No. of Questions : 8]

SEAT No. :

**P3057**

[Total No. of Pages : 2

**[5872]-151**

**M.E. (Civil)**

**WATER RESOURCES AND ENVIRONMENTAL ENGG.**

**Planning and Management of Water Resources**

**(2017 Pattern) (Semester-I) (501081)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *All questions 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)** Explain environmental aspects of planning and management of water resources. **[5]**

b) Comment on spatial and temporal characteristics of water resources. **[4]**

OR

**Q2) a)** Explain constraints like reversibility for development of water resources. **[5]**

b) Explain objectives of water resources planning. **[4]**

**Q3) a)** Explain how conjunctive use of water play important role in water management. **[4]**

b) How can reservoir sedimentation be measured and monitored. **[5]**

OR

**Q4) a)** How ground water content can be improved. **[4]**

b) Explain role of water doctrines to resolve disputes. **[5]**

**Q5) a)** Comment on causes of floods, effects of flood and methods to control floods. **[8]**

b) Discuss central water policy with regards to water allocation. **[8]**

OR

**[5872]-151**

**1**

**P.T.O.**

**Q6)** a) Explain essential data necessary for water power studies for storage project. [8]

b) Explain repayment of cost and allocation of cost for multipurpose project. [8]

**Q7)** a) Explain financial performance analysis to check economic viability of long term sustainable projects. [8]

b) Explain in detail basin planning (principles and procedures). [8]

OR

**Q8)** a) Explain with an example Inter Basin Water Transfer [8]

b) Explain discounting techniques for financial analysis of large dams. [8]



Total No. of Questions : 6]

SEAT No. :

P6789

[Total No. of Pages : 2

[5872]-153

M.E. (Civil) (WREE)

FLUID MECHANICS

(2017 Pattern) (Semester - I) (501083)

*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 a neat sketch wherever necessary.*

**Q1)** a) Derive the continuity equation for '3' dimensional flow in cartesian co-ordinate. [5]

b) In incompressible flow, the velocity vector is given by : [5]

$$V=(6xt + yz^2)i + (3t + xy^2)j + (xy - 2xyz - 6tz)k$$

i) Verify if continuity equation is satisfied.

ii) Determine acceleration vector at point (2, 2, 2) at t = 2

**Q2)** a) Explain the source & 'sink' in kinematics. [5]

b) Explain the concept of confrontal mapping. [5]

**Q3)** a) Derive Hagen - Poiseuille's equation using N.S. equation. [5]

b) What will be required power per km to over come viscous resistance to flow of oil of viscosity 1.9 poise through horizontal pipe of 10 cm diameter at rate of 650 litre per hour? [5]

Take specific gravity of oil = 0.85

*P.T.O.*

- Q4)** a) Obtain Von-Karman momentum integral equation. [5]  
b) A thin plate is moving in still air at velocity of 4m/s. The length of plate is 0.5m and its width is 0.4m. Calculate the thickness of boundary layer at the end of plate and drag force on one side of plate. Take  $\rho_{air} = 1.25 \text{ kg/m}^3$   
 $\nu = 0.15 \text{ stokes}$ . [5]
- Q5)** a) Derive the Reynold's equation of motion in turbulent flow. [5]  
b) Explain isotropic and homogenous turbulence. [5]
- Q6)** a) Describe the velocity of propagation for compressible flow. [5]  
b) State and explain fundamental equation, Continuity equation and energy equation in compressible fluid. [5]



Total No. of Questions : 8]

SEAT No. :

**P3058**

[Total No. of Pages : 2

[5872]-155

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

**HYDROLOGY**

**(2017 Pattern) (Semester - II) (501087)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer all 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 hydrologic cycle. State various rainguages. Explain in detail RADAR method. **[5]**

b) Explain Stanford Watershed Model. **[4]**

OR

**Q2) a)** Draw a flowchart for mathematical methods in hydrology and explain stochastic hydrology applications. **[6]**

b) Explain Chi square test. **[3]**

**Q3) a)** What is design flood? How it is finalized while designing hydraulic structure? **[4]**

b) Explain Pearson Type-III method. **[5]**

OR

**Q4) a)** Write note on method of images for ground water management. **[5]**

b) Explain the Goodrich method of flood routing. **[4]**

**Q5) a)** Explain step by step design of tube well & also explain types and construction methods for tube wells. **[8]**

b) What are causes of ground water pollution? State effects of ground water pollution. What are the methods to treat polluted ground water?**[8]**

OR

*P.T.O.*



- Q6)** a) What affects the quality of ground water in India. [8]  
b) Explain digital computer models. [8]

- Q7)** a) Explain any one widely used method of ground water recharge. [8]  
b) State various methods to conserve ground water and explain any two and also explain how it helps in management of water resources. [8]

OR

- Q8)** a) Explain electric analog model for ground water modeling with neat sketches. [8]  
b) Explain sand tank model and transparent model for ground water modeling with neat sketches. [8]



Total No. of Questions : 8]

SEAT No. :

**P3059**

[Total No. of Pages : 2

[5872]-157

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

**ADVANCE WASTE WATER TREATMENT**

**(2017 Pattern) (Semester - II) (501089)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the 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 indicates full marks.
- 3) Draw neat figures wherever necessary.

**Q1)** a) What is the significance of performing characterization of wastewater? What are the various parameters determined during characterization of wastewater? [2+2]

b) What is the significance of providing grit chamber? Explain the working principle of grit chamber. [2+3]

OR

**Q2)** a) What is the basic principle of membrane filtration? What are microfiltration, ultrafiltration and nanofiltration? [1+4]

b) What are the types of membrane filtration systems? Explain any one in detail. [2+3]

**Q3)** a) Explain working principle and mechanism of microfiltration. [2+2]

b) Distinguish clearly between plug flow reactor and continuous stirred tank reactor with respect to design and operation point of view. [1+5]

OR

**Q4)** a) Explain kinetics of biological growth and effect of endogenous metabolism. [2+2]

b) Write a short note on cross flow model. [1+5]

**P.T.O.**

**Q5)** a) What are the sources of heavy metals? Explain various methods of removal of heavy metals. [4+4]

b) Write the working principle and mechanism of root zone cleaning system. [4+4]

OR

**Q6)** a) What is DO deficit? Explain the significance of critical DO deficit and critical time while disposal of wastewater in river water. [2+3+3]

b) What are the fundamental considerations in land treatment systems? Write design objectives and site selection criteria of irrigation systems. [2+3+3]

**Q7)** a) What is the principle of anaerobic digestion? Write the factors governing anaerobic digestion. [4+4]

b) What are the various stages of digestion? Explain the characteristics of biogas and its application. [2+3+3]

OR

**Q8)** a) Write the working principle, advantages and disadvantages of UASBR. [2+3+3]

b) Write the various methods of sludge treatment and disposal. How can dry sludge be used for other purposes? [4+4]



Total No. of Questions : 8]

SEAT No. :

**P6771**

[Total No. of Pages :4

[5872]-158

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

**OPTIMIZATION TECHNIQUES**

**(2017 Pattern) (Semester-III) (601093)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed.
- 4) Use suitable data wherever required.

**Q1) a)** Discuss the Big M method for solving linear programming problem. [5]

b) Construct the dual [4]

$$\text{maximize } Z = 3x_1 + 10x_2 + 2x_3$$

$$\text{subject to } 2x_1 + 3x_2 + 2x_3 \leq 7$$

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

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

OR

**Q2) a)** Find the basic feasible solution of the following transportation problem by North west corner rule [5]

	1	2	3	4	5	Available
A	4	3	1	2	6	80
B	5	2	3	4	5	60
C	3	5	6	3	2	40
D	2	4	4	5	3	20
Required	60	60	30	40	10	

*P.T.O.*

b) A machine tool company decides to make four subassemblies through four contractors. Each contractor is to receive only one subassembly. The cost of each subassembly by the bids submitted by each contractor in hundreds of rupees is shown below. [4]

- i) Formulate the mathematical model for the problem.  
 ii) Show that the assignment model is a special case of the transportation model

	1	2	3	4
1	15	13	14	17
2	11	12	15	13
3	13	12	10	11
4	15	17	14	16

Q3) Using Dichotomous search method find maximum of function  $f(x)=x(5-x)$  in the interval (0,1) to an accuracy of 10%. Do three iterations. [9]

OR

Q4) A pipeline is to be laid from point 1 to point 8. The unit cost of laying the pipe line considering various routes from place I to j are given below. Use Dynamic programming to find the route which will be cheapest. [9]

From i to j	1-2	1-3	1-4	2-5	2-6	3-6	3-7	4-7	5-8	6-8	7-8
Unit cost in Thousand Rs	6	5	6	8	4	9	10	7	6	3	5

Q5) a) Aeroplane arrives at airport at an average rate of 8 planes per week and their arrival pattern follows poison distribution. On an average 12 planes are loaded and unloaded with exponential distribution per week. Determine

- i) The chance that a plane will be directly taken for loading and unloading and the proportion of time required for this process.  
 ii) The average queue length and number of planes in the system.  
 iii) Average time spent by the plane waiting in the queue and in the system.  
 iv) The probability that there are two planes in the queue. [8]

- b) Two jobs are to be performed on five machines A, B, C, D, and E. Processing times are given in the following table. [8]

Job 1		Machine				
	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Squence	B	C	A	D	E
	Time	5	4	3	2	6

Use graphical method to obtain the total minimum elapsed time.

OR

- Q6) The inter arrival time and the service time in a waiting line model have the following frequency distribution based on 100 such arrivals. [16]

Inter arrival time in Min	1	2	3	4	5	6	7
Frequency	4	10	13	22	30	14	7
Service time in Min	1	2	3	4	5	6	
Frequency	3	8	25	39	16	9	

Estimate the average waiting time, percentage waiting time of the vehicle, average idle time, percentage idle time of the service facility for 10 arrivals. use following random numbers

Arrivals	23	58	56	44	80	36	97	26	71	62
Service time	60	21	68	76	52	08	25	84	38	05

- Q7) a) Find the ranges of values of p and q which will render the entry (2,2) a saddle point for the game [8]

		Player B		
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
Player A	A <sub>1</sub>	2	4	5
	A <sub>2</sub>	10	7	q
	A <sub>3</sub>	4	P	6

b) Solve the following game.

[8]

		Player B	
		B <sub>1</sub>	B <sub>2</sub>
Player A	A <sub>1</sub>	30	2
	A <sub>2</sub>	4	14
	A <sub>3</sub>	6	9

OR

Q8) a) For any 2×2 two person Zero sum game without saddle point having payoff matrix for player A as [8]

		Player B	
		B <sub>1</sub>	B <sub>2</sub>
Player A	A <sub>1</sub>	a <sub>11</sub>	A <sub>12</sub>
	A <sub>2</sub>	a <sub>21</sub>	a <sub>22</sub>

Find the optimal mixed strategies and value of the game

b) Discuss rules for playing 'Game'. Write steps to detect a saddle point.[8]



Total No. of Questions : 8]

SEAT No. :

**P3060**

[Total No. of Pages : 2

[5872]-159

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

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester-III) (601094)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Your answers will be valued as a whole.*
- 4) *Assume suitable data, if neccessarry.*

- Q1) a)** Write a research proposal for a suitable research problem (any problem related to water resource or Environmental engineering can be considered) to a funding agency with reference to the following terms: Title, origin of the problem, expected outcome, significance of the study, objectives. **[5]**
- b) Discuss the merits and limitations of internet as source of literature review. **[4]**

OR

- Q2) a)** Write a research proposal for a suitable research problem (any problem related to water resource or environmental engineering can be considered) to a funding agency with reference to the following terms: title, origin of the problem, expected outcome, significance of the study, objectives. **[5]**
- b) Discuss the errors in research problem. **[4]**

- Q3) a)** Why should the data collected for research must be checked for reability, suitability, and adequacy? **[5]**
- b) Enlist various methods of methods of data collection, discuss any one. **[4]**

OR

- Q4) a)** Write a note on “Non-parametric tests for Hypothesis testing” **[5]**
- b) Discuss criteria of good measurements. **[4]**

**P.T.O.**



- Q5)** a) Discuss in detail cluster analysis. [8]  
b) Discuss simple regression analysis and its significance. [8]

OR

- Q6)** a) Discuss multidimensional scaling with a suitable example. [8]  
b) Explain principal component analysis. [8]

- Q7)** a) Enlist different types of reports and discuss formal and informal reports in detail. [8]  
b) Discuss plagiarism in research and how to avoid. [8]

OR

- Q8)** a) Write a note “Elements of a good presentation”. [8]  
b) Discuss the steps involved in patenting. [8]



Total No. of Questions 8]

SEAT No. :

**P6543**

**[5872]-161**

[Total No. of Pages : 3

**M.E. (Mechanical Design Engineering/Mechanical Automotive Engg. /  
Mechanical Computer Aided Design. Manufacture & Engineering)**

**ADVANCED MATHEMATICS**

**(2017 Credit Pattern) (Semester-I) (507201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *use of Logarithmic tables, electronic calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Apply Gram - schmidt method to given vectors to get an orthonormal basis.  $(1, -1, 1), (1, 0, 1), (1, 1, 2)$  **[5]**

b) If  $\phi + i\Psi$  represents the complex potential for electric field and  $\phi = x^3 - 3xy^2 + 2x$ , determine the function  $\Psi$ . **[5]**

**Q2) a)** Evaluate  $\oint \frac{e^{-z}}{(z-1)(z-2)^2} dz$  Where  $C; |z-3|=1$ . **[5]**

b) Solve the initial value problem in a mechanical system given by  $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = 6e^{-t}$  Where  $y(0) = 0$  and  $y'(0) = 1$  **[5]**

**Q3) a)** Find the Laplace transform of the function **[5]**

$$f(t) = (t+2).u(t-3) + e^{2t} \sin 3t \delta(t-2)$$

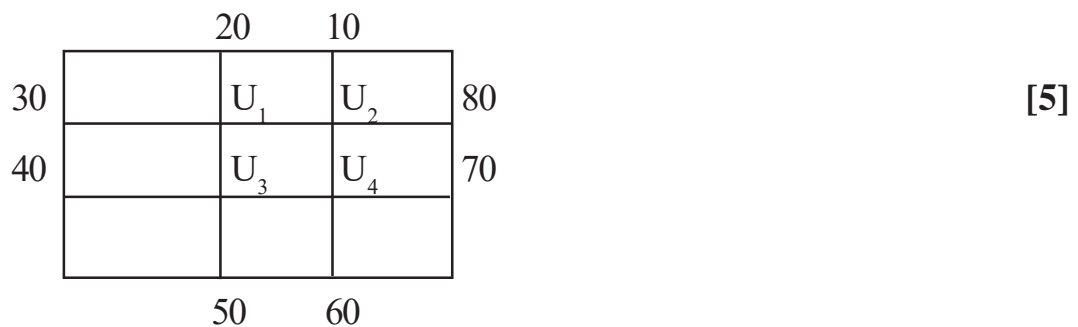
b) Find the power series solution of  $(1-x^2)\frac{d^2y}{dx^2} - 9y = 0$ . **[5]**

**P.T.O.**

- Q4) a)** Find the Largest Eigen value and corresponding Eigen vector of the matrix. [5]

$$A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix} \quad X_o = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

- b) Given the values of  $u(x, y)$  on the boundary of the square in the figure, evaluate the function  $u(x, y)$  satisfying Laplace equation  $\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} = 0$



- Q5) a)** Solve the equation  $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$  through Schmidt-bendre method. Use

$h = 1$  and find solution upto  $t = 2$ .

$$u(0, t) = u(0, 1) = 0 \quad u(x, 0) = \sin \pi x \quad t \geq 0, 0 < x < 1.$$

[5]

- b) Use Galerkin's method to solve the boundary value problem  $y'' - y + 4xe^x = 0, y(0) = y(1) = 0$  [5]

- Q6) a)** Find the function for which functional

$$\int_1^2 \frac{x^3}{(y')^2} dx, y(1) = 0, y(2) = 3, \text{ can be extremized} \quad [5]$$

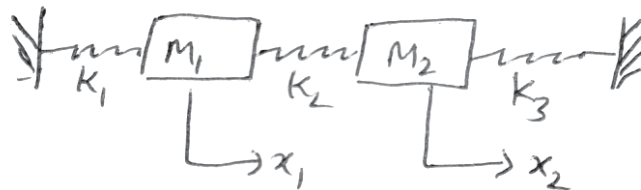
- b) Solve the Linear equation system using Least square method  $x - 2y = 1, x + y = 2, x + 2y = 4$  [5]

**Q7) a)** Show that the interior part of the circle  $|z - 2| = 2$  is mapped onto  $u < 0$  for the transformation  $w = \frac{z}{2z - 8}$  [5]

**b)** Find the Fourier cosine transform for the function. [5]

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 2 - x & 1 < x < 2 \\ 0 & x > 2 \end{cases}$$

**Q8) a)** For the following mass spring system  $m_1 = 1, m_2 = 3, k_1 = 1, k_2 = 3, k_3 = 3$ , assuming there is no friction. Find the natural frequencies and modes of vibration. [5]



**b)** Solve the differential equation  $\frac{\partial^2 U}{\partial t^2} = \frac{\partial^2 U}{\partial x^2}$  by taking  $h = 0.2$ , using Crank Nicolson method upto  $t = 0.6$  with condition  $u(0, t) = u(s, t) = 0, t \geq 0$  and  $U_t(x, 0) = 0, u(x, 0) = \sin \pi x, 0 < x < s$  [5]



Total No. of Questions 7]

SEAT No. :

**P6544**

**[5872]-162**

[Total No. of Pages : 2

**M.E.(Mechanical) (Design Engineering)**  
**MATERIAL SCIENCE AND MECHANICAL BEHAVIOR OF**  
**MATERIALS (502202)**  
**(2017 Pattern) (Semester-I) (502202)**

*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 indicate full marks.*
- 4) *Use of programmable calculator is not allowed.*
- 5) *Assume suitable data wherever necessary.*

- Q1)** a) Explain the applications of smart material by considering functional attributes. **[5]**
- b) Explain the constituents of composite materials in detail. **[5]**

**Q2)** A body is loaded under stresses  $\sigma_x = 10 \text{ MPa}$ ,  $\sigma_y = 3 \text{ MPa}$ ,  $\sigma_z = 2 \text{ MPa}$ ,  $\tau_{xz} = 3 \text{ MPa}$  and  $\tau_{yz} = \tau_{xy} = 0$ . Find the three principal stresses. Sketch the 3- dimensional Mohr's circle diagram for this stress state, and find the largest shear stress and octahedral stress in the body. **[10]**

- Q3)** a) Explain three point bending test. **[5]**
- b) Describe the phenomenon of Bauschinger effect in mild steel. **[5]**

**Q4)** An element of  $J_2$  - material is subjected to a proportional loading path with stress ratio  $\frac{\sigma}{\tau} = 2$ . The material obeys Hooks law up to elastic limit. Post-

yield behavior during simple tension of material is given by  $\varepsilon = \frac{\sigma}{e} + \frac{\sigma - \sigma_y}{m}$

with young's modulus  $E = 207 \text{ GPa}$ , yield stress  $\sigma_y = 207 \text{ MPa}$ , constant  $m = 25 \text{ GPa}$  and Poisson's ratio = 0.3 Find all the components of normal and shear strains for stress state of  $\sigma = 180 \text{ MPa}$  and  $\tau = 90 \text{ MPa}$ . **[10]**

**P.T.O.**

**Q5)** Explain residual stresses and residual strain in cylinder in torsion. [10]

**Q6) a)** Explain thermo plasticity in plastic yielding. [5]

b) Find shake down region for a circular rod of radius  $a$  with tensile force  $P$  and twisting moment  $M$ . [5]

**Q7)** What is viscoelasticity? Explain Voigt-Maxwell model for viscoelastic material with neat sketch. [10]



[5872]-163

**M.E. (Mechanical) (Design Engineering)**  
**ADVANCED STRESS ANALYSIS**  
**(2017 Credit Pattern) (Semester-I) (502203)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

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

**Q1)** Determine resulting stresses  $\sigma_x$ ,  $\sigma_y$  &  $\tau_{xy}$  for given Airy stress function  $\Phi = Axy + Bx^2 + Cx^2y + Dy^3 + Exy^3 + Fx^2y^3 + Gy^5$  where A,B,C,D,E,F,G are constant. (Refer Fig 1) [10]

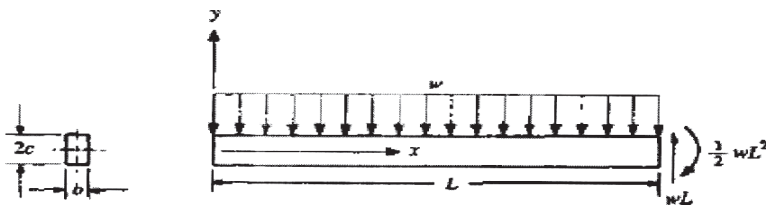
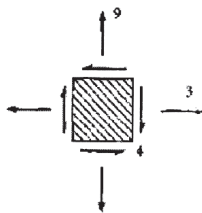


Fig.1

**Q2)** Determine state of stress, maximum, minimum shear stress, orientation of state of plane stress at a point and relative to xy coordinate system if state of stress on an element rotated at  $45^\circ$  clockwise from initial element as shown in Fig.2. Solve using transformation equation or 3D Mohrs circle method. [10]

Fig.2 Initial Element stress in N/mm<sup>2</sup>

**Q3)** An elliptical shaft of Semi axes  $a=0.05\text{m}$ ,  $b=0.025\text{m}$  and  $G=80\text{Gpa}$  is subjected to a twisting moment of  $1200\pi\text{Nm}$ . Determine maximum shearing stress and angle of twist per unit length. Derive the equation you may use. [10]

**Q4)** a) Derive Winkler Bach formula for curved beam. [6]  
 b) Determine location of neutral axis and eccentricity  $e$  for the curved bar of rectangular cross section as shown in figure 3. [4]

P.T.O.

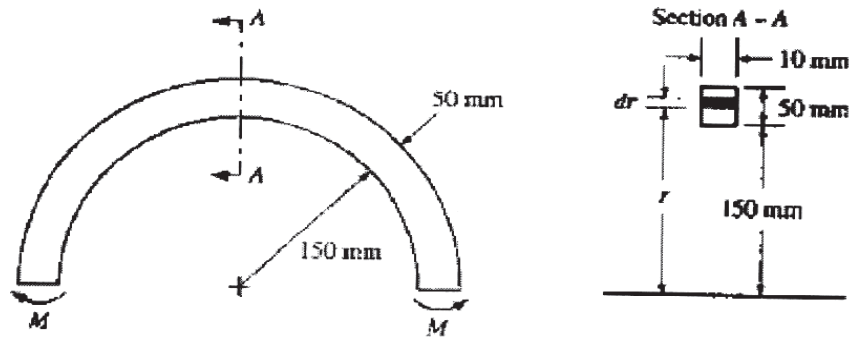


Fig.3 Curve bar section

**Q5)** Two semicircular disk are made of steel ( $E_1=E_2 = 200 \text{ GPa}$  and  $\nu_1=\nu_2=0.29$ ) The radii of curvature of the two surfaces at the point of contact are  $R_1=60 \text{ mm}$ ,  $R'_1 = 130\text{mm}$ ,  $R_2=80\text{mm}$  and  $R'_2=200\text{mm}$ . the angle between the planes of minimum curvature is  $\pi /3$ . If the load  $P$  is applied, determine maximum principal stress, maximum shearing stress and locate the point where each of these stress. Determine the approach  $\delta$  for thtwo disk because of load  $P$ . [10]

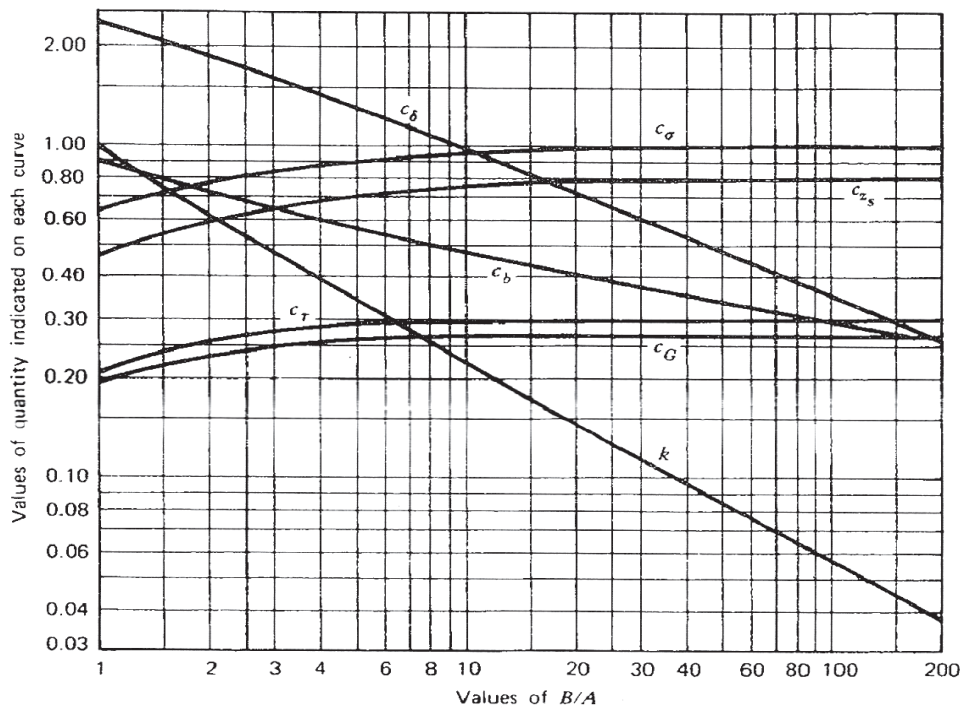


Fig4. Stress and deflection coefficient for two bodies in contact at a point.



**Q6)** For a three element rectangular rosette the strain observation made with gauge mounted on steel specimen are  $\epsilon_A=400 \times 10^{-6}$ ;  $\epsilon_B= -200 \times 10^{-6}$ ;  $\epsilon_C=200 \times 10^{-6}$  respectively. Determine principal stress and principal and their direction. Assume  $E=20700\text{N/mm}^2$   $\nu=0.29$  for material. **[10]**

**Q7) a)** Discuss the effect of stressed model in plane polariscope. **[5]**

b) Explain dimensional analysis in experimental techniques. **[5]**





**Q3) a)** What is meant by Cubic of Stationary Curvature and give its use. [5]

b) Explain the concept of Center Point Curve and Circle Point Curve. [5]

**Q4) a)** Write short notes on the following. [4]

i) Branch Defect.

ii) Order Defect

b) Describe the procedure to design a Four-link mechanism using the Relative Pole Method, when three positions of the input link ( $\theta_1, \theta_2, \theta_3$ ) and three positions of the output links ( $\phi_1, \phi_2$  and  $\phi_3$ ) are known. [6]

**Q5) a)** Explain the Robert Chebychev theorem and the Cognate linkages. [5]

b) Write a note on the 'Dyad'. [5]

**Q6)** Write short notes on the following. [10]

a) Matrix method of analysis of spatial mechanisms.

b) D-H parameters.

**Q7) a)** Explain the term 'Kinematically Complex' mechanism. Discuss its types with suitable examples. [5]

b) Explain the concept of Spatial Transformations of mechanisms. [5]



Total No. of Questions : 7]

SEAT No. :

**P3062**

**[5872]-166**

[Total No. of Pages : 3

**M.E. (Mechanical -Design Engineering)**  
**ADVANCED MECHANICAL VIBRATIONS**  
**(2017 Pattern) (Semester-II) (502208)**

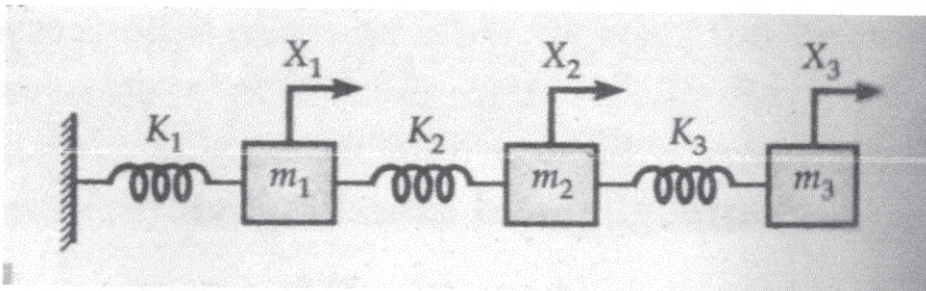
*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) Find the flexibility influence coefficients for the following system. [10]**



**Q2) Determine the natural frequencies and mode shapes of torsional oscillations of a uniform shaft of length L, mass density  $\rho$  and the cross sectional polar moment of inertia J. The shaft is fixed at one end and free at the other end.**

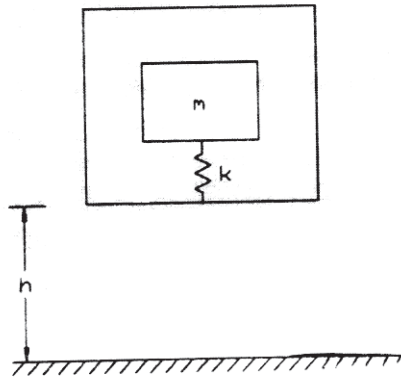
**[10]**

**Q3) a) Explain FFT analyzer with schematic diagram of vibration measurement set up. [5]**

Explain balancing of masses in single plane by vibration measurement technique. [5]

**P.T.O.**

**Q4)** A container having an apparatus suitably packaged inside it, is schematically represented in following fig. When the package is dropped on a hard surface during loading or unloading, analyse the system for its response. [10]



**Q5) a)** Explain how time domain and frequency domain techniques are used for condition monitoring and fault diagnosis. [5]

b) Explain Duhamel's Integral. [5]

**Q6) a)** A random signal has a spectral density that is a constant  $S(f) = 0.004 \text{ cm}^2/\text{cps}$  between 20 and 1200 cps and that is zero outside this frequency range. its mean value is 2.0 cm. Determine its rms value and its standard deviation. [10]

**Q7)** Write short notes on any three. [10]

- i) Auto correlation function
- ii) Rayleigh Ritz method
- iii) Analysis of narrow band system
- iv) Experimental modal analysis
- v) Fault Diagnosis

**Laplace Transform Pairs**

S. No.	$f(t)$	$L[f(t)]$
1.	$f(t)$	$\int_0^{\infty} f(t) e^{-st} dt = F(s)$
2.	$x(t) + y(t)$	$X(s) + Y(s)$
3.	$K f(t)$	$K F(s)$
4.	$U(t)$ or $1$	$1/s$
5.	$\delta(t)$	$1$
6.	$T$	$1/s^2$
7.	$t^n$	$\frac{n!}{s^{n+1}}$
8.	$\sin \omega t$	$\frac{\omega}{s^2 + \omega^2}$
9.	$\cos \omega t$	$\frac{s}{s^2 + \omega^2}$
10.a	$t e^{-at}$	$\frac{1}{(s+a)^2}$
10.b	$1 - e^{-at}$	$\frac{a}{s(s+a)}$
10.c	$e^{-at} - e^{-bt}$	$\frac{b-a}{(s+a)(s+b)}$
11.	$e^{-at} \sin \omega t$	$\frac{\omega}{(s+a)^2 + \omega^2}$
12.	$e^{-at} \cos \omega t$	$\frac{s+a}{(s+a)^2 + \omega^2}$
13.	$u(t-a)$	$\frac{e^{-as}}{s}$
14.	$\delta(t-a)$	$e^{-as}$
15.	$\begin{cases} 0 & \text{when } t < a \\ f(t-a) & \text{when } t > a \end{cases} = f(t-a) u(t-a)$	$e^{-as} F(s)$
16.	$dF(t)/dt$	$s F(s) - f(0)$
17.	$\frac{d^2 f(t)}{dt^2}$	$S^2 F(s) - s f(0) - \frac{df(0)}{dt}$
18.	$\int_0^t f(t) dt$	$\frac{F(s)}{s}$



Total No. of Questions : 7]

SEAT No. :

**P3063**

[Total No. of Pages : 2

[5872]-167

**M.E. (Mechanical) (Design Engineering)**

**FINITE ELEMENT METHOD**

**(2017 Pattern) (Semester - II) (502209)**

**Time : 3 Hours]**

**[Max. Marks : 50**

*Instructions to the candidates:*

- 1) *Solve any Five questions.*
- 2) *Assume suitable data if required.*
- 3) *Draw neat sketches and tables.*

- Q1)** a) Write basic steps of FEM and list 03 prominent limitations of using FEA. **[5]**  
b) Discuss the advantages and disadvantages of finite element method over conventional methods. **[5]**

- Q2)** a) Explain boundary condition and its applications. **[4]**  
b) A M.S. three stepped rod of Diameters 100 mm, 80 mm & 60 mm of  $E = 2 \times 100000$  N/sq.mm, and Length 200 mm, 180 mm and 150 mm from the first end. One end is fixed and other is subjected to axial tensile load of 25 kN. Model the rod with three stepped rod and solve the following by FEM. **[6]**  
i) Global stiffness matrix  
ii) Nodal displacements  
iii) Reaction forces

- Q3)** a) A 3 - Noded 1 - D rod element has displacements and co-ordinates as shown. **[6]**

Co-ordinate	1 [40,00]	2 [80,00]	3 [20,00]
Nodal displacement - 4	0.01	0.02	0.03

Calculate:

- i) Nodal shape functions
  - ii) Displacement at point P[70.00]
- b) Explain the term shear locking as used in Timoshenko Beam theory. How this problem is overcome. **[4]**

**P.T.O.**

- Q4)** a) What is Aspect Ratio of Element? What is the effect of Aspect Ratio on Accuracy? [4]  
b) Explain Hexahedral and Tetrahedral Elements used in 3D Problems in stress analysis. [6]
- Q5)** a) Explain Euler equation in linear and nonlinear buckling analysis with example? [5]  
b) Write short notes on: [5]  
i) Mindlin's Co-continuity element  
ii) Shear Locking
- Q6)** a) Explain types of dynamic problems with examples? And also list out 2 - numerical methods to solve eigen. [6]  
b) Explain h and P numerical convergence method. [4]
- Q7)** a) Explain Pre-Processing and Post-processing in Analysis. [5]  
b) Explain different types of symmetrics that occurs in meshing. [5]





[5872]-168

**M.E. (Mechanical) (Design Engineering)**  
**OPTIMIZATION TECHNIQUES**  
**(2017 Credit Pattern) (Semester-III) (602213)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Figures to the right side indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.

- Q1)** a) Write a short note on Mathematical modeling of optimization problem. Explain with suitable example. [6]
- b) Describe the following terms (Any Two) [4]
- i) Constraint Surface
  - ii) Objective Function
  - iii) Design Variable

- Q2)** Figure shows two frictionless rigid bodies (carts) A and B connected by three linear elastic springs having spring constants  $k_1$ ,  $k_2$ , and  $k_3$ . The springs are at their natural positions when the applied force  $P$  is zero. Find the displacements  $x_1$  and  $x_2$  under the force  $P$  by using the principle of minimum potential energy. [10]

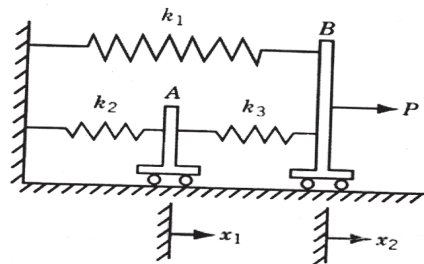


Figure. Spring-cart system

- Q3)** a) Write a short note on simplex algorithm. [5]
- b) Find the minimum of the function.

$f(X) = 0.65 - (0.75/1 + X_2) - 0.65 * X \tan^{-1} (1/X)$  Using Quasi-Newton method with the starting point  $X_1 = 0.1$  and the step size  $X=0.01$  in central difference formulas. Use  $\epsilon = 0.01$  for checking the convergence.

[5]

P.T.O.

**Q4)** Explain in brief. **[10]**

- a) ESO for stiffness optimization
- b) POWELL's method of optimization

**Q5)** Explain with suitable example Neural-Network-based optimization technique. **[10]**

**Q6)** Steel plates are available in thicknesses (in inches) of **[10]**

$\frac{1}{32}, \frac{1}{16}, \frac{3}{32}, \frac{1}{8}, \frac{5}{32}, \frac{3}{16}, \frac{7}{32}, \frac{1}{4}, \frac{9}{32}, \frac{5}{16}, \frac{11}{32}, \frac{3}{8}, \frac{13}{32}, \frac{7}{16}, \frac{15}{32}, \frac{1}{2}$

from a manufacturer. If the thickness of the steel plate, to be used in the construction of a pressure vessel, is considered as a discrete design variable, determine the size of the binary string to be used to select a thickness from the available values.

**Q7) a)** Write short note on optimization as design tool Topology. **[5]**

- b) List the different solution methods in topology optimization and explain one of them in details. **[5]**



Total No. of Questions : 10]

SEAT No. :

**P3064**

[Total No. of Pages : 2

[5872]-169

**M.E. (Mechanical Design Engineering)**  
**MECHANICAL MEASUREMENTS AND CONTROLS**  
**(2017Pattern) (Semester-III) (602214)**

*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.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicates full marks.*
- 4) *Else of electronic scientific pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain following static characteristics of measuring instruments: **[6]**

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

b) Explain FFT analyzer used for vibration measurement. **[4]**

OR

**Q2) a)** Explain classification of sensors and transducers used for different types of measurements. **[6]**

b) Explain working of Laser Doppler Vibrometer. **[4]**

**Q3) a)** Explain ADC and List various types of ADC. **[6]**

b) Explain Bit Width. What is the difference between 32-bit and 64-bit system? **[4]**

OR

**Q4) a)** What is Band Pass filter? Draw and explain the frequency response of a band pass filter. **[6]**

b) Explain Analog and Digital Signals with examples. **[4]**

**Q5) a)** A shaft with stiffness 'k' is fixed at its top to the ceiling and at the bottom is attached with a heavy disk. This bottom disk is allowed with a twist of ' $\theta$ ' along with a torque T. Also this bottom disk is immersed in a fluid which gives a damping 'c'. Assuming the states to be angular position and output to be angular velocity, find the state space model of the given system. **[6]**

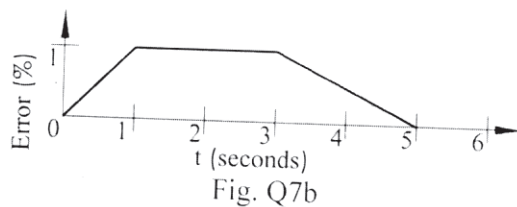
**P.T.O.**

- b) A linear system is described by the differential equation  $\frac{dy^2}{dt^2} + 4\frac{dy}{dt} + 3y = 3\frac{dy}{dt} + 1$ . Find the system Poles and Zeros of system and locate them on S-plane. [5]

OR

- Q6)** a) Explain Poles & Zeros of system. And Lyapunov's criterion for stability of the system. [5]  
 b) Differentiate between Time and Frequency Domain type modelling approach. [5]

- Q7)** a) Explain transient response specifications with neat sketch. [4]  
 b) Fig. 7b shows an error time graph. Sketch the PD controller output with respect to  $K_p=5\%/s$  and  $m(0)=20\%$  [6]



OR

- Q8)** a) Check the stability of the system whose characteristic equation is given by  $s^4 + 3s^3 + 2s^2 + s + 1 = 0$  [6]  
 b) Explain in detail PID tuning based on transient response. [4]

- Q9)** a) Draw the Bode log-magnitude and phase plots for the system  $G(s) = \frac{(s+10)}{(s+1)(s+5)(s+30)}$  [6]

- b) What is phase margin and gain margin? [4]

OR

- Q10)** a) Find analytical expression for the magnitude and phase responses of

$$G(s) = \frac{1}{(s+2)(s+1)}$$

also make plots of the log-magnitude and the phase using log-frequency in rad/s as the ordinate. [6]

- b) Explain tuning PID parameters based on frequency response. [4]



Total No. of Questions : 8]

SEAT No. :

**P6547**

**[5872]-171**

[Total No. of Pages : 4

**M.E. (Mechanical Heat Power Engineering / Mechanical Energy Engineering)**

**ADVANCED MATHEMATICS AND NUMERICAL METHODS  
(2017 Credit Pattern) (Semester - I) (507101)**

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

**Q1) a)** Using Bisection method, find an approximate root of the equation  $x^3 - 4x - 9 = 0$ , (carry out 4 iterations). **[5]**

b) Fit a second degree parabola to the following data. **[5]**

$x$	1	2	3	4	5	6	7
$y$	-5	-2	5	16	31	50	73

**Q2) a)** Solve the following equations using the LU decomposition: **[5]**

$$2x + 3y + z = 9$$

$$x + 2y + 3z = 6$$

$$3x + y + 2z = 8$$

b) Find  $y$  at  $x = 8$  from the following data using Newton's divided difference formula. **[5]**

$x$	5	7	11	13	17
$y$	150	392	1452	2366	5202

**P.T.O.**

**Q3) a)** Find the Hermite interpolating polynomial for the data: [5]

$x$	$f(x)$	$f'(x)$
0.5	4	-16
1	1	-2

and hence find  $f(1.5)$

b) Evaluate  $\int_0^{\pi/2} \sin x dx$  using Gaussian quadrature 3 point formula. [5]

**Q4) a)** Find the dominant eigen value and corresponding eigen vector of the

matrix A using power method where  $A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ . [5]

b) Evaluate  $\int_1^4 (x^3 + x - 1) dx$  by Gauss-Legendre's two point formula. [5]

**Q5) a)** Using Given's method reduce the following matrix A to the tridiagonal

form,  $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$ . [5]

b) Apply Runge - Kutta method of fourth order to find an approximate value of  $y$  for  $x = 0.2$  in step of 0.1, If  $\frac{dy}{dx} = x + y^2$ ,  $y(0) = 1$ . [5]

**Q6) a)** Using Adam's Bashforth predictor corrector method find  $y(0.4)$ , give

that  $\frac{dy}{dx} = \frac{xy}{2}$ ,  $y(0) = 1$ ,  $y(0.1) = 1.01$ ,  $y(0.2) = 1.022$ ,  $y(0.3) = 1.023$ .

[5]

- b) Solve the partial differential equation represented by mechanical system as  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  using Jacobi's method to find  $u_1, u_2, u_3, u_4$ , carry 5 iterations, given that

		1000	1000	
1000		$u_1$	$u_2$	1000
2000		$u_3$	$u_4$	500
2000				0
	1000	500	0	0

[5]

- Q7) a)** Use Crank - Nicolson method to solve  $\frac{\partial^2 u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  subject to conditions  $u(x,0) = \sin \pi x, 0 \leq x \leq 1, u(0,t) = u(1,t) = 0$ .

Assume  $\Delta x = h = 1/4$  &  $\Delta t = k = 1/16$ . Find all values of  $u$  for  $t = 0$  to  $t = 1/16$  for  $x = 0$  to  $x = 1$ .

[5]

- b) Solve the following simultaneous equations by Gauss-seidel method.

(5 iterations only)  $4x + y + 4z = 5$  [5]

$$x + 6y + 2z = 19$$

$$-x - 2y - 5z = 10$$

- Q8) a)** Solve the following differential equation using modified Euler Method :

$$\frac{dy}{dx} = \log(x + y) \text{ given } y(1) = 2 \text{ to get } y(1.2) \text{ using step size of } 0.2.$$

Assume permissible error  $= 1 \times 10^{-3}$ . [5]

- b) The transverse displacement ' $u$ ' of a point at a distance ' $x$ ' from one end at any time ' $t$ ' of a vibrating string satisfies the equation.  $\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$  for the following boundary.

Conditions:

$u = 0$  at  $x = 0, t > 0$ ,  $u = 0$ , at  $x = 4, t > 0$  and initial conditions,

$u = x(4 - x)$  at  $t = 0$  and  $t = 0.5$   $0 \leq x \leq 4$  and  $\frac{\partial u}{\partial x} = 0$  at  $t = 0, 0 \leq x \leq 4$

solve the equation numerically for  $0 \leq t \leq 2.5$  taking step in  $x$  as 1 and step in  $t$  as 0.5. [5]





Total No. of Questions : 7]

SEAT No. :

**P3065**

[Total No. of Pages : 2

[5872]-172

**M.E. (Mechanical) (Heat Power Engineering)**  
**ADVANCED THERMODYNAMICS & COMBUSTION**  
**TECHNOLOGY**  
**(2017 Pattern) (Semester-I) (502102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of steam tables, Mollier charts, scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Define the compressibility factor and explain compressibility chart with suitable sketch. [5]  
b) Explain P-T diagram for a pure substance. [5]
- Q2)** a) Sketch the Mollier chart and explain why do the isobars diverge from one another on mollier diagram. [5]  
b) The radiator of a steam heating system has a volume of 20 Lit. and is filled with superheated water vapour at 200 kpa and 150°C. At this moment both the inlet and exit valves to the radiator are closed. After a while the temperature of the steam drops to 40°C as a result of heat transfer to the air. Determine the entropy change of the steam during this process. [5]
- Q3)** a) What is the second law efficiency? How does it differ from the first-law efficiency? [4]  
b) Water enters a pump at 100kpa and 30°C at a rate of 1.35 kg/s and leaves at 4Mpa. If the pump has an isentropic efficiency of 70 percent. determine  
i) The actual power input  
ii) the rate of frictional heating  
iii) the energy destruction  
iv) the second law efficiency for an environment temperature of 20°C [6]
- Q4)** a) Set up a Tds relation in the following form  
 $Tds = C_p dT - B V T dp$  [5]  
b) Write a short note on Joule Thomson coefficient. [5]

*P.T.O.*

- Q5)** a) What is adiabatic flame temperature? [4]  
b) A Fuel mixture of 20 percent by mass methane ( $\text{CH}_4$ ) and 80 percent by mass ethanol ( $\text{C}_2\text{H}_6\text{O}$ ), is burned completely with Theoretical air. if the total flow rate of the fuel is 31 kg/s, determine the required flow rate of air [Molar masses of C=12kg/kmol,  $\text{H}_2$ =2kg/kmol  $\text{O}_2$ =32kg/Kmol and air=2g kg/kmol] [6]
- Q6)** a) Write short note on fugacity and activity. [4]  
b) State and explain Dalton's law of partial pressure. [6]
- Q7)** Write a short notes on (any two) [2×5=10]  
a) Thermodynamics of Nutrition and exercise.  
b) Gibb's phase rule.  
c) Thermodynamics of biological cells.



Total No. of Questions : 7]

SEAT No. :

**P3066**

**[5872]-173**

[Total No. of Pages : 3

**M.E. (Mechanical) (Heat Power Engineering)**  
**ADVANCED FLUID MECHANICS**  
**(2017 Course) (Semester - I) (502103)**

*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)** Explain the terms **[6]**

- i) Streamlines
- ii) Streaklines
- iii) Pathlines
- iv) Vorticity
- v) Stream function
- vi) Velocity potential

b) A steady, incompressible, two-dimensional velocity field is given by the following components in the  $xy$ -plane:

$$u = 1.1 + 2.8x + 0.65y, \quad v = 0.98 - 2.1x - 2.8y$$

Calculate the acceleration field (find expressions for acceleration components  $a_x$  and  $a_y$ ), and calculate the acceleration at the point

$$(x, y) = (-2, 3). \quad \text{[4]}$$

**Q2) a)** Explain the physical significance of the four nondimensional parameters in the non dimensionalized incompressible Navier-Stokes equation. **[4]**

b) For each case, calculate an appropriate Reynolds number and indicate whether the flow can be approximated by the creeping flow equations?

- i) A microorganism of diameter 5.0 mm swims in room temperature water at a speed of 0.2 mm/s.

**P.T.O.**

- ii) Engine oil at 140°C flows in the small gap of a lubricated automobile bearing. The gap is 0.0012 mm thick, and the characteristic velocity is 20.0 m/s.
- iii) A fog droplet of diameter 10 μm falls through 30°C air at a speed of 3.0 mm/s

For water at T=20°C,  $\rho = 998.0 \text{ kg/m}^3$  and  $\mu = 1.002 \times 10^{-3} \text{ kg/m}\cdot\text{s}$ .

For unused engine oil at T=140°C,  $\rho = 816.8 \text{ kg/m}^3$  and

$\mu = 6.558 \times 10^{-3} \text{ kg/m}\cdot\text{s}$ .

For air at T=30°C,  $\rho = 1.164 \text{ kg/m}^3$  and  $\mu = 1.872 \times 10^{-5} \text{ kg/m}\cdot\text{s}$ .

[6]

- Q3) a)** During a high Reynolds number experiment, the total drag force acting on a spherical body of diameter  $D = 12 \text{ cm}$  subjected to airflow at 1 atm and 5°C is measured to be 5.2 N. The pressure drag acting on the body is calculated by integrating the pressure distribution (measured by the use of pressure sensors throughout the surface) to be 4.9 N. Determine the friction drag coefficient of the sphere.

The density and kinematic viscosity of air at 1 atm and 5°C are  $\rho = 1.269 \text{ kg/m}^3$  and  $\nu = 1.382 \times 10^{-5} \text{ m}^2/\text{s}$ . The drag coefficient of sphere in turbulent flow is  $C_D = 0.2$ .

[5]

- b) Explain the concept of Superposition of Plane-Flow Solutions for irrotational vortex.

[5]

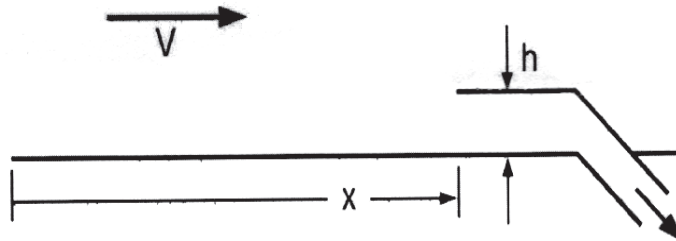
- Q4) a)** Explain adiabatic duct flow with friction and derive expression for fanno line.

[5]

- b) Carbon dioxide enters an adiabatic nozzle at 1200 K with a velocity of 50 m/s and leaves at 400 K. Assuming constant specific heats at room temperature, determine the Mach number (a) at the inlet and (b) at the exit of the nozzle. The gas constant of carbon dioxide is  $R = 0.1889 \text{ kJ/kg}\cdot\text{K}$ . Its constant pressure specific heat and specific heat ratio at room temperature are  $c_p = 0.8439 \text{ kJ/kg}\cdot\text{K}$  and  $k = 1.288$ .

[5]

- Q5) a)** In order to avoid boundary layer interference, engineers design a “boundary layer scoop” to skim off the boundary layer in a large wind tunnel (As shown in fig.). The scoop is constructed of thin sheet metal. The air is at 20°C, and flows at  $V = 65.0$  m/s. How high (dimension  $h$ ) should the scoop be at downstream distance  $x = 1.45$  m? [5]



- b) Obtain momentum-integral equation for boundary layer. [5]

- Q6) a)** Write short note on following with suitable diagram. [6]

- i) Wake
- ii) Large eddy simulation

- b) Determine the thickness of boundary layer at the trailing edge of smooth plate of length 4 m and of width 1.5 m, when the plate is moving with a velocity of 4 m/s in stationary air. Take kinematic viscosity of air as  $1.5 \times 10^{-5} \text{ m}^2/\text{s}$ . [4]

- Q7) a)** Write short note on [6]

- i) Governing equations
- ii) Boundary conditions
- iii) Shear stress models

- b) Illustrate Creeping flow past a cylinder. [4]



Total No. of Questions : 7]

SEAT No. :

**P3067**

[Total No. of Pages : 2

[5872]-175

**M.E. (Mechanical-Heat Power)**  
**ADVANCED HEAT TRANSFER**  
**(2017 Pattern) (Semester - II) (502107)**

*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 of each question indicate full marks.*
- 4) *Assume suitable data wherever necessary and mention the same clearly.*
- 5) *Use of steam tables, Mollier chart and calculator is allowed.*

- Q1)** a) Elaborate following in brief. **[5]**
- i) Effect of variation of temperature on thermal conductivity of metals.
  - ii) Effect of variation of temperature on thermal conductivity of non-metals.
- b) How center temperature and temperature at a specified depth is determined with the help of Heisler and Grober charts? **[5]**

- Q2)** Derive Three Dimensional Heat Conduction Equation in Cartesian Coordinates with Unsteady state and Heat Generation for Anisotropic material and deduce it to **[10]**

- a) 1-D Fourier Equation in x coordinate
- b) 2-D Laplace Equation in x and y coordinate
- c) 1-D Poisson's Equation in z coordinate

Derive Three Dimensional Heat Conduction Equation in Polar and Cylindrical Coordinates.

- Q3)** a) Experimental results for the local heat transfer coefficient  $h_x$  for flow over a flat plate with an extremely rough surface were found to fit the relation  $h_x(x) = x^{-0.1}$  **[5]**  
where  $x$  (m) is the distance from the leading edge of the plate. Develop an expression for the ratio of the average heat transfer coefficient for a plate of length  $x$  to the local heat transfer coefficient  $h_x$  at  $x$ .
- b) Write note on **[5]**
- i) Reynolds analogy.
  - ii) Chilton - Colburn analogy.

**P.T.O.**

- Q4) a)** Explain physical significance of following dimensionless numbers. [5]
- Peclet number.
  - Stanton number.
  - Rayleigh number.
- b) Water enters a tube with fully developed velocity and uniform temperature of 20°C. The inside diameter of the tube is 4cm and its length is 9 m. It is desired to heat the water to 60°C by maintaining the surface at 90°C uniform temperature. Determine the mass flow rate to satisfy the above condition. Take  $k = 0.64 \text{ W/m } ^\circ\text{C}$ ,  $\nu = 0.62 \times 10^{-6} \text{ m}^2/\text{s}$ ,  $\rho = 995 \text{ kg/m}^3$ ,  $C_p = 4187 \text{ kJ/kg } ^\circ\text{C}$ ,  $\beta = 4.25 \times 10^{-4}$  per degree Kelvin. Use following correlations.  $\text{Nu} = 0.023 \text{ Re}_d^{0.8} \text{ Pr}^{0.4}$ . [5]
- Q5) a)** Explain with significance: Velocity Boundary Layer & Thermal Boundary Layer. How thickness of VBL and thickness TBL are correlated with Prandtl number? [5]
- b) Draw natural convection current and identify characteristic length in case of following. [5]
- Vertical Cold plate.
  - Vertical Hot plate.
  - Horizontal plate with hot surface facing up.
  - Horizontal plate with hot surface facing down.
  - Horizontal cylinder.
- Q6) a)** Explain with neat sketch different regimes of pool boiling curve. [5]
- b) The steam at 165°C condenses in the shell side of a heat exchanger over the tubes through which water flows. Water enters the 4-cm-diameter, 14-m-long tubes at 20°C at a rate of 0.8 kg/s. Determine the exit temperature of water and the rate of condensation of steam. Take fluid properties at 85°C and latent heat of steam as 2066.5 kJ/kg. [5]
- Use following correlations
- |   |   |
|---|---|
| $\text{Nu} = 4.6$   | for laminar flow, Constant heat flux                |
| $\text{Nu} = 3.66$  | for laminar flow, Constant wall temperature         |
| $\text{Nu} = 0.023 \text{ Re}_d^{(0.8)} \text{ Pr}^{(0.4)}$ | for turbulent flow, Constant heat flux or wall temp |
- Q7) a)** What is view factor? What are different laws of evaluation of view factor? [5]
- b) What do you mean by radiation shield? Derive expression for the same. [5]



Total No. of Questions : 7]

SEAT No. :

**P3068**

[Total No. of Pages : 2

[5872]-176

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

**AIR CONDITIONING TECHNOLOGY**

**(2017 Pattern) (Semester-II) (502108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 7.*
- 2) *Draw neat labelled diagrams wherever necessary.*
- 3) *Assume suitable data if necessary and mention it clearly.*
- 4) *Use of steam table, p-h chart, Psychrometric chart and scientific calculator is allowed.*
- 5) *Figures to the right side indicate full marks.*

**Q1) a)** Explain the local and central Air conditioning System. **[4]**

b) Explain the significance of RSHP, GSHP and ESHP. **[6]**

**Q2) a)** What are the factors that effect IAQ in the building. **[4]**

b) 30 m<sup>3</sup>/min of stream of moist air at 15°C DBT and 13°C WBT are mixed with 12 m<sup>3</sup>/min of a second stream at 25°C DBT and 18°C WBT. Barometric pressure is one standard atmosphere. Determine the dry bulb and wet bulb temperature of the resulting mixture. **[6]**

**Q3)** 100 m<sup>3</sup>/min outdoor air at 43.3°C DBT and 37% relative humidity is mixed with 200 m<sup>3</sup>/min of air at 38.2°C DBT and 24.5°C WBT. The mixed air is dehumidified first by a cooling coil having bypass factor of 0.32 and apparatus dew point of 15°C and then by a chemical dehumidifier at 30°C dry bulb temperature. Air is then passed over a cooling coil whose surface temperature is 15°C and bypass factor 0.26. calculate: **[10]**

- a) Capacity of two cooling coils in tons of refrigeration
- b) Capacity of coil dehumidifier in kg/min
- c) Capacity of chemical dehumidifier in kg/min
- d) Total dehumidifying capacity of the system in kg/min

**P.T.O.**



**Q4)** The following data relates to the office air conditioning plant having maximum seating capacity of 25 persons: **[10]**

Outside design condition = 34°C DBT, 28°C WBT

Inside design conditions = 24°C DBT, 50% RH

Solar heat gain = 9000W

Latent heat gain per person = 100W

Sensible heat gain per person = 95W

Lighting Load = 2300W

Sensible heat load from other sources = 11600W

Infiltration load = 15 m<sup>3</sup>/min

Assure 40% fresh air and 60% of recalculated air passing through the evaporator coil and the by-pass factor of 0.15, find the dew point temperature of the coil and the capacity of the plant.

**Q5)** a) Write short note on frictional losses and dynamic losses in a duct. **[4]**

b) With the help of example, explain velocity reduction method of Duct design. **[6]**

**Q6)** a) Explain kitchen exhaust ventilation system. **[4]**

b) Write difference between water cooled VRV and air cooled VRV. **[6]**

**Q7)** a) Explain the open loop and close loop control system for air conditioning system. **[4]**

b) Short note on: **[6]**

i) Desiccant Dehumidification

ii) Types of ventilation system.



Total No. of Questions : 8]

SEAT No. :

**P3069**

[Total No. of Pages : 2

[5872]-177

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

**MEASUREMENTS AND CONTROLS**

**(2017 Pattern) (Semester - II) (502109)**

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) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

**Q1)** a) Differentiate between Threshold and Resolution with suitable examples.[5]

b) Explain the classification of measuring instruments. [5]

**Q2)** a) Explain the necessity of calibration. Describe the calibration procedure for pressure transducer. [6]

b) Explain uncertainty in measurement system. [4]

**Q3)** a) What are the sources of systematic error? [4]

b) Find the coefficient of correlation by Spearman's method for the following data: [6]

X	45	56	39	54	45	40	56	60	30	36
Y	40	36	30	44	36	32	45	42	20	36

**Q4)** a) Explain the working of McLeod gauge for measuring very low pressure.[5]

b) Explain Drag effect flow meter or constant pressure drop, variable area flow meter with diagram. [5]

*P.T.O.*

- Q5)** a) What are the properties of regression coefficients? [4]
- b) In a partially damaged records, the following data are available: [6]
- Variance of  $X = 25$ , Regression equation  $X$  upon  $Y \rightarrow 5X - Y = 22$ ,  
Regression equation  $Y$  upon  $X \rightarrow 64X - 45Y = 24$ . Find mean value of  
 $X$  &  $Y$  and Coefficient of correlation between  $X$  &  $Y$ .
- Q6)** a) Explain any two types of instruments for the measurement of temperature  
and heat flux. [5]
- b) Explain the measurement of humidity. [5]
- Q7)** a) Explain Measurement of Torque. [5]
- b) Explain with sketches the measurement of Noise. [5]
- Q8)** a) Explain the working of PI pneumatic controller with specific application. [5]
- b) Compare electronic with other type of controller. [5]



Total No. of Questions : 7]

SEAT No. :

**P6548**

[Total No. of Pages : 2

**[5872]-178**

**M.E. (Mechanical) (Heat Power)  
COMPUTATIONAL FLUID DYNAMICS  
(2017 Pattern) (Semester - III) (602113)**

*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)** Discuss the accuracy of the forward, backward and central difference method and explain which is most accurate and why? **[5]**

b) Find the divergence of the vector field  $\phi = \nabla (u, v, w) = (xy^2, 2xz, 4-z^2y)$  **[5]**

**Q2) a)** Give an example of the hyperbolic equations. Discuss the nature of the solution of hyperbolic equations. **[6]**

b) Define curl of velocity. Give an example of practical application of curl of velocity. **[4]**

**Q3) a)** Explain in brief structured grid generation in CFD simulations. Draw different mesh/grid elements used in structured grid generation along with its nomenclature. **[6]**

b) Derive an expression for grid transformations with respect to  $x, y$  and  $z$  spatial directions. **[4]**

**Q4) a)** Derive expression for two-dimensional advection equation using finite volume discretization. **[6]**

b) What is upwind method? Why upwind schemes are important for strongly convective flow? **[4]**

**P.T.O.**

- Q5)** a) Comment on the numerical schemes and its accuracies used in commercial software tools in industry. Explain benefits or limitations of these software tools in high precision applications. [6]
- b) Write note on TVD. Explain its necessity in CFD. [4]
- Q6)** a) What is turbulence modeling? Explain  $k-\omega$  model in detail. [7]
- b) What is characteristic of turbulence? Explain any two characteristics of turbulence. [3]
- Q7)** a) Write different steps in Pre-processing in detail. Explain how it affects the CFD solution? [6]
- b) Discuss any one advanced topic in CFD related to parallel computing, optimization techniques used in CFD or solution acceleration techniques. [4]



Total No. of Questions : 7]

SEAT No. :

**P3070**

[Total No. of Pages : 2

[5872]-179

**M.E. (Mechanical) (Heat Power Engineering)**  
**DESIGN OF HEAT TRANSFER EQUIPMENTS**  
**(2017 Pattern) (Semester-III) (602114)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neta diagrm must be drawn wherever necessary.*
- 3) *Figure to the right side indicate full marks.*
- 4) *Use of steam tables, Mollier charts, scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Draw temperature distribution in following configuration of heat exchanger. **[5]**

- i) Single-pass split flow (TEMA G) exchanger.
  - ii) Single-pass divided flow (TEMA J) exchanger with shell fluid mixed.
  - iii) A 1-2 TEMA E heat exchanger (one shell pass & two tube passes)
  - iv) A 1-2 Split flow (TEMA G) exchanger.
  - v) A 1-2 divided flow (TEMA J) exchanger with shell fluid mixed.
- b) Explain heat exchanger design methodology with the help of flow chart. **[5]**

**Q2) a)** Explain the principle of flow reversibility. **[4]**

- b) A counter flow heat exchanger is employed to cool 0.55kg/s ( $C_p=2.45\text{ks/kg}^\circ\text{C}$ ) of oil from  $115^\circ\text{C}$  to  $40^\circ\text{C}$  by the use of water. the inlet and outlet temperature of cooling water are  $15^\circ\text{C}$  and  $75^\circ\text{C}$  respectively. The overall heat transfer coefficient is expected to be  $1450\text{ w/m}^2\text{ }^\circ\text{C}$  using NTU method, calculate the following. **[6]**

- i) The mass flow rate of water
- ii) The effectiveness of the heat exchanger.
- iii) The surface area required.

**Q3)** A shell and tube heat exchanger is designed to cool the shell side lubricating oil from  $65^\circ\text{C}$  to  $60^\circ\text{C}$  following are the specifications for the shell & tube heat exchanger. **[10]**

Tube outside diameter =19mm

Tube wall thickness=1.2mm

Tube pitch=25 mm square layout

Number of baffles=14

**P.T.O.**

cross flow area near the shell centerline= $0.0442\text{m}^2$  number of effective tube rows crossed in one window Zone=3.868

Flow area through the window zone= $0.0126\text{m}^2$

Oil flow rate = $36.3\text{kg/s}$

Ideal tube bank friction factor= $0.23$

Number of effective tube rows baffle section = $9$

Shell side Reynolds number = $242$

Oil density= $840\text{kg/m}^3$

Factor for various leakage and bypass flows for the pressure drop correction are

- i) 0.59 for baffle to shell and tube to baffle leakage stream
- ii) 0.6 for baffle to shell by pass stream and
- iii) 0.81 for unequal baffle spacing on inlet and exit baffle sections.

Calculate shell side pressure drop.

- Q4)** a) Write note on Wilson plot technique. [5]  
b) Explain the major operating parameters that has to be considered while selecting heat exchanger. [5]

- Q5)** a) Explain the factors which affect the cooling tower performance. [5]  
b) What is the role of insulation in the design of furnace? Give any four insulations. [5]

- Q6)** a) What is steam traps? explain its working [5]  
b) Explain the construction and working of heat pipe. [5]

- Q7)** Write a short notes on (any two) [2×5=10]  
a) Bell Delaware method.  
b) Heat transfer augmentation techniques.  
c) Fouling factor.



Total No. of Questions : 8]

SEAT No. :

**P6549**

[Total No. of Pages : 2

**[5872]-181**

**M.E. (Chemical)**

**MATHEMATICAL AND STATISTICAL METHODS**

**(2017 Pattern) (Theory) (Semester-I) (509101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer total 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.*

**Q1) a)** Solve the differential equation by power series method  $y^2 - y = 0$  [5]

b) What does convergence of a power series mean? Why it is important? [5]

**Q2) a)** Find the potential in the interior of a sphere of unit radius when the potential on the surface is  $f(\theta) = \cos^2 \theta$ . [6]

b) Explain Laplace equation in cylindrical form. [4]

**Q3) a)** Find the Laurent series expansion of  $(z-1)/z^2$  for  $|z-1| > 1$  [5]

b) Write a note on series of complex terms. [5]

**Q4) a)** Solve the following system of ODE using Laplace transform method using initial conditions as  $x(0) = 1; y(0) = 0$  [6]

$$x' - y = e^t$$

$$y' + x = \sin t$$

b) Find the Laurent's expansion of  $f(z) = (7z-2)/[(z+1)z(z-2)]$  in the region  $1 < z < 3$ . [4]

**Q5) a)** Genetic theory states that children having one parent of blood type A and the other blood type B will always be of one of three types. A, AB, B and that the proportion of three types will on an average be as 1 : 2 : 1. A report states that out of 300 children having one A parent and B

*P.T.O.*



parent, 30 percent were found to be types A, 45 percent type AB and remainder type B. Test the hypothesis by  $\chi^2$  test. ( $P^*$  = Probability under  $H_0$  that of  $\chi^2 > \chi^2$  at 5%). [8]

Degree Freedom	1	2	3	4	5
$P^*$	3.841	5.991	7.815	9.488	11.070

b) Distinguish between experimental and extraneous variables. [2]

**Q6) a)** If Balls are drawn from a bag containing equal number of black and white balls, each ball being replaced before drawing another. In 2250 drawings 1018 black and 1232 white balls have been drawn. Do you suspect some bias on the part of the drawer? [6]

b) Explain residual error in regression model? [4]

**Q7) a)** To know the mean weights of all 10 year old boys in Delhi, a sample of 225 is taken. The mean weight of the sample is found to be 67 pounds with a S.D. of 12 pounds. Can you draw any inference from it about the mean weight of the population?

A normal population has a mean 0.1 and a S.D. of 2.1. Find the probability that the mean of sample of 900 members will be negative. [6]

b) Discuss brief about test of goodness of fit. [4]

**Q8) a)** The initial value problem for the heat equation on the whole real line is [7]

$$f_t = f_{xx} \quad t \geq 0$$

$$f(t = 0, x) = f_0(x) \text{ with } f_0 \text{ smooth and bounded.}$$

i) Write down the Green's function  $G(x,y,t)$  for this initial value problem.

ii) Write the solution  $f(x,t)$  as an integral involving  $G$  and  $f_0$ .

b) Comment on factorial experimentation with suitable example. [3]



Total No. of Questions : 8]

SEAT No. :

**P3071**

[Total No. of Pages : 2

[5872]-182

**M.E. (Chemical Engineering)**

**PROCESS OPTIMIZATION**

**(2017 Pattern) (509102) (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) *Figure to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

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

b) Write short note on convex and concave function. [5]

**Q2)** a) Explain in detail unimodal and multimodal function. [5]

b) Write a note on-continuity of a function. [5]

**Q3)** a) Using pattern search method, perform one iteration to minimize the function  $f(x) = x_1 - x_2 + 2x_1^2 + 2x_1 \cdot x_2 + x_2^2$  Assume initial point as (0,0). [5]

b) Explain steepest descent method for multi-variable optimization. [5]

**Q4)** Write short notes on:

a) Quadratic interpolation method. [5]

b) Evolutionary optimization method. [5]

**Q5)** Use Fibonnaci method to maximize  $Z=24x-2x^3$  in the range 0 to 10 to an accuracy of 1% carry out 4 iteration. [10]

**Q6)** a) Write internal constraints in theory of constraints. [5]

b) Explain application of theory of constraints in operations management.[5]

*P.T.O.*

- 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) Explain the differences between Genetic Algorithm and traditional methods. [5]
- b) What is fitness function in Genetic Algorithm? [5]



Total No. of Questions : 7]

SEAT No. :

**P6550**

[Total No. of Pages : 1

**[5872]-183**

**M.E. (Chemical Engineering)**  
**ADVANCED SEPARATION PROCESSES**  
**(2017 Pattern) (Semester-I) (509103)**

*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 an electronic pocket calculator is allowed..*
- 5) *Assume suitable data, if necessary.*
- 6) *Use of cell phone or mobile phone is prohibited in the examination hall (as well as smart watch)*

**Q1)** a) Distinguish between cross flow filtration and cross flow electro filtration. **[4]**  
b) Explain in brief design aspects of Ultrafiltration. **[6]**

**Q2)** a) Explain in brief permeation techniques for liquids and gases. **[5]**  
b) Write a short note on : Types of adsorption isotherms. **[5]**

**Q3)** Describe in brief about HPLC with working principle and working mechanism with a neat diagram. **[10]**

**Q4)** a) Describe in brief design aspects of microfiltration membrane process. **[5]**  
b) Discuss the reactive absorption for removal of hazardous gases like  $H_2S$ ,  $SO_x$  etc. **[5]**

**Q5)** a) Explain in brief Ion-Exchange chromatography. **[5]**  
b) Write a short note on: Extraction using Ultrasound technique. **[5]**

**Q6)** Nicotine (C) in a water (A) solution containing 1% nicotine to be extracted with kerosene (B) at  $20^\circ C$ . water and kerosene are immiscible with each other. Determine the percentage separation of Nicotine if 100 kg of Feed solution is extracted one with 150 kg solvent. Repeat for three theoretical extractions using 50 kg solvent each. **[10]**

**Q7)** a) Discuss in detail industrial effluent treatment by using modern techniques. **[5]**  
b) Write a short note on: Electrophoresis and Dielectrophoresis. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P3072**

[Total No. of Pages : 2

[5872]-185

**M.E. (Chemical Engg.)**

**ADVANCED TRANSPORT PHENOMENA**

**(2017 Pattern) (Semester - II) (509107)**

*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 electronic pocket calculator is allowed.*

**Q1)** Derive the equation of motion for isothermal systems starting from the momentum balance over a volume element. **[10]**

**Q2)** A spherical tank of radius  $R$  and its drain-pipe of length  $L$  and diameter  $D$  are completely filled with a heavy oil. At time  $t = 0$  the valve at the bottom of the drain-pipe is opened. Derive the time equation for complete draining of the tank. There is an air vent at the very top of the spherical tank. Ignore the amount of oil that clings to the inner surface of the tank, and assume that the flow in the drain-pipe is laminar. **[10]**

**Q3)** Develop the dimensionless wall heat flux relation for the temperature distribution for turbulent flow in tubes equipped with an electric heating coil which provide a constant wall flux  $q_w$ . **[10]**

**Q4)** Discuss the boundary layer theory for non-isothermal flow around a submerged object. **[10]**

**Q5)** A copper wire has a radius of 2 mm and a length of 5m. For what voltage drop would the temperature rise at the wire axis be  $10^\circ\text{C}$ , if the surface temperature of the wire is  $20^\circ\text{C}$ ? For copper, the Lorenz number is  $k/k_e T_o = 2.23 \times 10^{-8} \text{ volt}^2/\text{K}^2$ . **[10]**

**P.T.O.**

**Q6)** Gas A is absorbed by a stationary liquid solvent S, the latter containing solute B. Species A reacts with B in an instantaneous irreversible reaction according to the equation  $aA + bB \rightarrow \text{Products}$ . It may be assumed that Fick's second law adequately describes the diffusion processes, since A, B, and the reaction products are present in 'S' in low concentrations. Obtain expressions for the concentration profiles. **[10]**

**Q7)** A liquid 'B' is flowing very slowly around a spherical bubble of gas 'A' of radius 'R' (creeping flow). Develop the relation for the determination of the rate of mass transfer of 'A' into the surrounding fluid ' $N_{A0}$ ', if the solubility of gas 'A' in liquid 'B' is  $C_{A0}$ . State the assumptions. **[10]**

**Q8)** a) Explain the Reynolds Analogy in brief. **[5]**  
b) State the analogies among heat and mass transfer at low mass-transfer rates in terms of the basic relations. **[5]**



Total No. of Questions : 8]

SEAT No. :

**P3073**

[Total No. of Pages : 2

[5872]-186

**M.E.(Chemical)**

**ADVANCED PROCESS CONTROL  
(2017 Pattern) (Semester - II) (509108)**

*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 Process Identification? State the differences between Theoretical Modeling and Process Identification. **[5]**

b) Develop the state-space mathematical model of the two tank liquid level system. **[5]**

**Q2)** Discuss the significance of Relative Gain Array (RGA) analysis for MIMO systems. Recommend with reasoning, the best pairing for the system with following gain matrix and resulting RGA. **[10]**

$$K = \begin{bmatrix} -2 & 1.5 \\ 1.5 & 2 \end{bmatrix} \Rightarrow A = \begin{bmatrix} 0.64 & 0.36 \\ 0.36 & 0.64 \end{bmatrix}$$

**Q3)** Explain the stability analysis of Discrete-time systems in the complex plane. **[10]**

**Q4) a)** Discuss in detail the fundamentals of Model Predictive Control (MPC) with the predictive graph. **[5]**

b) Explain the concepts of Dynamic Matrix Control (DMC) with equations and the response graph. **[5]**

*P.T.O.*

**Q5)** Explain the Snowball effect occurring in material and energy balance systems with Recycle. **[10]**

**Q6) a)** State the notion of stability and mention how the Routh Array is used to determine the Stability of systems. **[5]**

**b)** Explain the concept of Feedback Control of a process. Derive the transfer function of a feedback control loop. **[5]**

**Q7)** Discuss the importance of Singular Value Analysis and the Condition Number of a system. **[10]**

**Q8)** Design a controller for the following first - order system using the Direct Synthesis controller design approach: **[10]**

$$g(s) = \frac{0.66}{6.7s + 1}$$





Total No. of Questions : 8]

SEAT No. :

**P6998**

[Total No. of Pages : 2

**[5872]-187**

**M.E. (Chemical Engineering )**

**ADVANCED REACTION ENGINEERING**

**(2017 Pattern)(Semester-II)(509109)**

*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)** Explain in brief Langmuir- Hinshelwood model. **[6]**

b) What are the various factors responsible for determination of rate controlling step in the fluid-particle reaction? **[4]**

**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. **[7]**

b) Write the steps for modelling diffusion with reaction. **[3]**

**Q3) a)** From a pulse input into a vessel we obtain the following output signal. **[6]**

Time, min.	1	3	5	7	9	11	13	15
Concentration, (mol/lit.)	0	0	10	10	10	10	0	0

We want to represent the flow through the vessel with the tanks - in -series model. Determine the no. of tanks to be used.

b) what is meant by effectiveness factor and its evaluation? **[4]**

**Q4) Discuss about:** **[10]**

- a) State of aggregation.
- b) Earliness and lateness of fluid mixing in the vessel.

**P.T.O.**

- Q5)** a) What is the significance of 'Thiele Modulus' catalytic reaction engineering? [6]  
b) Explain Rideal Eiley Model. [4]
- Q6)** a) Write a detail note on : [7]  
i) Effectiveness factor  
ii) Progressive conversion model  
b) List the type of reactor with neat sketch. [3]
- Q7)** Determine the amount of catalyst required in packed bed reactor for 80% conversion of 1000 mol/min if  $C_{A0} = 8 \text{ mol/m}^3$  of feed. [10]
- Q8)** a) Explain in details about the fluidised bed reactor. [6]  
b) Describe rate controlling steps in catalytic reactions. [4]



Total No. of Questions : 8]

SEAT No. :

**P3074**

[Total No. of Pages : 1

**[5872]-188**

**M.E. (Chemical)**

**PROCESS MODELING AND SIMULATION**

**(2017 Pattern)(Semester-III)(509113)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculators and steam tables is permitted.*

- Q1)** Define Model and also explain the need of modeling. **[10]**
- Q2)** Explain in detail steady state model with suitable example. **[10]**
- Q3)** Explain different methods of Design of Experiment. **[10]**
- Q4)** Develop a model for Membrane Reactor. **[10]**
- Q5)** Write assumption for a model of packed Extractor & develop a model. **[10]**
- Q6)** Give the simulation scheme for CSTR. Explain it with a case study. **[10]**
- Q7)** A patient just had surgery and is required to have at least 81 units of drug D1 and 120 units of drug D2 each day. Assume that an over dosage of either drug is harmless. Each gram of substance M contains 10 units of D1 and 8 units of drug D2 and each gram of substance N contains 2 units of D1 and 4 units of D2. Now suppose that both M and N contain an undesirable drug D3, 3 units per gram in M and 1 unit per gram in N. Find how many grams of substances M and N should be taken in order to meet the requirements and minimize the intake of D3 at the same time. **[10]**
- Q8)** Explain numerical methods pertaining to chemical engineering **[10]**



Total No. of Questions : 8]

SEAT No. :

**P3075**

[Total No. of Pages : 2

[5872]-189

**M.E. (Chemical Engg.)**

**ADVANCED THERMODYNAMICS**

**(2017 Pattern) (Semester - III) (509114) (Paper-II)**

*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 electronic pocket calculator is allowed.*

**Q1) a)** The following activity coefficient relation is applicable for a binary LLE system: **[6]**

$$\frac{G^E}{RT} = Ax_1x_2 \quad \text{in } \gamma_1 = Ax_2^2 = A(1-x_1)^2 \\ \text{in } \gamma_2 = Ax_1^2$$

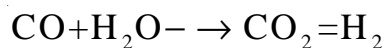
Determine the respective activity coefficients for the system if  $A=2.2$  for a composition of  $x_1=0.3$ .

b) Determine the degrees of freedom for the system of LLE with three components forming two immiscible phases: **[4]**

**Q2)** Explain the equilibrium criteria for liquid-liquid Equilibrium (LLE) for a 2-Phase, multi-component system with relations and graphs. **[10]**

**Q3)** Discuss about the different forms of equilibrium criteria for chemical reactions in detail. **[10]**

**Q4)** A mixture of CO, H<sub>2</sub>O and H<sub>2</sub> in the mole ratio 1:1:2 is fed to a reactor which is maintained at 10 bar and 1000 K, in which the following reaction take place:



Assuming that the gaseous components in the mixture are ideal gases and the equilibrium constant for the reaction at the given temperature is  $K=1.5$ , calculate the degree of conversion. **[10]**

*P.T.O.*

**Q5)** Explain the significance of Liouville Equation in detail. [10]

**Q6)** Explain the concept of degeneracy in statistical thermodynamics in detail. [10]

**Q7) a)** Air (as ideal gas  $C_p/C_v=1.4$ ) is compressed in a piston-cylinder from 1 bar, 300 K to 10bar, 300K. The minimum amount of work to be done per mole of air is [5]

**b)** One mole of ideal gas at 2 atm pressure expands irreversibly and adiabatically into vacuum to decrease its pressure to 1 atm. Determine the change in entropy (J/K) of the gas. [5]

**Q8)** Explain the process of density-gradient centrifugation for separation of DNA samples. [10]



Total No. of Questions : 8]

SEAT No. :

**P3076**

[Total No. of Pages : 2

[5872]-191

**M.E. (Chemical) (Environmental Engineering)**  
**APPLIED STATISTICS FOR ENVIRONMENTAL ENGINEERS**  
**(2017 Pattern) (Semester - I) (509131)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from each section.*
- 2) *Neat diagram 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 Latin square design used to eliminate the effect of 2 and 3 extraneous sources of variability respectively with model equations. **[10]**

**Q2)** An experiment was designed to study the performance of four detergents. The following “whiteness” reading were obtained with specially designed equipment for 12 loads of washing distributions over three different models of washing machines:

	Machine1	Machine 2	Machine 3	
Detergent A	45	43	51	139
Detergent B	47	46	52	145
Detergent C	48	50	55	153
Detergent D	42	37	49	128
	182	176	207	565

Looking on detergents as a treatments and the machines as blocks, obtain the appropriate analysis of variance table and at the 0.01 level of significance whether there are differences in detergents or in washing machines. **[10]**

*P.T.O.*

**Q3)** Find the covariance of the two random variables whose joint density is given by

$$f(x, y) = \begin{cases} 2 & \text{For } x > 0, y > 0, x + y < 1 \\ 0 & \text{elsewhere} \end{cases} \quad [10]$$

**Q4)** Explain the method of moments Generating function for the CHI-Square distribution. [10]

**Q5) a)** Elaborate relation between t and f distribution. [5]

**b)** What are the types of errors associated in testing hypothesis. [5]

**Q6)** Discuss in detail stepping stone method. [10]

**Q7)** Explain randomized block design model with suitable illustration. [10]

**Q8)** Discuss degeneracy in transportation problem. [10]



Total No. of Questions : 8]

SEAT No. :

**P3077**

[Total No. of Pages : 1

[5872]-192

**M.E. (Chemical) (Environmental Engg.)  
ENVIRONMENTAL MANAGEMENT  
(2017 Pattern) (Semester - I) (509132)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain the different environmental management standards for chemical industries. [5]  
b) Discuss the various advantages of environmental auditing. [5]
- Q2)** a) Discuss trade and environmental management. [5]  
b) Explain EIA evaluation in India. [5]
- Q3)** a) What is 74<sup>th</sup> amendment of the constitutions. [5]  
b) What are the features of the directive principles of state policy? [5]
- Q4)** a) Explain command and control regulations. [4]  
b) Explain how a rule is notified and gazetted. [3]  
c) What are the different environmental acts? [3]
- Q5)** a) Explain fundamental rights and duties of indian citizens. [5]  
b) Write short note on general procedure for Risk assessment. [5]
- Q6)** a) Discuss the various steps in rule notification. [5]  
b) Give the different between regulations and laws. [5]
- Q7)** a) Explain the role of Central Pollution Control Board for sustainable growth. [5]  
b) Write short note on Kyto protocol. [5]
- Q8)** a) Explain the role of Ministry of forest for conservation of environment.[5]  
b) Discuss general features of annual report of Ministry of Environment for current year. [5]





Total No. of Questions : 8]

SEAT No. :

**P3078**

**[5872]-193**

[Total No. of Pages : 1

**M.E. (Chemical - Environmental)  
ENVIRONMENTAL CHEMISTRY  
(2017 Pattern) (Semester - I) (509133)**

*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)** Discuss greenhouse gases and global warming. **[10]**

**Q2)** What are Colloids? Explain the use of colloids in Environmental Engineering with suitable example. **[10]**

**Q3)** What are the ill effects of particulate matter on human health? **[10]**

**Q4)** Explain the Fate of chemicals in aquatic environment. **[10]**

**Q5)** What are the sources of particulate matter in Thermal power plant? **[10]**

**Q6)** What is CO<sub>2</sub> capture mechanism? **[10]**

**Q7)** What is Anion exchange capacity? How do determine it. **[10]**

**Q8)** What are different effects of Air pollutants on materials? **[10]**



Total No. of Questions : 8]

SEAT No. :

**P3079**

[Total No. of Pages : 1

**[5872]-194**

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

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (509134)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What do you mean by research? Explain its significance in modern times. [5]  
b) What are the main issues in formulating the research problem? [5]
- Q2)** a) Distinguish between research methods and research methodology. [5]  
b) Discuss the criteria for choice of topic of research. [5]
- Q3)** Discuss the design of experiments in research with suitable case study? [10]
- Q4)** Explain the significance and applications of various graphs and charts in research with suitable examples. [10]
- Q5)** Give the significance and applications of algorithms in research. [10]
- Q6)** Discuss the Neural Network based optimization in research. [10]
- Q7)** Consider a suitable case study in research and explain the format for research report writing. [10]
- Q8)** Write short notes on following: [10]  
a) Copyright  
b) IPR



Total No. of Questions : 8]

SEAT No. :

P6999

[Total No. of Pages : 2

[5872]-195

**M.E. (Chemical) (Environmental Engineering)**  
**WASTEWATER TREATMENT & DESIGN**  
**(2017 Pattern) (Semester - II) (509137)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Explain configurations for ideal and nonideal reactors. **[10]**

**Q2)** a) Explain mass transport processes. **[5]**

b) What are the important factors to be considered for selecting unit operations and processes. **[5]**

**Q3)** A treated wastewater with a flow rate of 1000 L/min is to be treated with PAC to reduce the concentration of residual organics measured as TOC from 5 to 1 mg/L. The Freundlich adsorption isotherm parameters were developed. Assuming the following data apply, determine the PAC requirements to treat the wastewater flow. If the PAC costs Rs. 0.50/ kg, estimate the annual cost for treatment, assuming the PAC will not be regenerated. **[10]**

Compound - mixed organics.

Initial Concentration  $C_0=5$  mg/L

Final Concentration  $C_g=1$  mg/L

GAC density= $450$  g/L

Freundlich capacity factor,  $k_f= 150$  (mg/g) (L/mg)  $1/n$

Freundlich intensity parameter,  $1/n = 0.5$

**P.T.O.**

- Q4)** Determine the theoretical amount of air required at 20 °C to reduce the ammonia concentration from 40 to 1 mg/L in a treated wastewater with a flow rate of 4000 m<sup>3</sup>/d. Assume the pH of the wastewater has been increase to a value of 11, the Henry's constant for ammonia at 20 °C is 0.75 atm., and the air entering the bottom of the tower does not contain any ammonia. [10]
- Q5)** a) How activated carbons are prepared and explain carbon regeneration and reactivation. [5]  
b) Explain the concept of uptake capacity. [5]
- Q6)** a) Discuss process design consideration for rotating biological contactors (RBC). [5]  
b) What are the biological properties of waste. [5]
- Q7)** Determine the capacity of a chlorinator for a treatment plant with an average wastewater flow of 1000 m<sup>3</sup>/d. The peak daily factor for the treatment plant is 3.0 and the maximum required chlorine dosage is to be 20 mg/L. [10]
- Q8)** a) Explain Principle and working of Trickling filter. [5]  
b) Discuss the general design consideration for anaerobic treatment process. [5]



Total No. of Questions : 10]

SEAT No. :

**P3080**

[Total No. of Pages : 2

**[5872]-196**

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

**SOLID WASTE MANAGEMENT**

**(2017 Pattern) (Semester - II) (509138)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) Neat diagram must be drawn wherever necessary.*
- 3) Assume suitable data, if necessary.*

*Q1)* Give the chemical and biological properties of the solid waste. **[10]**

OR

*Q2)* Illustrate the compositions of solid waste. **[10]**

*Q3)* Give the various types of solid waste collection system and explain the general consideration for waste storage at source. **[10]**

OR

*Q4)* Analyze the economics of solid waste generation rate. **[10]**

*Q5)* Explain the guidelines given for sorting for material recovery in detail. **[10]**

OR

*Q6)* Explain the energy recovery system from the biomethanation. **[10]**

*P.T.O.*

**Q7)** Give the advantages and disadvantages of various technological options of composting of solid waste. **[10]**

OR

**Q8)** Illustrate the parameters affecting on the recovery of energy from the solid waste. **[10]**

**Q9)** Explain the leachate and landfill gas management. **[10]**

OR

**Q10)** Explain the elements of functional management plan for solid waste system. **[10]**

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P7000**

[Total No. of Pages : 1

[5872]-197

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

**INDUSTRIAL WASTE TREATMENT**

**(2017 Course) (Semester - II) (509139)**

*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 the treatment techniques for removal of Organic pollutants from Industrial waste. **[10]**

**Q2)** Write short notes Trickling Filters. **[10]**

**Q3)** Explain Tertiary treatments for industrial Wastewater. **[10]**

**Q4)** What are clean up and cleaner technologies? Explain with proper examples. **[10]**

**Q5)** Explain the treatment techniques for the removal of Heavy Metals from industrial wastewater with neat flow diagram. **[10]**

**Q6)** Draw the flow sheet for treatment of sugar waste and focus on its cost benefit analysis with all details. **[10]**

**Q7)** Explain the concept, objective, design and cost-benefit analysis of common ETP plant. **[10]**

**Q8)** Write note on Flow chart for sludge treatment & disposal. **[10]**



Total No. of Questions : 8]

SEAT No. :

P6765

[Total No. of Pages : 2

[5872] - 198

**M.E. (Environmental) (Chemical Engineering)**  
**REMOTE SENSING AND GIS APPLICATIONS IN**  
**ENVIRONMENTAL ENGINEERING**  
**(2017 Pattern) (Semester - III) (509143)**

*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 applications Remote Sensing technique. **[5]**

b) Define Electromagnetic Radiation and its interactions with atmosphere. **[5]**

**Q2)** Write short note on “Various satellites in orbit and their sensors” in detail. **[10]**

**Q3) a)** Explain Active and Passive Remote Sensing system. **[5]**

b) Write down the use of Aerial Photographs in industry. **[5]**

**Q4)** Differentiate between analog and digital system of remote sensing. **[10]**

**Q5)** Write short notes on : **[10]**

a) Image classification.

b) Indian remote sensing satellites.

**P.T.O.**



**Q6)** Explain the following in brief. **[10]**

- a) Spectral response of natural earth surface features.
- b) Interpretation of radar imagery.

**Q7)** Explain concept of G.I.S. and state any four components of G.I.S. **[10]**

**Q8)** State any four data sources for G.I.S. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P3081**

[Total No. of Pages : 2

[5872]-199

**M.E. (Chemical) (Environmental Engg.)**  
**INDUSTRIAL POLLUTION PREVENTION & CLEANER**  
**PRODUCTION**  
**(2017 Pattern) (Semester - III) (509144)**

*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 the importance of industrialization and sustainable development. [5]  
b) Write note on industrial ecology for pollution prevention and cleaner production. [5]
- Q2)** a) Discuss the various key indicators for the sustainability. [5]  
b) Explain the cleaner technology and cleaner production concept. [5]
- Q3)** a) Enlist the environmental Management Hierarchy for pollution control and cleaner production. [5]  
b) Explain the role of government and institution in pollution prevention and cleaner production. [5]
- Q4)** a) Discuss the role of process and equipment optimization in pollution prevention and control. [5]  
b) Explain the applications of internet information pollution prevention and cleaner production. [5]
- Q5)** Explain the pollution prevention and control by following ways. [10]  
a) Reuse  
b) Recover  
c) Recycle  
d) Raw material substitution.

**P.T.O.**

**Q6)** Discuss the technical and environmental feasibility analysis of pollution prevention and cleaner production program. **[10]**

**Q7) a)** Explain the role of cost analysis for pollution prevention and control. **[5]**

b) Write a note on environmental audit. **[5]**

**Q8)** Write short notes on.

a) International Environmental standards-ISO 14001 **[5]**

b) Life cycle costing. **[5]**



Total No. of Questions : 6]

SEAT No. :

P6796

[Total No. of Pages : 2

[5872]-201

M.E.

(Computer Engg/AIDS/Computer Engg. Master Data Science)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (510101)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat diagrams wherever necessary.

**Q1)** a) What is Research Methodology? What is the research process? Elaborate on the importance of objectives and outcomes of research? [9]

OR

b) What is the significance of the code of ethics in research? What are the characteristics of engineering research? [9]

**Q2)** a) What is a research plan? What is the use of mathematical modeling in a research plan? [8]

OR

b) What is the significance of following in literature survey [8]

- i) Shodhganga
- ii) Google Scholar
- iii) Citations
- iv) Paraphrasing

**Q3)** a) What is the hypothesis and the Null hypothesis? How statistical analysis helps in testing of hypothesis? [8]

OR

b) State the use of the following tools [8]

- i) PSPP
- ii) SOFA
- iii) AQUAD
- iv) CAT

P.T.O.

**Q4) a)** State the importance of optimization in engineering research? With the help of an example, explain what gradient optimization is? [8]

OR

b) State the simplex optimization steps? What are constraints and cost function? State the similarity and differences in simplex and gradient methods of optimization? [8]

**Q5) a)** What are the guidelines for conducting surveys? How are respondents identified? What are human factors associated with surveys conducted for research? [8]

OR

b) When to use surveys in research? Comment on survey delivery, timelines and questionnaire formation? [8]

**Q6) a)** What are various reports used for compiling research findings? Discuss the thesis organization with the significance of the appendix in the thesis? [9]

OR

b) Elaborate following research outcomes and when which publication is to be attempted. [9]

i) Patent

ii) Copyright

iii) Research Paper



Total No. of Questions : 7]

SEAT No. :

**P3082**

[Total No. of Pages : 1

[5872]-202

**M.E. (Computer Engineering)**

**BIO-INSPIRED OPTIMIZATION ALGORITHMS**

**(2017 Pattern) (Semester - I) (510102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q.No. 7 is compulsory, solve any 5 from Q.No.1 to Q.No.6*
- 2) *Figure to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain the philosophy of natural computing. [4]  
b) Illustrate the process of problem solving as a search track. [4]
- Q2)** a) Explain the term standard evolution algorithm and its advantages. [4]  
b) Explain the term Evolutionary biology. [4]
- Q3)** a) Give basic principle of Swarm Intelligence system. [4]  
b) Interpret the biological terminology into Ant Colony Optimization and Ant Clustering Algorithm. [4]
- Q4)** a) Explain CUCKOO search algorithm. [4]  
b) Explain Bat algorithm and discuss rules of Bat algorithm. [4]
- Q5)** a) Summarize aiNet learning algorithm. [4]  
b) Discuss procedure to implement monitoring phase of negative selection Algorithm. [4]
- Q6)** a) Discuss architecture of framStick. [4]  
b) Illustrate boid flocking. [4]
- Q7)** a) Explain any one application of Genetic algorithm. [6]  
b) What is artificial life & what are the goal of artificial life. [4]



Total No. of Questions : 8]

SEAT No. :

**P3083**

**[5872]-203**

[Total No. of Pages : 2

**M.E. (Computer Engineering)**  
**SOFTWARE DEVELOPMENT AND VERSION CONTROL**  
**(2017 Pattern) (Semester - I) (510103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** Explain incremental design of software development process with diagram. **[5]**

b) Explain data centered architecture with example. **[4]**

OR

**Q2) a)** Explain software architecture design models. **[5]**

b) Explain quality attributes of the design product. **[4]**

**Q3) a)** Explain software architecture in agile projects. **[5]**

b) Explain configuration management tools evaluation and selection. **[4]**

OR

**Q4) a)** Why source code management is important? **[5]**

b) Explain risk based testing in detail. **[4]**

**Q5) a)** Explain in detail source management models with advantages and disadvantages of distributed version control. **[8]**

b) Differentiate between centralized version control and distributed version control. **[8]**

OR

**P.T.O.**

- Q6)** a) Explain file locking and version merging. [8]  
b) Explain graph structure in detail with types of version control in detail. [8]

- Q7)** a) Write a note on open source version control tools. [8]  
i) GIT  
ii) GitHub  
iii) SVN  
b) Explain facilities offered by advanced version control tools. [8]

OR

- Q8)** a) Write a note on open source version control tools. [8]  
i) CVS  
ii) Apache subversion  
iii) Mercurial  
b) Write a note on terminology related revision control tools in terms of baseline, branch, commit, merge, repository, tag, trunk. [8]  
i) Integration  
ii) Common vocabulary

\*\*\*



Total No. of Questions : 12]

SEAT No. :

**P3084**

[Total No. of Pages : 2

**[5872]-204**

**M.E. (Computer Engineering)**

**EMBEDDED AND REAL TIME OPERATING SYSTEMS**

**(2017 pattern) (Semester-I) (510104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Black figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) With a diagram explain classification of embedded systems. [5]  
b) What is the use of watchdog timer in embedded system. [3]

OR

- Q2)** a) Explain the software tools used for embedded system development. [5]  
b) Give the characteristics of embedded systems. [3]

- Q3)** a) Explain embedded systems on chip with neat diagram. [4]  
b) Briefly explain about the ARM processor & its features. [4]

OR

- Q4)** a) Give the various features of SHARC and TigerSHARC processors. [4]  
b) Explain any two networked embedded systems with their application. [4]

- Q5)** a) Explain any two mobile system protocols. [5]  
b) Enlist the differences between ISA and PCI buses. Give example systems supported by these buses. [4]

OR

- Q6)** a) Explain about parallel port interfacing with switches & keypad. [5]  
b) Give the brief description of SPI and SCI. [4]

*P.T.O.*

**Q7) a)** What is RTOS. List the real Time applications. [4]

b) What is precedence graph and task graph? Give details. [4]

OR

**Q8) a)** what are the three important categories of parameters which characterize the tasks. [4]

b) Explain Fixed and Dynamic priority algorithms. [4]

**Q9)** Explain various ways of Inter-process communication-semaphores, message queues, mailboxes and pipes. [9]

OR

**Q10)** Explain priority inversion with an example. [9]

**Q11)** Write short notes on any two. [8]

a) Windows CE

b) RTLinux

c) Embedded software development tools.

OR

**Q12)** With neat diagram Explain software development process for embedded system. [8]



Total No. of Questions : 10]

SEAT No. :

P7001

[Total No. of Pages : 3

[5872]-205

M.E. (Computer Engineering)

OPERATION RESEARCH

(2017 Pattern) (Semester - II) (510108)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Assume suitable data if necessary.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.

Q1) A firm produces three products. These products are processed on three different machines. The time to manufacture one unit of each of the products and daily capacity of the three machines is given in the table below. [5]

Machine	Time per unit(Minutes)			Machine capacity (minutes/day)
	Product 1	Product 2	Product 3	
M1	3	4	2	740
M2	5	--	2	570
M3	--	3	4	630

It is required to determine the daily number of units to be manufactured for each product. The Profit per unit for each product 1, 2 and 3 is Rs. 3, Rs. 7 and Rs. 9 respectively. It is assumed the all amounts produced are consumed in the market. Formulate the L.P. model for the problem

Q2) A project consists of a series of tasks labeled A, B, ..., H, I. Construct the network diagram having the following constraints : [5]

A < D, E; B, D < F; C < G; C < H; F, G < I.

Find the time of the completion of the project when time in days of each task is as follows :

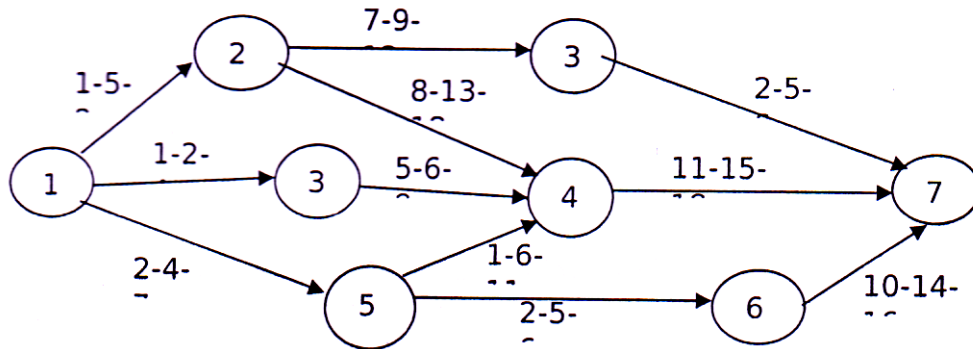
Task : A=8, B=10, C= 8, D=10, E=16, F= 17, G=18, H=14, I=9.

Also identify the critical path

P.T.O.

**Q3)** Define EOQ. Derive EOQ Formula when Demand Rate is Non-Uniform and Replenishment rate is finite. [5]

**Q4)** Consider the network shown in the figure. For each activity, the three time estimates  $t_o$ ,  $t_m$ , and  $t_p$  are given along the arrows in the  $t_o - t_m - t_p$  order. Determine variance and expected time for each activity. [5]



**Q5)** Solve using Graphical Method [5]

Minimize  $Z = 2x_1 + 3x_2$  subject to the constraints

$$x_1 + 4x_2 \geq 60,$$

$$-2x_1 - 3x_2 \leq -15 \text{ and } x_1, x_2 \geq 0$$

**Q6)** An item is produced at the rate of 20 items per day. The demand occurs at the rate of 25 items per day. If the setup cost is Rs. 50 per setup and holding cost is Rs. 0.01 per unit of item per day, find the economic lot size for one run, assuming that shortages are not permitted. Also find the time of cycle and minimum total cost for one run. [5]

**Q7)** Obtain initial basic feasible solution for following transportation problem by North-west corner method. [5]

	D1	D2	D3	D4	Supply
S1	19	30	50	10	17
S2	70	30	40	60	19
S3	40	8	70	20	28
Demand	15	18	17	14	Total=64

**Q8)** For the following activity data draw the network diagram : **[5]**

Activity	A	B	C	D	E	F	G	H	I	J	K
Preceded by	--	--	A	B	A	B	C, D	G, F	E	H, I	J

**Q9)** Discuss its characteristics. Also define the following terms : **[5]**

- a) Strategy
- b) Pure Strategy
- c) Mixed Strategy

**Q10)** For what value of  $\lambda$ , the game with following payoff matrix is strictly determinable? **[5]**

		Player B		
		B1	B2	B3
Player A	A1	$\lambda$	-1	-2
	A2	6	$\lambda$	-7
	B3	2	4	$\lambda$



Total No. of Questions : 12]

SEAT No. :

P7249

[Total No. of Pages : 2

[5872]-206

**M.E. (Computer Engineering)**  
**SYSTEM SIMULATION AND MODELING**  
**(2017 Pattern) (Semester - II) (510109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 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 are different components of System explain with an example. [5]  
b) Describe the different system properties. [3]

OR

- Q2)** a) Describe the system approach of analysis, design and control. [4]  
b) How the simulation models are Classified. Give there characteristic. [4]

- Q3)** a) Determine the sequence of numbers generated by the LCG with  $a=5$ ,  $c=3$ ,  $m=16$  &  $Z_0=7$ . [4]  
b) Give the properties of white noise. [4]

OR

- Q4)** a) Explain Statistical properties of U [0,1] generators. [4]  
b) Differentiate Between deterministic and Stochastic Models. [4]

- Q5)** a) Briefly explain the constraint propagation with the help of relaxation. [3]  
b) With the help of a diagram describe exogenous and endogenous signals. What are different varieties of exogenous signals? [5]

*P.T.O.*

OR

**Q6)** What are the properties of Petri net? Consider a producer /consumer system with an infinite buffer. Model this system using a Petri net. [8]

**Q7)** With an illustrative Example explain the simulation of queuing System. [8]

OR

**Q8)** Describe M/M/2 queuing model with example. [8]

**Q9)** a) Explain types of simulation with respect to output analysis. [5]

b) Explain the problem of initial transient. [4]

OR

**Q10)** a) Describe the type of simulations with regards to output analysis. Give example for each. [6]

b) Why the replication/deletion approach for estimation of mean is preferred over other methods justify the answer. [3]

**Q11)** Write short notes on : [9]

a) Simulation tools.

b) Verification and Validation of model building.

OR

**Q12)** Explain the importance of modeling machine down time correctly with the help of suitable example. [9]



Total No. of Questions : 6]

SEAT No. :

**P3085**

[Total No. of Pages : 1

[5872]-207

**M.E. (Computer Engineering)**

**MACHINE LEARNING**

**(2017 Pattern) (Semester - II) (510110)**

**Time : 3 Hours]**

**[Max. Marks : 50**

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

- Q1)** a) Define and explain probabilistic machine learning in detail. [4]  
b) Explain supervised machine learning with suitable examples. [4]
- Q2)** a) What is LDA? Explain LDA with suitable example. [5]  
b) Discuss any one feature extraction algorithm. [5]
- Q3)** a) Draw diagram for multilayer perceptron and explain in detail. [4]  
b) Define Artificial Neural Network. Discuss activation functions in short. [4]
- Q4)** a) Explain any one non-supervised machine learning algorithm in detail. [4]  
b) Describe algorithm for association rule mining with one example. [4]
- Q5)** a) What principle of Bay's theorem? Explain with suitable formula. [4]  
b) Discuss normal distribution with suitable diagram. [4]
- Q6)** Write a short note on: [8]  
a) Rate vulnerabilities.  
b) Counterfeit merchandise profiling.





Total No. of Questions : 12]

SEAT No. :

**P6766**

[Total No. of Pages : 2

**[5872]-208**

**M.E. (Computer Engineering)**

**FAULT TOLERANT SYSTEMS**

**(2017 Pattern) (Semester- III) (610101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8, Q.No. 9 or Q.No. 10 Q.No. 11 or Q.No. 12.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** What is reliability modeling? Differentiate between combinatorial and Markovian analytical technique. Explain with suitable examples. **[8]**

OR

**Q2)** Explain following in detail. **[8]**

- a) Information redundancy
- b) Time redundancy

**Q3)** Draw the hierarchy of fault modeling levels. Explain all levels with an example. **[8]**

OR

**Q4)** What is fault simulation? Explain important components of fault simulator. **[8]**

**Q5)** Explain iterative-based heuristic routing approach for fault tolerant routing algorithms in hypercube. **[9]**

OR

**Q6)** Describe n-dimensional hypercube. Draw 4-cube architecture. Explain how hamming distance between two addresses is calculated? **[9]**

**Q7)** Explain following : **[8]**

- a) BSN reliability
- b) BSN fault diameter

OR

**P.T.O.**

**Q8)** Differentiate between HIN and HCN with respect to the topological cost. [8]

**Q9)** What are different important components in computer, when it is modeled as graph? Explain each component in detail. [8]

OR

**Q10)** Define and explain in detail. [8]

- a) Two terminal reliability
- b) All terminal reliability

**Q11)** Enlist and explain in detail. [9]

- a) Omission failures and
- b) Response failures

OR

**Q12)** What is reliable group communication? Differentiate between flat group and hierarchical group and discuss their advantages and disadvantages. [9]



Total No. of Questions 12]

SEAT No. :

**P3086**

**[5872]-209**

[Total No. of Pages : 2

**M.E. (Computer Engineering)  
INFORMATION RETRIEVAL  
(2017 Pattern) (Semester-III) (610102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q3 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 whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of Scientific Calculator is permitted.*

- Q1)** a) Find two differently spelled proper nouns whose soundex codes are the same. [5]
- b) Explain the difference between data retrieval and information retrieval [4]

OR

- Q2)** Give an example of a sentence that falsely matches the wildcard query mon\*h if the search were to simply use a conjunction of bigrams. [9]

- Q3)** Compute variable byte code and gamma codes for the posting list (777, 17743, 294068, 312511336) [9]

OR

- Q4)** Explain Heaps' law and Zipfs law with suitable example. [9]

- Q5)** Justify the following statement with suitable example. [8]

“Inverse document frequency of a rare term is high whereas of a frequent term is likely to be low”.

OR

- Q6)** Explain vector space model for scoring with suitable example. [8]

*P.T.O.*

**Q7)** Draw inverted index that would be built for the following document collection. [8]

Doc1 new house sales top forecasts

Doc2 home sales rises in July

Doc3 increase in home sales in July

Doc4 July new home sales rise

Apply the following query

- i) Home and sales
- ii) (July or sales) And (new or homes)

OR

**Q8)** Explain Vector Space Model for XML information retrieval. [8]

**Q9)** Suppose we have collection that consists of the four documents given in the table below.

Doc Id	Document Text
1	Click go the shears boys click click click
2	Click click
3	Metal here
4	Metal shears click here

Build a query likelihood language model (unigram model) for this document collection for the query 'click shears' and rank the documents. [8]

OR

**Q10)** Explain the types of language models with suitable example. [8]

**Q11)** What is Naive Bayes algorithm, when we can use this algorithm in text analysis? [8]

OR

**Q12)a)** What is mean by Content based Information Retrieval? What are its advantages? [4]

b) What is mean by Latent Semantic Indexing? Explain with example. [4]



Total No. of Questions : 12]

SEAT No. :

**P3087**

[Total No. of Pages : 2

[5872]-211

**M.E. (Computer Networks)**

**510201: RESEARCH METHODOLOGY**

**(2017 Pattern)(Semester-I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) 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, Q.11 or Q.12.
- 2) Assume suitable data where ever necessary.
- 3) Figures to the right indicate full marks.

**Q1)** Explain types of research and work flow? **[10]**

OR

**Q2)** Explain Research Questions and Engineering Ethics? **[5]**

Distinguish between Research methods and Research methodology? **[5]**

**Q3)** Explain Impact factor, h-index, I-index, plagiarism in research publication?**[8]**

OR

**Q4)** what are types of publications? Explain measures of research impact and literature review? **[8]**

**Q5)** Write short notes on GNU, PSPP and SOFA tool? **[8]**

OR

**Q6)** Explain the Null hypothesis testing in detail? **[8]**

**Q7)** Explain multi-parameter optimization technique with suitable example? **[8]**

OR

**Q8)** Explain merits and demerits of Monte Carlo optimization technique? **[8]**

**P.T.O.**

**Q9)** Why undertake a survey? Explain general survey guidelines? [8]

OR

**Q10)** Write short notes on Qualitative Analysis Tools- AQUAD, CAT? [8]

**Q11)** Explain with suitable example IEEE / ACM paper templates? [8]

OR

**Q12)** Explain steps involved in research presentation? [8]



Total No. of Questions : 07]

SEAT No. :

**P3088**

**[5872]-212**

[Total No. of Pages : 1

**M.E. (Computer Engineering) (Computer Networks)**

**NETWORK SECURITY**

**(2017 Pattern) (Semester-I) (510202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q. No. 7 is compulsory solve any five from Q.No. 1 to Q.No. 6 .*
- 2) *Figures to the right indicates full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1)** What is threat? State and explain four primary classes of threats to network security. **[8]**

**Q2)** Who are hackers? List different types of hackers and their intention. Explain tools used for hacking. **[8]**

**Q3)** What is social Engineering is? List different forms of social engineering? Explain any one form of social engineering in detail? **[8]**

**Q4)** What is cross - site scripting (XSS) attack? What are different types of cross-site scripting (XSS) attack. **[8]**

**Q5)** What is SQL injection? Explain different ways to defend against SQL injection attacks. **[8]**

**Q6)** What is Ack-Storm Dos attacks? How it can be launched? How Ack - Dos attacks can be Prevented? **[8]**

**Q7)** State and explain OS fingerprinting Techniques. How Passive fingerprinting works? Explain any two fingerprinting Defenses. **[10]**



Total No. of Questions : 8]

SEAT No. :

**P3089**

**[5872]-213**

[Total No. of Pages : 2

**M.E. (Computer Networks)  
WIRELESS SENSOR NETWORKS  
(2017 Pattern) (Semester - I) (510203)**

*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) Describe data aggregation as an optimization problem. [6]  
b) Differentiate between traditional networks and wireless sensor networks. [6]

OR

- Q2)** a) Explain data-centric storage. [6]  
b) With suitable diagram explain the Hogthrob Node Architecture. [6]
- Q3)** a) Describe Contention-Free MAC Protocol : The Lightweight Medium Access Control (LMAC) protocol. [6]  
b) Explain Single-hop localization : Approximate point in triangle. [6]

OR

- Q4)** a) Describe Contention-Based MAC Protocol: The Data-Gathering MAC (DMAC). [6]  
b) Explain connectivity in a multihop network. [6]
- Q5)** a) Explain the Poisson point processes as uniform random deployments. [7]  
b) Explain with suitable diagram how to determine the k-coverage. [6]

OR

**P.T.O.**



- Q6)** a) Describe the Reliability requirements in sensor networks. [6]  
b) Explain Mechanisms for congestion detection and congestion handling in WSN. [7]
- Q7)** a) Explain with figure examples of attacks and the CIA model. [6]  
b) Explain Security Protocols for Sensor Networks. [7]

OR

- Q8)** Write Short Notes on (Any Two) [13]
- a) Key Management.
  - b) Security attacks on Routing and on Transport Layer.
  - c) Defenses Against DoS Attack.



Total No. of Questions : 12]

SEAT No. :

**P3090**

[Total No. of Pages : 2

**[5872]-216**

**M.E. (Computer Networks)**

**NETWORK DESIGN AND ANALYSIS**

**(2017 Pattern) (Semester - II) (510209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) *Figures to right indicate full marks.*
- 3) *Neat diagram must be drawn whenever necessary.*
- 4) *Assume suitable data, if necessary.*

**Q1)** What are the different phases of network design and explain it in detail. **[8]**

OR

**Q2)** Explain user, application, device, network, other requirements. **[8]**

**Q3)** What is fragmentation IP packet? Explain with diagram. **[8]**

OR

**Q4)** What is need of NAT? Explain the working of NAT using example. **[8]**

**Q5)** Explain application of queuing system in network design. Analyze M/M/n queuing system using state transition diagram. **[9]**

OR

**Q6)** What are queue performance parameters? Explain M/M/1 queue model performance. **[9]**

**P.T.O.**

**Q7)** What is need of routing algorithm? Explain Dijkstra's algorithm in detail. [8]

OR

**Q8)** State and explain Little's theorem. [8]

**Q9)** State and Explain various QoS mechanism to ensure in QoS network. [9]

OR

**Q10)**What is Queuing? What are the different Queuing mechanism and explain it. [9]

**Q11)**What is Wireshark? Explain features of Wireshark. [8]

OR

**Q12)**Define the following terms : [8]

- a) Next generation networks.
- b) Cyber physical systems.

**x x x**

Total No. of Questions : 12]

SEAT No. :

**P3091**

[Total No. of Pages : 2

[5872]-217

**M.E. (Computer Network)**  
**510210 : DATA ALGORITHMS**  
**(2017 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Answer the question of 1 or 2, 3 or 4, 5 or 6, 7 or 8, 9 or 10, 11 or 12.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

**Q1)** In secondary sorted, Give the example of your choice to explain the following terms and their importance: Logical (Key, value) pair, Natural key, Natural value and composite key. [8]

OR

**Q2)** What is POJO moving average? Write solution using queue. [8]

**Q3)** Left Outer Join  $(T_1, T_2, K) = \{(k, t_1, t_2) \text{ where } k \in T_1.K \text{ and } k \in T_2.K\}$

$\cup \{(k, t_1 \text{ null}) \text{ where } k \in T_1.K \text{ and } k \notin T_2.K\}$ . Above is the given a mathematical definition in term of set theory for left outer join. What K,  $T_1$  and  $T_2$  signifies, take suitable example and explain. [8]

OR

**Q4)** Explain Left outer join data flow in phase 1 and 2 with the help of classes in Hadoop. [8]

**Q5)** Take any suitable example to secondary sort algorithm to demonstrate MapReduce/Hadoop solution and explain various Classes used in MapReduce/Hadoop solution. [9]

OR

**Q6)** “One can sort the input data and then easily select the K largest records from the sorted file. This is often the most efficient method for very large K” to implement this sort give the construct of Map and Reduce functions.[9]

*P.T.O.*

**Q7)** What is the significance of following terms in Market basket analysis (Justify your answer with suitable example): [9]

- a) Minimum support
- b) Minimum improvement
- c) Minimum confidence

OR

**Q8)** Write and explain MapReduce Phases for generating association rule in Spark with step by step approach. [9]

- Q9)** a) What is scatter search? Which are comparative algorithms for scatter search? Give any three comparison points.  
b) Explain five method template for scatter search implementation.

[8]

OR

**Q10)** Find the most optimal solution using SS algorithm for following job scheduling. For betterment of result how we can use various improvement methods. [8]

	Machine 1	Machine 2	Machine 3	Machine 4	Machine 5
Job 1	23	10	40	26	27
Job 2	30	18	30	39	37
Job 3	12	2	13	31	6
Job 4	50	4	8	15	41
Job 5	21	33	8	12	8

**Q11)** Formulate the Minimum Cost Network flow problem for following instance: Given a network  $G = (N, A)$ , with a cost  $C_{ij}$ , upper bound  $U_{ij}$ , and Lower Bound  $L_{ij}$  associated with each directed arc  $(i, j)$  and supply by each node. Find the cheapest integer valued flow such that it satisfies : [8]

- a) the capacity constraints on the arcs
- b) the supplies/demands at the nodes
- c) that the flow is conserved through the network

Assume suitable data if required. Justify how it is better than others.

OR

**Q12)** Explain network simplex algorithm and minimum cost flow problem. [8]



Total No. of Questions : 12]

SEAT No. :

**P3092**

[Total No. of Pages : 2

**[5872]-218**

**M.E. (Computer Networks)**

**FAULT TOLERANT SYSTEMS**

**(2017 Pattern)(Semester-III)(610201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidate:*

- 1) *Answer six questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side of question indicate full marks.*

**Q1)** Explain Discrete (Markov) Model in detail with example? **[9]**

OR

**Q2)** Explain various error detection codes in details with examples? **[9]**

**Q3)** What is fault simulation? Explain in detail components of fault simulation? **[9]**

OR

**Q4)** Explain in detail about deductive fault simulation algorithm? **[9]**

**Q5)** Explain Iterative-Based Heuristic Routing Algorithm with example? **[8]**

OR

**Q6)** Explain in detail Node Labeling technique? **[8]**

**Q7)** Explain in detail about BSN connectivity, BSN Fault Diameter? **[8]**

OR

**Q8)** Explain in detail about degree and diameters in Hierarchical cubic networks. **[8]**

*P.T.O.*

**Q9)** Explain in detail about Daisy-Chain Architectures and Multi-Drop Architectures? [8]

OR

**Q10)** What is token ring network and bypass switch network? Explain how reliability calculates in both networks? [8]

**Q11)** Explain Message Logging Based Checkpoints in detail? [8]

OR

**Q12)** Explain the following terms [8]

- a) Faults
- b) Errors
- c) Failures
- d) Pocess resilience



Total No. of Questions 8]

SEAT No. :

**P3093**

**[5872]-219**

[Total No. of Pages : 2

**M.E. (Computer Networks)  
MOBILE AD HOC NETWORKS  
(2017 Course) (Semester-III) (610202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) What is multipath Propagation? Explain how it affects signal quality. [6]  
b) What are the advantages of reservation - based MAC protocols over contention based MAC protocols? [6]

OR

- Q2)** a) Differentiate between cellular networks and Ad Hoc wireless networks [6]  
b) Discuss the differences in topology reorganization in DSDV and CGSR routing protocols. [6]
- Q3)** a) Comment on the scaling properties of source-initiated and receiver initiated multicast protocols with respect to the number of sources and receivers in the group. [6]  
b) What are the limitations of the IEEE 802.11 MAC protocol that prevent it from supporting QoS traffic? [6]

OR

- Q4)** a) Explain Multicast routing protocol based on zone routing in detail. [6]  
b) Compare and contrast the IEEE 802.11e MAC protocol with the DBASE protocol. [6]
- Q5)** a) What are the major differences between ad hoc wireless networks and sensor networks? [7]  
b) What are the advantages of a clustered architecture over a layered architecture in a sensor network? [6]

OR

**P.T.O.**



**Q6)** a) How does the hybrid usage of TDMA and FDMA minimize energy consumption? [6]

b) Describe the Sybil attack and the sinkhole attack on sensor networks. [7]

**Q7)** a) Compare and contrast UWB communication with conventional wide-band communication techniques based on spread spectrum techniques. [6]

b) Give two advantages and disadvantages in using laser diodes as light sources for optical wireless networks [7]

OR

**Q8)** Write short Notes on (Any Two) [13]

a) Software defined Radio-Based Multimode Systems

b) Optical Wireless WDM

c) The service provider model for Wi-Fi systems



Total No. of Questions : 8]

SEAT No. :

**P3094**

[Total No. of Pages : 2

[5872]-221

**M.E. (Electrical) (Control Systems)**  
**Optimization Techniques in Control System**  
**(2017 Pattern) (Semester-I) (503101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Use of analytical method to investigate for extreme points **[5]**

$$f(x) = 2x_1^3 + x_2^3 + x_1^2 + 2x_2^2 + 4.$$

Explain the concept of convex and concave function. **[4]**

OR

**Q2)** Find the maxima and Minima if any of the function

$$f(x) = 2x^3 - 18x^2 + 27x - 9. \quad \text{[9]}$$

**Q3)** Use a Lagrangian multiplier to minimize the function

$$f(x) = -2x_1^2 + 5x_1x_2 - 4x_1 + 18x_2 \text{ subject to } g(x) = x_1 + x_2 = 7 \text{ and } x_1, x_2 \geq 0. \quad \text{[9]}$$

OR

**Q4)** Explain what do you understand by dual simplex method. **[9]**

*P.T.O.*

**Q5)** Explain the method of conversion of non-serial system to serial system problem. [16]

OR

**Q6)** Explain final value and initial value problems dynamic programming in continuous time systems. [16]

**Q7)** Conversion of a Zero-One Polynomial programming Problem into a Zero-One LP problem. [8]

Explain the Gomory's cutting plane method. [8]

OR

**Q8)** Explain the basic concept of stochastic linear and non linear programming. [16]



Total No. of Questions 6]

SEAT No. :

**P3095**

**[5872]-222**

[Total No. of Pages : 2

**M.E.(Electrical) (Control Systems)  
AUTOMATION IN MANUFACTURING  
(2017 Pattern) (Semester-I) (503102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Questions from Q.1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagram must be drawn whenever necessary.*

- Q1)** a) Write a short note on Servomechanism. [5]
- b) Explain construction of Ratchet and Pawl Mechanism. [5]
- c) What is directional control Valve? Explain operation of single Solenoid valve. [4]
- d) What is cyber Physical System and explain its features. [4]

OR

- Q2)** a) Explain Hall Effect sensor. [4]
- b) Explain any one type of Stepper motor. [4]
- c) Differentiate Pneumatic and Hydraulic actuating systems. [5]
- d) Explain architecture of Cyber Physical system. [4]

- Q3)** a) List out the benefits of Digital Manufacturing? [8]
- b) Explain the architecture of Digital Manufacturing. [8]

OR

- Q4)** a) Explain different methods of Digital manufacturing science? Explain any one. [8]
- b) Explain Operation Reference Mode of Digital Manufacturing. [8]

**P.T.O.**

- Q5) a)** Explain characteristics of Industry 4.0 [8]  
b) Explain the benefits of Industry 4.0 [8]

OR

- Q6) a)** Explain working of Industry 4.0 Explain in detail. [8]  
b) List out the drivers of Industry 4.0 Explain in detail. [8]



Total No. of Questions : 5]

SEAT No. :

**P3096**

**[5872]-223**

[Total No. of Pages : 2

**M.E. (Electrical)**  
**CONTROL SYSTEMS**  
**Non Linear Control System**  
**(2017 Pattern) (Semester - I) (503103)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket Calculator and steam table is allowed.*
- 4) *Assume suitable data if necessary.*
- 5) *Q.5 is compulsory.*

**Q1) a)** Explain following terms **[6]**

- i) Hysteresis
- ii) Critical Jump resonance
- iii) Limit Cycle

b) Draw the phase plane trajectory for the following equation using Isocline method  $\ddot{x} + 2\varepsilon w\dot{x} + w^2x = 0$ , given  $\varepsilon = 0.5$ ,  $w = 1$ . Initial point (0, 6) **[6]**

c) An autonomous system is given by 
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Examine the stability using Liapunov Direct Method. **[6]**

OR

**Q2) a)** Express Scalar function given below in quadratic form & test it for definiteness

$$V(x) = 4x_1^2 + 5x_2^2 + x_3^2 - 8x_1x_2 + 4x_1x_3 - 4x_2x_3 \quad [6]$$

b) Explain delta method of constructing a phase plane trajectory for a given system. **[6]**

c) Explain Popov criterion for absolute stability. **[6]**

**P.T.O.**

- Q3)** a) Explain the terms [6]
- i) Sliding Phase
  - ii) Reaching Phase
  - iii) Chattering as used in sliding control
- b) Write a short note on Input - Output Linearization. [5]
- c) Write a short note on Chattering as used in Sliding Control. [5]

OR

- Q4)** Explain the following (any two) [16]
- a) Concept of Variable Structure Control
  - b) Properties of Sliding Mode Control
  - c) Effect of disturbance on Sliding Mode Control
- Q5)** Explain any two of the following [16]
- a) Explain any non-linear system design using sliding mode technique.
  - b) Effect of disturbance on Sliding Mode Control.
  - c) Matched & Unmatched uncertainty in case of Sliding Mode Control.

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Total No. of Questions : 4]

SEAT No. :

**P3097**

[Total No. of Pages : 2

**[5872]-224**

**M.E. (Electrical) (Control System)  
RESEARCH METHODOLOGY  
(2017 Pattern) (Semester - I) (503104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain in brief defination, characteristic, Research need, objectives and types of research. [7]
- b) Write short note on technical papers as journal papers conference papers, survey papers, poster papers. [6]
- c) Write short notes on : [5]
- i) J 10 Index
  - ii) H index
  - iii) Artical metrices
  - iv) Journal metrices

OR

- Q2)** a) Explain in brief types of technical reports and thesis. [6]
- b) Write short notes on : [6]
- i) Copy right
  - ii) Royalty
  - iii) IPR
- c) Explain with illustration linear dependance and independance. [6]

*P.T.O.*



**Q3)** Solve any two :

a) Comment on solution of the system equation with r equations s and n unknown. [8]

b) Reduce the given system equations. Also analyze the obtained solution.[8]

$$x + 2y - 2z = -1$$

$$y - 3z = 4$$

$$2x + 3y - 5z = -4$$

c) Write short note on Gaussian elimination method for solving linear equations. [8]

**Q4)** Solve any two :

a) Write short note on Echelon matrix with illustration. [8]

b) For a given system  $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$  find eigen values eigen vectors, Diagonal matrix and characteristic equation. [8]

c) Write software programming for finding eigen values, eigen vectors if system matrix A is given. [8]



Total No. of Questions : 6]

SEAT No. :

**P3098**

[Total No. of Pages : 2

[5872]-225

**M.E. (Electrical Engineering) (Control System)**  
**MULTIVARIABLE AND OPTIMAL CONTROL SYSTEM**  
**(2017 Pattern) (Semester - II) (503107)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain the definition of controllability and observability of multivariable control system. [4]
- b) Define observer. What are advantages of observer in a given system. [5]
- c) Explain Concept of state observer and disturbance observer, with it's advantages and limitations. [5]
- d) State the infinite time state regulator problem. [4]

OR

- Q2)** a) Explain the state space model theory. [4]
- b) Elaborate sliding mode observer and give it's robustness properties. [5]
- c) Discuss the nonlinear Extended state observer with it's advantages, applications and limitations. [5]
- d) Explain. [4]
- i) Minimum fuel problem.
  - ii) State regulator problem.

- Q3)** State the Pontryagin's minimum principle. Discuss step by step procedure of solving optimal control problem using Pontryagin's minimum principle. [16]

OR

- Q4)** a) Explain the optimal control theory. [10]
- b) Define Hamiltonian. Derive state, Co-state and control equations. [6]

*P.T.O.*

- Q5)** a) Discuss in detail the Bang - bang control strategy. [8]  
b) Explain the optimal control law with example. [8]

OR

- Q6)** a) Explain the minimum time optimal control problem. [8]  
b) Define and explain singular control solution. [8]



Total No. of Questions : 6]

SEAT No. :

**P3099**

[Total No. of Pages : 2

[5872]-226

**M.E. (Electrical) (Control Systems)**  
**CONTROL OF POWER ELECTRONICS CIRCUITS**  
**(2017 Credit Pattern) (Semester - II) (503108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain the relation between switched models, sampled-data models, averaged models, and large-signal and small-signal models, behavioural models. [6]
- b) What are control Goals in Power Electronic converter operation? [6]
- c) Explain the buck converter concept with normalization and modelling. [6]

OR

- Q2)** a) Describe sampled-data model type and switched model type. What are the assumptions made for implementation of model? [6]
- b) Explain different control principals of power Electronic converter. [6]
- c) Explain the role and objectives of power electronic converters in control of power electronic. [6]

- Q3)** a) Explain the use of resonant controller in a hybrid d-q stationary control. [8]
- b) With the help of circuit diagram explain the concept of sliding surface with buck boost converter. [8]

OR

- Q4)** a) Explain variable structure control of a single phase boost converter (Power factor correction) with generalized circuit diagram and modelling steps. [8]
- b) Discuss the example of Grid connected single phase DC-AC converter. [8]

OR

**P.T.O.**

- Q5)** a) With the help of three phase rectifier operated by pulse width modulation. Explain control in rotating d-q frame. [8]
- b) Draw neat diagram of three phase voltage source grid connected inverter connected with associated d-q frame control structure and Explain system modelling steps. [8]

OR

- Q6)** a) Explain pragmatic design approach of variable structure control. [8]
- b) Draw and Explain variable structure control of a three phase rectifier as a MIMO system. [8]

✱ ✱ ✱

Total No. of Questions : 8]

SEAT No. :

**P6551**

[Total No. of Pages : 2

[5872]-227

**M.E. (Electrical) (Control System)**

**DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS**

**(2017 Pattern) (Semester - II) (503109)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 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) Write notes on : **[5]**

- i) Sampling Theorem
- ii) Quantization

b) Explain discrete time systems and classify. **[4]**

OR

**Q2)** a) Determine inverse z-transform of  $X(z) = -\frac{z[z+1]}{[z-1][z^2+z+1]}$  using Partial Fraction Expansion method. **[5]**

b) What is meant by Circular Convolution and its different properties? **[4]**

**Q3)** a) Define DFT and its important properties. **[4]**

b) Classify FFT algorithms. Explain Radix-2 DIF FFT algorithm. **[5]**

OR

**Q4)** a) Explain the Impulse Invariant method of IIR filter design and discuss the problems associated with this method. **[5]**

b) Classify the digital filters and describe the design procedure of analog low pass Butterworth filter. **[4]**

*P.T.O.*

**Q5)** a) Explain the process of windowing using illustrations. What is a Rectangular window function? What are the desirable features of window functions? [10]

b) Discuss realization of FIR filters in detail with proper mathematical model and block diagram. [6]

OR

**Q6)** a) A filter is described by: [6]

$$y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n] + \frac{1}{3}x[n-1]$$

Draw Cascade realization of the same.

b) Describe in detail: [10]

i) Symmetric and anti-symmetric FIR filters

ii) Hanning window method to design FIR filters

**Q7)** a) Discuss condition monitoring and various methods of speed control of electrical machines by DSP. [8]

b) Explain in detail modern measurement of frequency by applying Digital Signal Processing. [8]

OR

**Q8)** a) How PWM generation is performed by modern technique using DSP? Write some practical applications of PWM generation. [8]

b) Describe the design procedure of Discrete PID controller. [8]



Total No. of Questions : 6]

SEAT No. :

**P3100**

[Total No. of Pages : 2

[5872]-228

**M.E. (Electrical Engineering) (Control System)**

**ADVANCED DRIVES AND CONTROL**

**(2017 Credit Pattern) (Semester-III) (603101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right bracket indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronics calculator is allowed.*

- Q1)** a) Why choppers are preferred for speed control of DC motors? State the applications. [4]
- b) Explain in details thermal consideration of the given rating of the motor. [5]
- c) Differentiate the VSI with CSI supplying the three phase induction motor, on the basis of the following: [5]
- i) Circuit diagram and commutation
  - ii) Performance of the motor
- d) Write a note on direct torque control of three phase induction motor drive. [4]

OR

- Q2)** a) Write a note on spatial MMF distribution in the airgap of three phase inverter fed induction motor drive. Discuss the effect of space harmonics on the production of torque pulsations. [5]
- b) Write a note on Pulse width Modulated inverter fed induction motor drive. [4]
- c) With neat diagram, explain system model and derive the transfer function of the converter fed D.C. motor [5]
- d) Prove the steady state criterion of electrical drives, State the assumptions. [4]

*P.T.O.*



- Q3)** Explain the following in detail: [8]  
a) Switched Reluctance Motor  
b) Trapezoidal SPM drive [8]

OR

- Q4)** Write a note on  
a) Permanent magnet synchronous motor and its solid state controller [8]  
b) Sinusoidal SPM drive [8]

- Q5)** a) Write a note on modern trends in electric drives control. [8]  
b) Explain the effect of RMS voltage variation on the performance of electrical drive in closed loop control. [8]

OR

- Q6)** Explain in detail the role of following in the closed loop control system of the electrical drive  
a) PI controller [8]  
b) PID controller [8]



Total No. of Questions : 7]

SEAT No. :

**P3101**

[Total No. of Pages : 2

[5872]-229

**M.E. (Electrical) (Control Systems)**

**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**

**(2017 Pattern) (Semester-III) (603102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Qu.1 or Qu.2, Qu.3 or Qu.4, Qu.6 or Qu.7 Qu.5 is compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Use of algorithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Compute the QR factorization of matrix: 
$$\begin{bmatrix} 12 & 27 \\ 4 & 2 \\ 6 & 10 \end{bmatrix}$$
 **[5]**

b) Explain the parametric and non-parametric methods of system identification. **[4]**

OR

**Q2) a)** What is the importance of persistently exciting input signal in system identification? what order of p.e. is white noise? **[5]**

b) Derive least square estimate of  $\theta$  for the model given by  $y = \phi\theta$ . **[4]**

**Q3)** Write a short note on **[9]**

- a) Instrumental Variable method.
- b) Model structure.
- c) pattern recognition
- d) Bayesian learning.
- e) Maximum likelihood method
- f) Recursive estimation

OR

*P.T.O.*

- Q4) a)** With the help of block diagram explain ‘self tuning regulator’. [4]  
**b)** Prove the matrix inversion lemma: [5]

$$[A + BCD]^{-1} = A^{-1} - A^{-1}B[C^{-1} + DA^{-1}B]^{-1}DA^{-1}$$

$$[A + BCD]^{-1} = [A + BCD]\{A^{-1} - A^{-1}B[C^{-1} + DA^{-1}B]^{-1}DA^{-1}\} / I = I$$

- Q5) a)** Write a short note on [8]  
 i) Kalman filter as a state estimator.  
 ii) MIT rule.  
**b)** What are various adaptive schemes and how they are implemented? [8]

- Q6)** Consider a position servo described by  $\frac{dv}{dt} = -av + bu$  and  $\frac{dy}{dt} = v$ ; where  $a$  and  $b$  are unknown. Assume the control law  $u = \theta_1(u_c - y) - \theta_2v$  is used and that it is desired to control the system in such a way that the transfer function from command signal to process output is given by  $G_m(s) = \frac{w^2}{s^2 + 2\zeta ws + w^2}$  determine an adaptive control law that adjusts the parameters so that the desired objective is obtained [16]

OR

- Q7)** With the help of both MIT rule and Lyapunov theory, design an MRAS for system described by  $G(s) = \frac{b}{s+a}$  where  $a$  and  $b$  are unknown. The controller is given by  $u(t) = \theta_1 u_c(t) + \theta_2 y(t)$  and the desired closed loop model is  $\frac{dy_m}{dx} = -a_m y_m + b_m u_c$ . Draw simulation diagram and compare two methods.

Assume  $V(\theta) = \frac{1}{2}[e^2 + \frac{1}{b\gamma}(b\theta_2 + a - a_m)^2 + \frac{1}{b\gamma}(b\theta_1 - b_m)^2]$ . [16]



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 3

**P3102**

**[5872]-231**

**M.E. (Electrical) (Power Electronics and Drives)**

**LINEAR SYSTEMS THEORY AND DESIGN**

**(2017 Pattern) (Semester-I) (503301)**

*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) *Use of electronic calculator is allowed.*

**Q1) a) Compute the following. [5]**

i) Consider the vectors  $a = -2j$  and  $b = i - 2j + k$

Deduce the direction cosine between  $a$  and  $b$ .

ii) Find the angle between the vectors  $a$  and  $b$ .

where  $a = i + 2j - k$  and  $b = -i + j - 2k$ .

b) Check whether the following vectors are linearly dependent or independent [4]

i)  $\bar{a} = (1, 1, 1)$   $\bar{b} = (1, 2, 0)$   $\bar{c} = (0, -1, 1)$

ii)  $\bar{a} = (1, 0, 0)$   $\bar{b} = (0, 1, 0)$   $\bar{c} = (0, 0, 1)$

**Q2) a) Explain with examples, the following characteristics of square matrices:[4]**

i) Symmetric

ii) Identity Matrix

iii) Diagonal

iv) Skew-symmetric

**P.T.O.**

- b) Find the eigen values of the followign matrix. [5]

$$A = \begin{bmatrix} 1 & 2 & 4 \\ 0 & 4 & 7 \\ 0 & 0 & 6 \end{bmatrix}$$

OR

The following data represent the heights of 16 adults in centimeters. [5]  
 162 ; 168; 177; 147; 189; 171; 173; 168; 178; 184; 165; 173; 179; 166;  
 168; 165; Divide the data into 5 equal length intervals between and draw  
 a histogram, frequency polygon also find frequency density for each  
 class.

- Q3) a) Explain test of significance with procedure and significance. [8]

OR

Explain in detail central limit theorem. [8]

- b) Researchers have conducted a survey of 1600 coffee drinkers asking  
 how much coffee they drink in order to confirm previous studies. Find  
 the value of Chi square ( $\chi^2$ ), degrees of freedom, As per previous studies  
 72% of the country drink the coffee. Comment on : Are the distribution  
 same at  $\alpha=0.05$ . [8]

	Expected Coffee drinkers	Observed coffee drinkers
2 cups/week	240	206
1 cup/week	208	193
1 cup/day	432	462
2+cup/day	720	739

Probability of exceeding critical value of Chi square			
Distribution			
Df (degree of freedom)	0.05	0.01	0.001
1	3.841	6.635	10.828
2	5.991	9.210	13.816
3	7.815	11.345	16.266
4	9.488	13.277	18.467
5	11.070	15.086	20.515
6	12.592	16.812	22.458
7	14.067	18.475	24.322
8	15.507	20.090	26.125
9	16.919	21.666	27.877
10	18.307	23.209	29.588

- Q4) a)** Find the line of best fit for the following data, treating x as dependent variable (Regression equation x on y):

X	14	12	13	14	16	10	13	12
Y	14	23	17	24	18	25	23	24

Hence, estimate the value of x when  $y = 16$ . **[8]**

- b) Explain method of sequential differences and method of least square for graphical data representation and parameter determination. **[8]**



Total No. of Questions: 6]

SEAT No. :

**P6552**

**[5872]-232**

[Total No. of Pages : 2

**M.E. (Electrical) (Power Electronics & Drives)**  
**MODELING AND ANALYSIS OF ELECTRICAL MACHINES**  
**(2017 Pattern) (Semester-I) (503302)**

*Time : 3 Hours]*

*[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 whenever necessary.*
- 3) *Assume suitable data wherever necessary.*
- 4) *Use of Scientific calculator is allowed.*

**Q1) a)** Derive the expression for electrical torque of kron's primitive machine. Show that no torque is produced by interaction between the flux and current on the same axis. [9]

b) Derive the equations for steady state speed and torque and also discuss steady state and transient analysis of separately excited DC motor. [9]

OR

**Q2) a)** Explain d-q model of three phase induction motor in the rotor reference frame. [9]

b) Discuss and derive the transformation for currents between a rotating balanced three phase winding and rotating two phase winding. [9]

**Q3) a)** Discuss the stator voltage equations of synchronous machine in rotor reference frame. [8]

b) Write the short note on steady state operation of synchronous machine. [8]

OR

**Q4) a)** Obtain an expression for instantaneous torque in three phase salient pole synchronous machine using impedance matrix method. [8]

b) Derive the expressions for armature to field and armature self inductances for salient pole synchronous machine. [8]

**P.T.O.**

- Q5) a)** Explain the methods to linearize the model of synchronous machine. [8]
- b) Write the short notes on eigen values of
- i) Induction machine
  - ii) Synchronous machine. [8]

OR

- Q6) a)** Write and discuss linearize the model of synchronous machine. [8]
- b) Write the short note on small displacement stability. [8]





Total No. of Questions : 6]

SEAT No. :

**P3103**

**[5872]-233**

[Total No. of Pages : 2

**M.E. (Electrical) (Power Electronics & Drives)**

**POWER CONVERTERS - I**

**(2017 Pattern) (Semester - I) (503303)**

*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) Use of calculator is allowed.
- 4) Assume Suitable data, if necessary.

**Q1) a)** Explain the following related to IGBT. **[10]**

- i) Surge current Rating
- ii) Voltage rating
- iii) Applications

b) Explain the working of a single phase full wave rectifier supplying a RLE load for continuous conduction mode with a neat diagram and waveforms. Derive the equation for average output voltage and RMS output voltage. **[8]**

OR

**Q2) a)** A single phase full a wave ac voltage regulator feeds a load of  $R = 10$  ohms with an input voltage of 230 V and 50 Hz. Firing angle of both the Thyristors is 30 degrees. Calculate **[10]**

- i) Rms value of output voltage
- ii) Load power and input power factor
- iii) Average and RMS current of thyristors

b) Explain the Cuk Converter with neat diagram and waveforms **[8]**

**Q3) a)** With a neat diagram explain the working of a full wave ac voltage regulator with RLE load derive expression for RMS output voltage. **[8]**

**P.T.O.**

- b) Explain integral control method and Phase angle control method for single phase AC/AC voltage regulator. [8]

OR

- Q4)** a) Explain the internal and external methods to control the output voltage of inverter. [8]

- b) A single phase voltage controller is employed for controlling the power flow from 230 V 50Hz into a load circuit containing  $R = 4\Omega$  and  $\omega L = 2\Omega$ . Calculate The control range of firing angle maximum value of RMS load current maximum power and power factor. [8]

- Q5)** a) With a neat diagram and relevant waveform explain the working of a single phase to single phase step down midpoint type cycloconverter supplying RL load for continuous load current. [8]

- b) With a neat diagram and waveforms explain the working of Single phase to single phase cyclo-converters. [8]

OR

- Q6)** a) With a neat diagram and relevant waveform explain the working of a three phase to three phase bridge type cycloconverter. [8]

- b) A three phase cycloconverter feeds a single phase load of 190 V at 35 A at power factor of 0.75 lagging Determine [8]

- i) Required supply voltage
- ii) Thyristor rating
- iii) Power factor of supply current

\*\*\*

Total No. of Questions : 6]

SEAT No. :

**P6553**

**[5872]-234**

[Total No. of Pages : 2

**M.E. (Electrical ) (Power Electronics and Drives)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (503304)**

*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) *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 packet calculator and steam tables is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) How do you define a research problem? Explain how to select research problem. [6]
- b) What is research process? State the steps of research process and explain the activities in each step. [6]
- c) Justify the necessity of literature review in the formulation of research problem. [6]

OR

- Q2)** a) Explain role of statistics in research. [6]
- b) Explain with block diagram methods of data collection. [6]
- c) Explain in brief writing references using LaTeX. [6]

- Q3)** Write short note on [16]
- a) Copy Right
  - b) Intellectual Property
  - c) Plagiarism
  - d) Patents

OR

**P.T.O.**

- Q4)** a) Compare different types of technical papers. [10]  
b) Explain the budgeting of research proposal. [6]
- Q5)** a) Explain structure and components of scientific report. [9]  
b) Explain in brief importance of effective communication. [7]

OR

- Q6)** Write short note on [16]
- a) Structure of survey
  - b) Oral presentation
  - c) Funding agencies of research
  - d) Use of visual aids in research



Total No. of Questions : 6]

SEAT No. :

**P3104**

[Total No. of Pages : 2

[5872]-235

**M.E. (Electrical) (Power Electronics and Drives)**

**AC AND DC DRIVES**

**(2017 Pattern) (Semester - II) (503307)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2 Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Figures to the right side indicates full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume any missing data if necessary.*

- Q1)** a) Explain four quadrant operation of Electric drive with suitable example. [6]  
b) Explain principle of operation of VSI driven Induction motor. [6]  
c) How motor duty, heating and cooling affects the temperature of motor? [6]

OR

- Q2)** a) Explain different types of industrial loads. [6]  
b) Explain Steady state analysis of separately excited DC motor fed by chopper. [6]  
c) Explain with neat circuit diagram operation of separately excited DC motor connected to 1 phase fully controlled converter. Derive expression showing speed torque relationship. Draw output voltage and current wave forms. [6]

- Q3)** a) Compare DC motor control analogy with vector controlled induction motor. [8]  
b) Explain field oriented control of induction motor. [8]

OR

- Q4)** a) Explain the principle of vector control and its implementation for rotor flux oriented control. Justify your explanation with necessary phasor diagram and block diagrams. [8]  
b) Giving implementation block diagram discuss direct vector control of induction motor. [8]

*P.T.O.*

- Q5** a) Describe the operation of PMDC motor drive and derive the expression for torque generated in it. [4]
- b) What is multi-stack stepper motor? Discuss performance characteristics of this motor. [4]
- c) With the help of neat block diagram explain how the speed is controlled in BLDC motor. [8]

OR

- Q6** a) Discuss the control circuit & performance characteristics of switched reluctance motor. [4]
- b) Explain the driver circuit used for control of brushless motor. [4]
- c) With necessary sketches explain the operation of multi-stack stepper motor. Also discuss torque Vs stepping rate characteristics. [8]



Total No. of Questions : 5]

SEAT No. :

**P3105**

[Total No. of Pages : 2

[5872]-236

**M.E. (Electrical) (Power Electronics & Drives)**

**POWER CONVERTERS - II**

**(2017 Pattern) (Semester - II) (503308)**

*Time : 3 Hours]*

*[Max. Marks : 50*

**Q1)** Answer any three. **[18]**

- a) Explain concept of Space Vector Modulation? Write the advantages of SVM.
- b) Explain concept of cascade multilevel inverter. How it helps in reducing harmonics from output.
- c) Explain in detail zero current switching and zero voltage switching.
- d) Explain with circuit diagram and output waveform forward converter.

**Q2)** Draw the diagram of heat transfer and explain. **[16]**

- a) Specific heat flow rate.
- b) Thermal resistance.
- c) Thermal resistivity.
- d) Thermal co efficient.
- e) Thermal conductivity.

OR

**Q3)** Explain in detail four types of heat transfer mechanisms in detail. **[16]**

**Q4)** a) Explain need for snubber circuit. How it reduces stresses on the power device. **[8]**

- b) An inductor is to be designed to meet the following specifications:  
 $L = 100 \text{ micro H}$ ;  $I_{\text{rms}} = 4 \text{ A}$  sinewave ;  $f = 200 \text{ kHz}$  ;  $T_s = 100 \text{ C}$  and  $T_a = 30 \text{ C}$  . The inductor is to be fabricated on a double-E core made from 3F3 ferrite. The windings are be made with foil conductors which have  $k_{cu} = 0.6$ . A core size of  $a = 1 \text{ cm}$  is chosen for the design. The emissivity  $E$  of the surface of the completed inductor equals 0.9 and that the vertical height is  $3a$ .

**P.T.O.**

- i) Determine the conductor cross-sectional area,  $A_{cu}$ , and number of turns  $N$ . Ignore eddy currents and the proximity effect.
- ii) Specify the length of the air gaps in the core. Assume  $\sum g = 3\text{mm}$ . [8]

OR

- Q5)** a) Explain inductor design procedure with algorithm. [8]  
b) Explain turn off snubber and overvoltage snubber with circuit diagram. [8]

★ ★ ★



Total No. of Questions : 5]

SEAT No. :

**P3106**

[Total No. of Pages : 1

[5872]-237

**M.E. (Electrical) (Power Electronics and Drives)**

**503309 : ADVANCED CONTROL SYSTEMS**

**(2017 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) *Assume suitable data, if necessary.*
- 4) *Use of electronic calculator is allowed.*

- Q1)** a) Explain methods of PID controller tuning. [6]  
b) Explain the concept of sliding mode control. [3]

OR

- Q2)** Explain three pole placement methods. [9]

- Q3)** a) Explain in detail sliding mode observer. [4]  
b) Explain observer based sliding control for Boost DC/DC converter in detail. [5]

- Q4)** a) Explain the concepts of stability of nonlinear system. [8]

OR

Define equilibrium point. Also find all equilibrium points for each of the following system. [8]

i)  $\dot{x}_1 = -x_1 + x_2$                        $\dot{x}_2 = 0.1x_1 - 2x_2 - x_1^2 - 0.1x_1^3$

ii)  $\dot{x}_1 = -x_1 + x_2(1 + x_1)$                $\dot{x}_2 = -x_1(1 + x_1)$

- b) Explain any one method of constructing Lyapunov's functions for nonlinear systems. [8]

- Q5)** a) Explain Feedback linearization in detail. [8]

- b) Explain obtain IO linearization of the system. [8]

OR

Obtain IO linearization of the system. [8]

$$\dot{x}_1 = -x_1 + \frac{2 + x_3^2}{1 + x_3^2} u$$

$$\dot{x}_2 = x_3$$

$$\dot{x}_3 = x_1 x_3 + u \text{ and } y = x_2$$



Total No. of Questions : 6]

SEAT No. :

**P3107**

[Total No. of Pages : 2

**[5872]-238**

**M.E. (Electrical) (Power Electronics and Drives)  
SPECIAL APPLICATIONS OF POWER ELECTRONICS  
(2017 Pattern) (Semester-III) (603301)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2 Q.3 or 4, Q.5 or 6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of logarithmic table slide rule, mollier charts electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain the concept of cyber security and cloud computing. [9]
- b) Explain the working of [9]
- i) Thyristor switched reactor (TSR),
  - ii) Thyristor switched capacitor

OR

- Q2)** a) Explain the role of power electronics in signal conditioning required for Inter facing sensors to open source hardware. [9]
- b) Short note on : [9]
- i) Smart Home
  - ii) Smart Building

- Q3)** a) Explain in detail Distributed Energy Resources [8]
- b) Explain in detail Distributed Energy Resources interconnection with a hosting grid, integration and interconnection issues and challenges. [8]

OR

- Q4)** Explain in detail phase Measurement Unit (PMU) and its application for wide area monitoring Protection and control (WAMPAC). [16]

*P.T.O.*

**Q5) a) Write short note on: [8]**

- i) Application of power electronics in Illumination
  - ii) Application of power electronics in heating system.
- b) Identify the various voltage disturbances likely to occur in power system operation. How can it be control using uninterruptured power supplies? Explain its working with the help of block diagram. [8]

OR

**Q6) Explain the role of power electronics in. [16]**

- a) Hybrid vehicle system
- b) Battery charging system
- c) SMPS



Total No. of Questions: 6]

SEAT No. :

**P6554**

**[5872]-239**

[Total No. of Pages : 1

**M.E. (Electrical) (Power Electronics & Drives)**  
**ENERGY MANAGEMENT AND POWER QUALITY IN**  
**ELECTRICAL DRIVES**  
**(2017 Course) (Semester-III) (603302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve 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 scientific calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Explain VFD controlled operation of fans and pumps. **[9]**

**b)** Explain Grounding aspects in power electronics circuits? **[9]**

OR

**Q2) a)** Explain capacitor size sand location fixation criterion. **[9]**

**b)** Discuss reasons for Grounding. **[9]**

**Q3) a)** Write detail note on different voltage variation indices. **[8]**

**b)** What is power quality benchmarking? Explain in detail. **[8]**

OR

**Q4) a)** Write the procedure to design a harmonic filter. **[8]**

**b)** Discuss in detail various voltage regulation devices. **[8]**

**Q5) a)** Explain objectives and consideration of power quality monitoring. **[8]**

**b)** Write detail note on Power quality measuring equipment. **[8]**

OR

**Q6) a)** List various power quality monitoring instruments and briefly explain their use. **[8]**

**b)** Explain the application of intelligent system in power quality monitoring. **[8]**



Total No. of Questions : 8]

SEAT No. :

P3108

[Total No. of Pages : 3

[5872]-241

**M.E. (Electrical Power System)**  
**COMPUTER APPLICATIONS IN POWER SYSTEM**  
**(2017 Pattern) (Semester - I) (503201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) What are the theorems used in optimizing single variable functions? [4]  
b) Minimize  $f(x) = x_1^2 - x_2^2$  subjected to  $g(x) = x_1 x_2 - 1 = 0$  using direct substitution method. [5]

OR

- Q2)** a) Draw surface constraint diagram showing behavior and side constrains. Also indicate bounded and unbounded, acceptable and unacceptable points on surface constraint. [4]  
b) Minimize  $f(X) = 2x_1^2 + x_2^2$  using Steepest Descent Method from starting point  $X = [1, 2]^T$ . Perform one iterations. [5]

- Q3)** a) What are the assumptions made in decoupled and fast decoupled load flow method? [4]  
b) What are assumptions made in three phase load flow analysis? [5]

OR

- Q4)** a) Define following terms : [4]  
i) Local maxima  
ii) Global minima  
b) Derive equations of Newton Raphson load flow analysis in polar ordinates. [5]

**P.T.O.**

**Q5) a)** Define economical load dispatch problem without considering and with considering losses. [6]

b) Two units of the system have following cost curves. [10]

$$f(P_{G1}) = 0.00889P_{G1}^2 + 10.333P_{G1} + 200 \text{ Rs/h}$$

$$f(P_{G2}) = 0.00741P_{G2}^2 + 10.833P_{G2} + 240 \text{ Rs/h}$$

The transmission loss are given by

$$P_L = 0.001P_{G1}^2 + 0.002P_{G2}^2 - 0.0004P_{G1}P_{G2}$$

Where  $P_G$  is in MW. Determine the economic operating schedule to meet the demand of 150 MW using classical method perform one iterations.

OR

**Q6) a)** Explain solution economic load dispatch problem using NR method. [6]

b) The incremental production costs of both the units are [10]

$$\frac{dF_1}{dP_1} = 0.4P_1 + 40 \text{ Rs/MWh and } \frac{dF_2}{dP_2} = 0.5P_2 + 30 \text{ Rs /MWh}$$

Determine economical schedule for the sharing of 180MW demand considering generation limit on each unit as 25MW and 100MW. Determine the saving obtained by economical loading over equal load sharing.

**Q7) a)** The transmission loss coefficients  $B_{mn}$  expressed in pu on the base of 100MVA of a power system network having three plants are given by [10]

$$B = \begin{bmatrix} 0.01 & -0.001 & -0.002 \\ -0.001 & 0.02 & -0.003 \\ -0.002 & -0.003 & 0.03 \end{bmatrix}$$

Three plants supply power of 100MW, 200MW and 300MW respectively into the network. Calculate the transmission loss and incremental transmission losses of the plant in MW.

b) Explain economic load dispatch for active and reactive power balance.[6]

OR

**Q8)** For the system shown in Fig. 1 find the loss of coefficients in  $\text{MW}^{-1}$ , if the base is 100MV A. **[16]**

Given that  $I_{L1} = (1.0 - j0.2)pu$        $I_{L2} = (0.5 - j1.0)pu$

$Za = (0.02 + j0.1)pu,$        $Zb = (0.03 + j0.15)pu,$

$Zc = (0.05 + j0.25)pu$        $I_{21} = (0.25 - j0.05)pu, V1 = 1.0 + j0 pu$

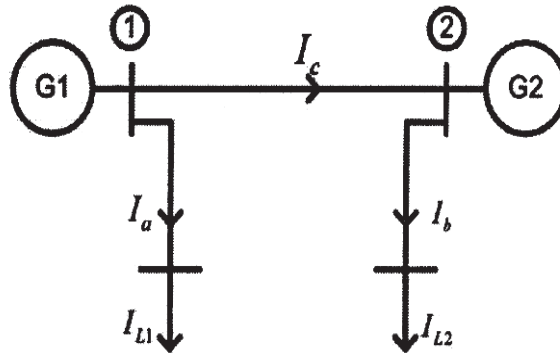


Fig.1



Total No. of Questions : 5]

SEAT No. :

P3109

[Total No. of Pages : 2

[5872]-242

**M.E. (Electrical Power Systems)**  
**POWER SECTOR ECONOMICS & MANAGEMENT**  
**(2017 Pattern) (Semester - I) (503202)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer all questions from the following.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of logarithmic tables sliderule, mollier charts, electronic pocket calculator and steam tables is allowed.*

**Q1)** Attempt any three of following :

**[18]**

- a) Explain institutional structure of power sector before and during reforms.
- b) Discuss the stages of tariff determination in India.
- c) Calculate net present value for investment of Rs. 5,00,000 and cash flows for coming 6 yrs are Rs. 1,00,000, Rs. 1,50,000, Rs. 1,50,000, Rs. 2,00,000, Rs. 2,00,000 and Rs. 1,00,000 respectively. Take discounting factor as 11%.
- d) Discuss the factors affecting tariff for renewable energy sources.
- e) Discuss deregulation experiences from UK.
- f) Explain whole sale and Retail competition models

**Q2)** a) What are the different factors affect market clearing price? **[8]**

b) What are different ancillary services? How these obtained? **[8]**

OR

**Q3)** a) Discuss the perspectives of participants in power and energy market. **[8]**

b) Explain marginal pricing, dispatch based pricing and location or zonal pricing. **[8]**

**P.T.O.**



- Q4)** a) What are the physical transmission rights? How does it affect power market operation? [8]
- b) Why power network may get congested? Discuss common solutions to avoid it. [8]

OR

- Q5)** a) What is arbitrage? With suitable examples explain in detailed. [8]
- b) Explain transmission ownership models. [8]



Total No. of Questions : 6]

SEAT No. :

**P6555**

[Total No. of Pages : 2

**[5872]-243**

**M.E. (Electrical) (Power Systems)**

**POWER SYSTEM MODELING**

**(2017 Pattern) (Semester-I) (503203)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Total Three questions. Answer one question from Q.1 and Q.2, Q.3 or Q.4, and Q.5 or Q.6 each..*
- 2) *Assume suitable data if necessary.*
- 3) *Write down all the assumptions made.*
- 4) *Give  $F^{abc} = [P] F^{dq0}$ , where Park's transformation*

$$[P] = \begin{bmatrix} k_d \cos \theta & k_q \sin \theta & k_o \\ k_d \cos \left( \theta - \frac{2\pi}{3} \right) & k_q \sin \left( \theta - \frac{2\pi}{3} \right) & k_o \\ k_d \cos \left( \theta + \frac{2\pi}{3} \right) & k_q \sin \left( \theta + \frac{2\pi}{3} \right) & k_o \end{bmatrix}$$

(where,  $K_d = K_q = \sqrt{2/3}$  and  $K_o = \sqrt{1/3}$ ).

**Q1)** What is phase shifting transformer? Develop a mathematical model of phase shifting transformer. **[18]**

OR

**Q2)** Elaborate need of excitation system in power system. Explain working of the excitation system with the help of functional block diagram. **[18]**

**Q3)** Discuss with the help of suitable diagrams working of d.c. generator exciter pilot excitation control scheme of alternator. **[16]**

OR

**P.T.O.**

**Q4)** Explain with the help of suitable diagram working of static excitation control scheme of alternator. **[16]**

**Q5)** What is need of load modeling in power system? Discuss in details the various types of static load modeling represented in power system. **[16]**

OR

**Q6)** With the help of the model of synchronous machine, develop the model of an induction motor. **[16]**



Total No. of Questions : 6]

SEAT No. :

**P3110**

[Total No. of Pages : 2

**[5872]-244**

**M.E. Electrical (Power System)  
RESEARCH METHODOLOGY  
(2017 Pattern) (Semester - I) (503204)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any one question from each pair of questions: Q.1 & Q.2, Q.3 & Q.4, Q.5 & Q.6.*
- 2) *Figures to the right side indicate full marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is the importance of research funding in research? [4]
- b) Compare research methods and research methodology. [4]
- c) Define citation index, science citation index, i10 index, and H-index.[4]
- d) Define optimization and state the various applications of optimization.[6]

OR

- Q2)** a) Explain the different types of reports. [4]
- b) Compare descriptive and analytical research and applied and fundamental research. [6]
- c) Give important highlights of the patent law. [4]
- d) State the statement of an optimization problem. [4]
- Q3)** a) Explain the characteristics of a Constrained Problem. [8]
- b) Explain basic approach of penalty function method. [8]

*P.T.O.*

OR

**Q4)** a) Give classification of constraint optimization techniques. [8]

b) Explain convex programming problem. [8]

**Q5)** a) Explain particle swarm optimization with example. [8]

b) Explain ant colony optimization algorithm with example. [8]

OR

**Q6)** a) Compare genetic algorithm and simulated annealing. [8]

b) What is linear regression? Explain with mathematical expressions. [8]

□□□

Total No. of Questions : 8]

SEAT No. :

P3111

[Total No. of Pages : 2

[5872]-245

**M.E. (Electrical Engineering) (Power Systems)**

**503207 : POWER SYSTEM DYNAMICS**

**(2017 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable additional data, if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1)** a) What is transient stability in the power system? Obtain the criterion for transient stability. [6]  
b) State and explain the methods of improving the transient stability. [6]

OR

- Q2)** Explain, in relation with Islanding-(i) Under frequency sensitivity and (ii) under voltage trip sensitivity. [12]

- Q3)** State the objective of Power System Stabilizers & explain tuning of PSS using  
i) field test results ii) Analytical techniques [14]

OR

- Q4)** Describe the various steps in the investigation of dynamic stability of a multi machine power system. State any assumptions made. [14]

- Q5)** State the types of synchronous Machine models based on number of damper winding used. Derive the stator equations of machine model 1.1 [12]

OR

**P.T.O.**

**Q6)** Derive the expressions for calculation of initial conditions for analysis of dynamics of synchronous machine connected to infinite bus bar. [12]

**Q7)** Derive the characteristic equation & apply the Routh- Hurwitz criterion with & without AVR of SIMB. [12]

OR

**Q8)** Derive the state equations of for small signal simplified synchronous machine model. [12]



Total No. of Questions : 6]

SEAT No. :

P3112

[Total No. of Pages : 2

[5872]-246

**M.E. (Electrical) (Power System)**  
**POWR SYSTEM PLANNING & RELIABILITY**  
**(2017 Pattern) (Semester - II) (503208)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No. 1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No. 5 or Q.No. 6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain weather sensitive forecasting in details. [6]  
b) Explain Markov process in details for reliability evaluation. [6]  
c) Explain steepest descent method for reliability evaluation. [6]

OR

- Q2)** a) Explain co-relation method of load forecasting. [6]  
b) A power system having 5 units of 100 MW each with of FOR - 0.03. The load model is linear in nature having maximum load of 400 MW and minimum load of 150 MW. Calculate the system LOLE. [6]  
c) Write short note on reliability cost. [6]

- Q3)** a) Explain the role of construction monitoring of transmission line projects. [8]  
b) Write short note on analysis of causes of failure of transmission line. [8]

OR

- Q4)** a) Explain causes of failure of transmission line in details. [8]  
b) Explain goals of short term transmission planning in details. [8]

*P.T.O.*



- Q5)** a) Explain network re-configuration method in distribution systems. [8]  
b) Explain effects of dis-connectors, circuit breakers and isolators on distribution systems. [8]

OR

- Q6)** a) Explain the effect of weather in distribution system planning in details.[8]  
b) Explain effects of weather on distribution system. [8]



Total No. of Questions : 5]

SEAT No. :

P3113

[Total No. of Pages : 2

[5872]-247

**M.E. (Electrical) (Power System)  
HVDC & FLEXIBLE AC TRANSMISSION  
(2017 Pattern) (Semester - II) (503209)**

*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 side indicate full marks.*
- 4) *Use of calculator is allowed.*

**Q1)** Solve any Three:

**[3 × 6 = 18]**

- a) Write short note on Twelve pulse converters used in HVDC system.
- b) What is converter fault? List different types of converter fault. Explain short circuit in bridge in detail.
- c) Discuss the different types of MTDC system with neat diagram.
- d) Explain CIA control for HVDC link with diagram.
- e) Compare HVDC light (VSC) with HVDC classic (LCC) with advantages & disadvantages.

**Q2)** a) How PWM techniques used for voltages & frequency control of load voltage in VSC operation. **[8]**

b) Compare VSC - HVDC with CSC - HVDC. **[8]**

OR

**Q3)** a) Explain the need of FACTS controller in modern power system. List the advantages of different FACTS controllers. **[8]**

b) Explain the working of STATCOM. Compare its V-I characteristic with SVC. **[8]**

**P.T.O.**

- Q4) a)** Explain TCSC & effect of delay angle on its reactance. [8]
- b) How an UPFC scheme can be implemented using two back to back voltage source converters? [8]

OR

- Q5) a)** Discuss the functional system control scheme for the SSSC. [8]
- b) With phasor diagram explain the different modes of operation of UPFC. Give the details of working in each mode. [8]





Total No. of Questions : 5]

SEAT No. :

P3114

[Total No. of Pages : 2

[5872]-248

**M.E. (Electrical) (Power Systems)**  
**ADVANCED POWER SYSTEM PROTECTION**  
**(2017 Pattern) (603201) (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) Figures to the right side indicate full marks.*
- 4) Use of calculator is allowed.*

**Q1) Solve any Three :**

**[3 × 6 = 18]**

- a) Draw and explain in detail equivalent circuit of protection PT.
- b) A 1200/5, C400 with secondary resistance  $0.61\Omega$  and a  $2.0\Omega$  is the relay burden. Based on the accuracy classification, what is the maximum symmetrical fault current that may be applied to this CT without exceeding a 10% ratio error?
- c) What are the assumptions made for conducting short circuit studies of a power system network?
- d) Elaborate various types of faults in power systems.
- e) Derive the equivalent circuit of a CCVT.

**Q2) a) Explain in detail Finite Impulse Response (FIR) Filter and Infinite Impulse Response (IIR) Filter. [8]**

**b) Explain protection of transformer using digital filtering scheme. [8]**

OR

**P.T.O.**

**Q3) a)** Draw and explain block diagram of numerical relay. State function of each block. [8]

b) Explain causes of different faults in synchronous generator. Explain principle of microprocessor based unit protection scheme. [8]

**Q4) a)** Explain amplitude comparison travelling wave relay scheme; how it is useful for protection of forward as well as reverse faults in transmission line. [8]

b) What is meant by Over-reach of distance relay? How this problem is solved in three - stepped distance protection? [8]

OR

**Q5) a)** Write a note on integrated operation of national power system in terms of features, size and trends. [8]

b) Discuss backup protection and relay coordination. [8]



Total No. of Questions : 5]

SEAT No. :

P3115

[Total No. of Pages : 2

[5872]-249

M.E. (Power Systems)

ELECTRICAL

Power Quality Assessment and Mitigation  
(2017 Pattern) (Semester - III) (603202)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Attempt any three of the following : **[18]**

- a) Explain power quality issues as per IEEE 115g standard.
- b) Explain different sources which introduce transient over voltages in power network.
- c) Discuss types of sags, major causes and consequences.
- d) Discuss mitigation measures for voltage sag.
- e) Explain impact of harmonics on Acquantities.
- f) Explain harmonics produced by house hold and office antomation equipments.

**Q2)** a) Discuss with suitable examples of principles of controlling harmonics. **[8]**

b) Explain filter design criteria. **[8]**

OR

*P.T.O.*

- Q3)** a) Discuss with neat diagram active harmonic filters. [8]  
b) Explain following with respect to transformer [8]  
i) k-rated transformer  
ii) system response

- Q4)** a) Explain objectives and requirements of power quality monitoring. [8]  
b) Explain selection of monitoring locations and initial site survey. [8]

OR

- Q5)** a) With suitable diagram explain power quality monitors. [8]  
b) Discuss selection of transducers and power quality monitors. [8]





Total No. of Questions : 8]

SEAT No. :

P3116

[Total No. of Pages : 2

[5872]-251

**M.E. Electronics (Digital Systems)**  
**ANALOG & DIGITAL CMOS DESIGN**  
**(2017 Pattern) (Semester - I) (504101)**

*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) *Draw neat diagram wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What are the types MOSFET parasitics due to internal capacitances? Draw the model for MOSFET parasitics. Explain overlap capacitance with proper diagram. [5]
- b) Explain the body Effect in MOSFET. Discuss its consequences on threshold voltage and MOSFET performance. [5]
- Q2)** a) Explain three different modes of MOSFET operation with proper diagrams, viz. Accumulation, Depletion and Inversion. [5]
- b) What are the various lithographic techniques in CMOS fabrication process? Explain photolithography process. [5]
- Q3)** a) Explain Static, dynamic and short circuit power dissipations in MOSFET. Explain, how to calculate dynamic power dissipation? [5]
- b) Write short notes MOS on MOSFET Fan-In-and Fan-Out. [5]
- Q4)** a) Draw and explain the CMOS inverter circuit and its RC delay model. Also explain how to calculate the RC delay? [5]
- b) Write short note on interconnects and RC model. [5]

*P.T.O.*

- Q5)** a) Explain, how to design a diode using MOSFET? What is the MOSFET's region of operation when using MOSFET as a diode? Explain the condition between  $V_{DG}$  and  $V_T$  for enhancement device. Also write, I and V characteristic equations of the MOS diode. [5]
- b) Discuss the need for differential amplifier. What is CMRR? Explain with mathematical analysis, how differential amplifier minimizes the noise level and improves the SNR (Note : explain with the help of block diagrams).[5]
- Q6)** a) How to design Current Source and Current Sink using MOSFET? Explain properly with : [6]
- i) Circuit Diagrams
- ii) Characteristics
- iii) Conditions for  $V_{OUT}$
- iv) Which parameter is a measure of the flatness of the Current Source or Current Sink characteristics?
- v) Specify the ways to their performance.
- b) Specify any two applications of MOSFET current mirror. Explain with circuit diagram, how to use current mirror as an active load. [4]
- Q7)** a) Implement two input NAND and NOR gates using MoFETs. Calculate logical efforts and delays for both implementations. Write the reasons why NAND is preferred over NOR in logic design? [5]
- b) Write short note on : BICMOS Circuits and Applications. [5]
- Q8)** a) What is Dynamic CMOS logic in VLSI? What is the difference between Static and Dynamic CMOS logic circuits? Why Dynamic CMOS is faster than Static CMOS logic? [5]
- b) Write short note on : Sense Amplifier as a Read Circuitry. [5]



Total No. of Questions : 8]

SEAT No. :

P3117

[Total No. of Pages : 2

[5872]-253

**M.E. (Electronics) (Digital Systems)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern) (Semester - I) (504103)**

*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 indicates full marks.*
- 4) *Assume suitable data wherever necessary.*

**Q1) a)** Enlist any five characteristics of embedded systems. **[5]**

b) Enlist any five features of ARM cortex. **[5]**

**Q2)** Explain architecture of LPC 1768. **[10]**

**Q3) a)** Explain in detail task scheduling. **[5]**

b) Define & explain RTOS. **[5]**

**Q4) a)** Explain in detail interrupt handling for embedded OS. **[5]**

b) Explain how to develop Android application. **[5]**

**Q5) a)** Explain kernel initialization process. **[5]**

b) Explain construction of Linux Kernel. **[5]**

**P.T.O.**

- Q6)** a) Explain LCD device driver steps in detail. [5]  
b) Explain the steps for porting linux on ARM. [5]
- Q7)** a) Explain digital camera with block diagram. [5]  
b) Explain with block diagram automatic motoring. [5]
- Q8)** a) Explain failure analysis of embedded system. [5]  
b) Why EMI/RFI certification is important for embedded system. [5]



Total No. of Questions : 8]

SEAT No. :

P3118

[Total No. of Pages : 2

**[5872]-255**  
**F. Y. M.E. (Electronics)**  
**(Digital System)**  
**ADVANCED DSP PROCESSORS**  
**(2017 Pattern) (Semester - II) (504107)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain Very Long Instruction Word architecture. [5]  
b) Explain the Fixed point and Floating point formats used for number representation in DSP. [5]
- Q2)** a) Discuss briefly about the Direct and Indirect addressing modes of TMS320C54XX Processor. [5]  
b) Explain the accumulators in TMS320C54XX Processor. [5]
- Q3)** a) Write the features of TMS320C6713 Processor. [5]  
b) Which is the type of TMS320C6713 architecture? Draw it. [5]
- Q4)** a) Explain the stages in instruction pipeline of the processor? [5]  
b) What is the use of circular addressing mode? [5]
- Q5)** a) What are features of visual DSP++? [5]  
b) How to create and build a project in Code Composer Studio. [5]

**P.T.O.**

- Q6)** a) Explain the linking process rules in Visual DSP++. [5]  
b) Explain DMA controller in Black fin processor. [5]
- Q7)** a) Discuss the selection criteria of Digital Signal Processor. [5]  
b) Explain code generation tools provided by Code Composer Studio. [5]
- Q8)** a) Explain the steps for creating a new project in Code Composer Studio. [5]  
b) Explain the Code Composer Studio's versatile debugger using Breakpoints. [5]



Total No. of Questions : 8]

SEAT No. :

**P3119**

[Total No. of Pages : 2

**[5872]-256**

**M.E. (Electronics) (Digital Systems)  
PLDS & ASIC DESIGN  
(2017 Pattern) (Semester - II) (504108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain the resource sharing in system design with suitable example. [5]  
b) What is System On Chip? What are the advantages and disadvantages of SOC? [5]

**Q9)** a) Write a short note on Pipelining. [5]  
b) What do you understand by data path and control path? [2]  
c) Explain the hardware and software co-design. [3]

**Q3)** a) Explain the Complex Programmable Logic Device XC 9500 architecture. [5]  
b) Differentiate between functions and procedures in VHDL. [5]

**Q4)** a) Write short notes w. r. t. VHDL on : [5]  
i) Operator Interference.  
ii) Library and Packages.  
b) Explain the sequential and concurrent statements in VHDL programming, with suitable examples. [5]

**P.T.O.**

- Q5)** a) Explain general FPGA Architecture. [4]  
b) Explain FPGA Design flow. [4]  
c) Explain Types of Programmable Interconnections in FPGA. [2]
- Q6)** a) Explain the architecture of Xilinx Spartan-II. [5]  
b) What is the process of debugging? Explain debugging step in FPGA Design. [5]
- Q7)** a) Explain the types of Application-Specific Integrated Circuit (ASIC). [5]  
b) What is a Custom IC? Explain Custom IC Design flow. [5]
- Q8)** a) What is the standard cell based ASIC design? What is the roll of cell libraries in ASIC design? In short, explain the steps in ASIC cell libraries design. [5]  
b) What do you understand by IP Cores in Application-Specific Integrated Circuits (ASICs) and System On Chip designs? Explain the IP Core types. [5]





Total No. of Questions : 8]

SEAT No. :

P3120

[Total No. of Pages : 2

[5872]-257

**M.E. Electronics (Digital Systems)**  
**IMAGE PROCESSING & COMPUTER VISION**  
**(2017 Pattern) (Semester - II) (504109)**

*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) *All questions carry equal marks.*

**Q1) a)** Write a note on any one image transforms techniques. **[5]**

i) DCT.

ii) Haar.

b) With the help of examples explain 4, 8, and m-connectivity. **[5]**

**Q2) a)** What is significance of histogram equalization? Also state its effect in image processing with the appropriate examples. **[5]**

b) What are first order and second order spatial filters. Differentiate between them. **[5]**

**Q3) a)** Enlist different color systems used in color image processing. Explain in detail RGB model. **[5]**

b) Write a note on color image Sharping and Smoothing. **[5]**

**Q4) a)** Write a short note on tone and color corrections. **[5]**

b) Write a note segmentation in HIS vector space. **[5]**

**P.T.O.**

- Q5)** a) Write a note on geometrical transformations. [5]  
b) What is distance transformation approach used in image registration? [5]
- Q6)** a) Explain the head and hat algorithm. [5]  
b) Write a note on rigid transformation. [5]
- Q7)** a) What is surface representation? Explain in detail surface simplification. [5]  
b) Write a note on stereo based head tracking. [5]
- Q8)** a) Explain in proper steps Marr's Theory for 3D vision. [5]  
b) Explain Basic principle for 3D geometry. [5]





Total No. of Questions : 7]

SEAT No. :

**P3121**

[Total No. of Pages : 2

**[5872]-258**

**M.E. (Electronics) (Digital Systems)  
SYSTEM ON CHIP DESIGN  
(2017 Pattern) (Semester - III) (604101)**

*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) Draw neat diagram wherever necessary.*
- 4) Assume suitable data if necessary.*

**Q1) a)** Draw SOC architecture and explain in short. **[5]**

b) Explain with example Barrel Shifter. **[5]**

**Q2) a)** Draw block diagram and explain on chip peripheral bus. **[6]**

b) What are the advantages and disadvantages of the reconfiguration. **[4]**

**Q3) a)** Explain simple bus model without resubmission. **[6]**

b) Explain the effect of bus transactions and contention time on overall system performance. **[4]**

**Q4) a)** Where FIFO based mechanism are useful. **[5]**

b) Explain the most common reasons for simulation-synthesis. **[5]**

**Q5) a)** Draw and explain SOC design flow. **[5]**

b) Explain hard real-time DPM Policies. **[5]**

**P.T.O.**

- Q6)** a) Explain different sequential arcs with example. [5]  
b) Explain factors on which the transition time seen at the input of the gate is dependent. [5]
- Q7)** a) Explain the term slack time where it is used. [5]  
b) Explain the low-power bus encoding. [5]



Total No. of Questions : 8]

SEAT No. :

P3122

[Total No. of Pages : 2

[5872]-259

**M.E. Electronics (Digital Systems)**

**WIRELESS SENSOR NETWORK FOR IOT**

**(2017 Pattern) (Semester - III) (604102)**

*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) *Assume suitable data, if necessary.*

**Q1)** a) What are the hardware components of Wireless Sensor Network? [5]

b) Explain any one real-time application of WSN. [5]

**Q2)** a) Explain the various challenges of Wireless Sensor Network. [5]

b) Explain the optimization goals of WSN. [5]

**Q3)** a) Explain how target detection and tracking achieved in sensor network.[5]

b) Explain fundamentals of MAC protocols. [5]

**Q4)** a) Explain any one aggregation techniques. [5]

b) Explain IEEE 802.11.4 MAC protocol. [5]

**Q5)** a) Explain big data and IOT analytics in details. [5]

b) Explain elements of an IOT eco-system. [5]

**P.T.O.**

- Q6)** a) Compare IPV4 and IPV6. [5]  
b) What are the link layer technologies in IOT. [5]
- Q7)** a) Explain any one real time application of IOT. [5]  
b) List and explain any two IOT data protocols. [5]
- Q8)** a) Explain IOT reference architecture. [5]  
b) Explain importance of ethics in IOT. [5]



Total No. of Questions : 8]

SEAT No. :

P3123

[Total No. of Pages : 2

[5872]-261

**M.E. (Electronics & T C) (Communication Networks)**  
**MODELLING AND SIMULATION OF COMMUNICATION**  
**NETWORKS**  
**(2017 Pattern) (Semester - I) (504501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any FiVE questions.*
- 2) *Draw neat diagram 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 parameters of performance estimation in simulation? [4]  
b) Why PN sequence generators are needed in simulation? What are its Components? Also mention properties of a PN sequence? [4]  
c) What is up sampling and down sampling in communication system?[2]
- Q2)** a) What are the different methods to map uniform random variables to an arbitrary pdf? [4]  
b) Explain the graphical technique for post processing. [4]  
c) Explain the role of simulation in communication system? [2]
- Q3)** a) Giving the example state the estimation model for band pass signal. [4]  
b) What are correlated Gaussian Numbers? Why do we need them? [4]  
c) What are the various specifications to be considered while simulating a radio channel? [2]

*P.T.O.*



- Q4)** a) What are the aspects for selection of sampling frequency for a simulation? [4]
- b) What are various techniques to generate uniformly distributed random numbers? [4]
- Compare and contrast the following algorithms.
- i) Mixed congruence algorithm
- ii) Multiplicative algorithm with prime modulus.
- c) What are the categories of a communication channel? [2]
- Q5)** a) Compare and contrast pure Monte Carlo approach and semi-analytic approach to performance estimation of a communication system. [4]
- b) Enlist factors to be considered while simulating nonlinearities. [4]
- c) What is direct component and Quadrature component of a signal? [2]
- Q6)** a) What is semi analytic simulation technique? Hence suggest modifications in an algorithm for BER estimation for QPSK. [4]
- b) Find out the power spectral density relation in a Tapped delay line model. [4]
- c) Elaborate methodology used in mapping a problem into a simulation model. [2]
- Q7)** a) Describe a two state Markov model for discrete channels with memory. [4]
- b) Explain Queue system related to network modeling? [4]
- c) What is the significance of relative frequency in Monte-Carlo estimation? [2]
- Q8)** a) Explain Poisson's modeling. [4]
- b) What are the different techniques used to reduce run time of the Monte Carlo method? Hence explain importance of sampling. [4]
- c) How to estimate the error probability in a digital transmission system? [2]



Total No. of Questions : 8]

SEAT No. :

P3124

[Total No. of Pages : 2

[5872]-262

**M.E. (E&TC) (Communication Networks)**  
**HIGH SPEED COMMUNICATION NETWORKS**  
**(2017 Pattern) (Semester - I) (504502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions out of 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*

**Q1) a)** How does AAL play a role? [5]

b) Compare and contrast performance of TCP over UBR and ABR. [5]

**Q2) a)** How does streaming protocol work? What are different streaming protocols? Explain any one in detail. [5]

b) Describe various characteristics of queuing system. [5]

**Q3) a)** Why is video filtering is needed? Explain working principle of video filtering? [6]

b) Explain H.264/AVC coder. [4]

**Q4) a)** How does Cell Delay Variation relate to performance of Congestion control in ATM networks? [5]

b) How does streaming protocol work? What are different streaming protocols? Explain any one in detail. [5]

**P.T.O.**

- Q5)** a) Explain any two Dynamic Protocols. [6]  
b) Explain Frame Relay network with an example of its application. [4]
- Q6)** a) Discuss two ATM protocols. [5]  
b) What is the need of Wireless LANs? Explain with an example. [5]
- Q7)** a) Explain the working with architecture of 802.11. [6]  
b) Describe with diagram the connection of ATM in ATM cell. [4]
- Q8)** a) How is Congestion control achieved in Frame Relay? [5]  
b) Enlist various Image compression techniques. Explain any one in detail.[5]



Total No. of Questions : 8]

SEAT No. :

P3125

[Total No. of Pages : 2

[5872]-263

**M.E. (Electronics & Telecommunication)**

**COMMUNICATION NETWORKS**

**Network Security**

**(2017 Pattern) (Semester - I) (504503)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions out of eight questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Right hand side number indicate marks.*

**Q1)** a) Explain in detail Network Security & operations? [5]

b) Explain Secure software Design? [5]

**Q2)** a) Explain conventional encryption. [5]

b) Explain security architecture? [5]

**Q3)** a) Explain cryptography with example? [5]

b) Explain access control? [5]

**Q4)** a) Explain cipher block? [5]

b) Explain operating system security management? [5]

**Q5)** a) Explain Network security applications? [5]

b) Explain Cybersecurity? [5]

**P.T.O.**

- Q6)** a) Explain encapsulating security payload? [5]  
b) Explain need of cybersecurity for wired networks? [5]
- Q7)** a) Explain web security requirements? [5]  
b) Explain Cyberattacks with example? [5]
- Q8)** a) Explain SSL? [5]  
b) Explain need of cybersecurity for online shopping? [5]



Total No. of Questions : 8]

SEAT No. :

P3126

[Total No. of Pages : 2

[5872]-264

M.E. (Electronics / E & TC all Branches)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (504504)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any 5 questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of cell phone is prohibited in the examination hall.
- 6) Use of electronic pocket calculator is allowed.

**Q1)** a) What do you mean by Citation and Impact Factor? Write the names of any two International Journals of your domain and its Impact Factor.[5]

b) Explain Steps in Setting up a computer model to predict performance of experimental system. [5]

**Q2)** a) Explain the characteristics of static and dynamic instrumentation? What is the role of instrument in research? [5]

b) Explain the various steps involved in research. What are the characteristics of good research? [5]

**Q3)** a) Explain ANOVA with suitable example. [5]

b) Explain the terms arithmetic mean, median, mode, geometric mean and harmonic mean. Find out the standard deviation for the following data.

17, 13, 15, 17, 25, 21, 23 [5]

**Q4)** a) Write short notes on Principal component analysis. [5]

b) How will you differentiate between descriptive statistics and inferential statistics? Describe the important statistical measures often used to summaries the survey/research data. [5]

P.T.O.

- Q5)** a) Explain mathematical models as a conceptual model as a system. Explain the modeling elements and their interrelationship. [5]  
b) What do you mean by asymptotic analysis? Explain with suitable example. [5]
- Q6)** a) Describe in brief, the outline and structure layout of a research report, covering all relevant points. [5]  
b) Describe the different measurement scale used in process system. [5]
- Q7)** a) Explain the dissemination of research findings and address on different steps and precautions while writing research report. [5]  
b) Explain the ethics and plagiarism check of the research article. What are the various tools available? [5]
- Q8)** a) Write a short note on 'Documentation' in the context of a research report. [5]  
b) Describe different steps involved in writing a research proposal. [5]



Total No. of Questions : 8]

SEAT No. :

P3127

[Total No. of Pages : 2

[5872]-265

**M.E. (E&TC) (Communication Networks)**

**TRAFFIC ANALYSIS AND QOS**

**(2017 Pattern) (Semester - II) (504507)**

*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.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of cell phone is prohibited in the examination hall.*
- 5) *Use of electronic pocket calculator is allowed.*

**Q1) a)** What are different four aspects of SNMP communication Model? Explain Administrative model in Detail. **[6]**

b) Explain Difference between database of network management system & its MIB. **[6]**

OR

**Q2) a)** What are different message PDUs used in SNMP operation. Explain the encapsulation in detail. Write a note on Trap PDU with a suitable diagram showing different fields. **[6]**

b) Explain SNMP architecture in detail with all models. **[6]**

**Q3) a)** Explain the conceptual Model of Telecommunication Management Network. **[7]**

b) Describe in detail Optical network & MAN feeder network. **[6]**

OR

**Q4) a)** Discuss the TMN service Management architecture in detail. **[7]**

b) Write a short note on Multi Protocol Label switching. **[6]**

**P.T.O.**



- Q5)** a) Explain the utility & application area of high speed LANs. [7]  
b) Explain 802.5 token Ring Technology in High Speed LANs. [6]

OR

- Q6)** a) Define Integrated service. Explain it in detail in context of QoS. [7]  
b) Explain in detail different types of Ethernet. [6]

- Q7)** a) Write a short note on MPLS traffic Engineering. [6]  
b) What are function provided by ISA to manage congestion & QoS transport? [6]

OR

- Q8)** a) What is the difference between flow control and Error Control? [6]  
b) Describe Traffic Control and Congestion Control in ATM Networks. [6]



Total No. of Questions : 8]

SEAT No. :

P3128

[Total No. of Pages : 2

[5872]-266

**M.E. (E&TC) (Communication Networks)**  
**BROADBAND WIRELESS TECHNOLOGIES**  
**(2017 Pattern) (Credit System) (Semester - II) (504508)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) Explain the advantages of Block based transmissions over continuous transmission. [5]
- b) Discuss the block diagram of multi-input-multi-output (MIMO) transceiver. [5]
- Q2)** a) Discuss the performance of MIMO for frequency selective fading channels. [5]
- b) Discuss in detail about SVD based Eigen beam forming technique. [5]
- Q3)** a) Compare the various spread spectrum techniques used in ultrawideband system. [5]
- b) Explain Carrier sense multiple access with collision avoidance MAC in detail. [5]
- Q4)** a) Explain ALOHA and slotted ALOHA protocols in Media Access control. [5]
- b) Discuss the Energy efficient MAC protocol with suitable diagrams. [5]

*P.T.O.*

- Q5)** a) Describe the features of MANET routing protocol in Wireless Broadband Networks with suitable examples. [5]  
b) Compare the multirate DS-CDMA system with conventional CDMA system. [5]
- Q6)** a) Discuss the Point-multipoint WiMAX networks in detail. [5]  
b) Explain Dynamic BW allocation algorithm (DBA) in WiMAX. [5]
- Q7)** a) Explain the architecture of Ethernet Passive Optical Networks (EPONS) in detail. [5]  
b) Explain the difference between passive and active optical network. [5]
- Q8)** Write a short note on (any two) :
- a) Hybrid WOBAN [5]  
b) Intra-ONU scheduling [5]  
c) BW management for Multichannel EPONS [5]



Total No. of Questions : 8]

SEAT No. :

**P7002**

[Total No. of Pages : 2

[5872]-267

**M.E. (E &TC) (Communication Networks )**

**SDR AND COGNITIVE RADIO**

**(2017 Pattern) (Semester-II) (504509)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q5 or Q.6, Q7 or Q8.*
- 2) *Neat diagrams to be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain the history of Cognitive Radio and its evolution. [7]  
b) How is convergence between military and commercial systems established in the concept of Cognitive Radio? [6]
- Q2)** a) What are the fundamental limitations of Cognitive Radio Technology? [7]  
b) What are the future scope of Software Defined Radio. [6]
- Q3)** a) Give an overview of Cognitive Radio Architecture. [6]  
b) How is end to end communication accomplished in the case of Cognitive Radio? [6]
- Q4)** a) Write on different layer wise architecture of Cognitive Radio. [6]  
b) What are the frequency plans available for Cognitive Radio Networks? [6]
- Q5)** a) Describe the architectural overview of SCA. [6]  
b) Explain the compliance between SCA and JTRS. [6]
- Q6)** a) What are the requirements of CORBA? [6]  
b) Write short note on Real Time Operating Systems. [6]

*P.T.O.*

- Q7)** a) Explain the principle of phased array antennas. [7]  
b) How are adaptive techniques applied to antennas? [6]
- Q8)** a) How is baseband signal processing achieved in Cognitive Radio systems? [7]  
b) Give an account of Radio Frequency design. [6]



Total No. of Questions : 8]

SEAT No. :

**P6556**

[Total No. of Pages : 2

**[5872]-268**

**M.E. (Electronic Tele Communication Networks)**

**4G LTE CELLULAR SYSTEMS**

**(2017 Credit Pattern) (Semester-III) (604501)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a) What is 3GPP specification release for UMTS and LTE? [5]**

b) What is access stratum signaling and non access stratum signaling?[5]

**Q2) a) Explain Medium Access Control (MAC) protocol in detail. [5]**

b) Explain the following Communication protocols. [5]

i) Protocol model/user plane protocols.

ii) Air interface transport protocols.

**Q3) a) Explain Radio Access network (RAN) protocol architecture. [5]**

b) With reference to transmission of scheduling messages on the PDCCH, Explain. [5]

i) Downlink control information

ii) Resource allocation

**Q4) a) With reference to RF requirement for LTE, briefly explain transmitter and receiver characteristics, Also, state the regional and band specific requirement. [5]**

b) Explain LTE advanced system with radio interface characteristics. [5]

**P.T.O.**

- Q5) a)** Explain carrier cross scheduling. [5]
- b) With respect to uplink multi antenna transmission, explain the following.[5]
- i) Precoder based multi antenna transmission for PUSCH.
  - ii) Uplink multi user MIMO.
- Q6) a)** With reference to Medium Access Control explain, [5]
- i) Logical channels & transport channels.
  - ii) Scheduling.
- b) What are handover and mobility issues related to LTE systems? [5]
- Q7) a)** What are various types of relays according to 3GPP and explain its classification? [5]
- b) What is duplexing scheme? Explain in detail. [5]
- Q8) a)** What is role of Relays in LTE-Advance cellular systems? Explain various schemes of relaying. [5]
- b) What is CoMP? Explain broader overview of its architecture. [5]



Total No. of Questions : 8]

SEAT No. :

P3129

[Total No. of Pages : 2

[5872]-269

M.E. (E&TC) (Communication Networks)

**MODERN COMMUNICATION RECEIVER DESIGN &  
TECHNOLOGY**

(2017 Pattern) (Semester - III) (604502)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) With the help of suitable block diagram , explain the implementation of double conversion receiver. [5]

b) Enlist the various types of image reject mixers used in direct conversion receiver. [5]

**Q2)** a) With the help of suitable block diagram, explain the ideal receiver. [5]

b) Explain Drift-Canceling Loops and the Barlow-Wadley Receiver with suitable diagram. [5]

**Q3)** a) Explain the design of Automatically Switched Half-Octave Filter Banks for HF transceiver. [5]

b) Explain the system composite noise figure with block diagram. [5]

**Q4)** a) Define Dynamic Range of receiver. Define Two-Tone Dynamic Range receiver. [5]

b) Define the following terms in brief w.r.t. dynamic range. [5]

i) Linear composite dynamic range (LCDR):

ii) Spurious-free second-order dynamic range (IP2SFDR)

**P.T.O.**



- Q5)** a) Explain the Coherency in Synthesizers. [5]  
b) Explain the Gilbert Cell Mixers with suitable diagram. [5]
- Q6)** a) Explain the Double-Balanced Mixer with its performance characteristics [5]  
b) Explain the following parameters w.r.t Mixers. [5]  
i) Compression Point (-1 dB)  
ii) Desensitization Level and Isolation
- Q7)** a) Write the applications of Logarithmic IFs [5]  
b) What is the significance of Automatic Gain Control (AGC) in Receivers. [5]
- Q8)** a) Enlist different Noise Blanker & state the importance of Noise Blanker in IF receiver. [5]  
b) What are design considerations for Audio and Baseband Amplifier of receiver? [5]



Total No. of Questions : 8]

SEAT No. :

P3130

[Total No. of Pages : 2

[5872]-271

M.E. (E & TC) (Microwave)

**ELECTROMAGNETICS & ANTENNA THEORY**

**(2017 Pattern) (Semester - I) (504301)**

*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 the equivalence principle and illustrate its applications in aperture antenna analysis with a suitable example. [5]

b) Determine the length of the antenna whose input resistance is  $50\Omega$  [5]

**Q2)** a) Why spiral antenna is broadband antenna. [4]

b) A spherical reflector has a 10ft diameter. If at 11.2GHz the maximum allowable phase error is  $\lambda/16$ , find the maximum permissible aperture. [6]

**Q3)** a) A rectangular aperture with a constant field distribution with  $a = 3\lambda$  and  $b = 2\lambda$  is mounted on an infinite ground plane, compute the, [10]

- i) FNBW in the E-plane
- ii) HPBW in the E-plane
- iii) FSLBW in the E-plane
- iv) FSLMM in the E-plane
- v) directivity

**P.T.O.**

- Q4)** a) Describe the following antenna with illustrative structural diagram, radiation pattern & features. **[10]**
- i) Cassegrain reflectors
  - ii) Spherical reflector
  - iii) Corner reflector
- Q5)** a) The radius of a small loop of constant current is  $\lambda/25$ . Find the physical area of a loop and compare it with its maximum effective aperture. **[6]**
- b) With respective constructional details explain Rhombic Antenna. **[4]**
- Q6)** a) Explain the various feeding methods in microstrip patch antenna. **[4]**
- b) A microstrip antenna with overall dimensions of  $L = 0.906$  cm (0.357 inches) and  $W = 1.186$  cm (0.467 inches), substrate with height  $h = 0.1588$  cm (0.0625 inches) and dielectric constant of  $\epsilon_r = 2.2$ , is operating at 10 GHz. Find. **[6]**  
The input impedance
- Q7)** a) Explain the following parameters of antenna. **[5]**
- i) Reflection coefficient
  - ii) VSWR
- b) Drive an expression for boundary conditions for boundary between two different magnetic materials. **[5]**
- Q8)** a) Derive an expression for total electric field for 2 - element linear array and explain the principle of patterns multiplication with reference to antenna array. **[6]**
- b) Write the Salient features of lens antenna and explain the principles of working with relevant diagrams. **[4]**



Total No. of Questions : 8]

SEAT No. :

P3131

[Total No. of Pages : 2

[5872]-272

M.E. (E&TC) (Microwave)

RF AND MICROWAVE CIRCUIT (504302)

(2017 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) Use of electronics pocket calculator is allowed.
- 4) Assume suitable data if necessary.
- 5) figures to the right indicate full marks.

**Q1)** a) Explain with working of following microwave components using proper diagrams. [6]

- i) Wilkinson Power divider
- ii) Two hole Coupler

b) Explain working of two hole directional coupler. [4]

**Q2)** a) Derive the expressions for propagation constant, impedance, and power flow for the lossless coaxial line. [6]

b) For an arbitrary N port microwave device, derive the relationship between transmission (ABCD) matrix and impedance matrix. [4]

**Q3)** a) How inter symbol interference affects on wireless communication? Derive expression for roll of factor. [5]

b) Write short note on conversion gain and distortion. [5]

P.T.O.

- Q4)** a) Write a note on dynamic range and sources of noise in microwave circuits. [5]  
b) Derive the equation of scattering matrix for two hole directional coupler. [5]
- Q5)** a) Describe in detail construction and operating principal of PIN diode. [6]  
b) Explain MESFET in terms of Construction, Working & frequency response. [4]
- Q6)** a) How RF diode differs from conventional semiconductor diode? Explain construction and working of Schottky diode with related parametric derivation. [6]  
b) Explain operating principle of Tunnel diode. [4]



Total No. of Questions : 6]

SEAT No. :

P3132

[Total No. of Pages : 2

[5872]-273

M.E. (E & TC) (Microwave)

MICROWAVE MEASUREMENTS

(2017 Pattern) (Semester - I) (504303)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any Five questions.*
- 2) *Assume suitable data, if necessary.*

**Q1)** a) Derive the expression for impedance and reflection coefficient for Loss less two conductor transmission line. [5]

b) Define phase velocity and phase constant for sinusoidal waves of transmission line. Derive the equation for phase velocity and phase constant. [5]

**Q2)** a) What is the significance of attenuation in measurement. Draw a practical Circuit used for attenuation. [5]

b) Explain Noise with method to reduce it. [5]

**Q3)** a) State the different elements of Network analyzer. Give the significance of any one element. [5]

b) State the different types of power sensors explain any one. [5]

**Q4)** a) Draw and Explain the Block schematic spectrum Analyzer. [5]

b) Give the advantages of power sensors in Microwave Measurement.[5]

*P.T.O.*

**Q5)** State the different types of power splitter used in RF power measurement, Explain any one. **[10]**

**Q6) a)** Draw and Explain the Noise figure Analyzer. **[5]**

**b)** Explain how the signal analysis is done using spectrum Analysis. **[5]**



Total No. of Questions : 6]

SEAT No. :

P3133

[Total No. of Pages : 2

[5872]-276

M.E. (E & TC) (Microwave)

RF AND MMIC TECHNOLOGY

(2017 Pattern) (Semester - II) (504308)

*Time : 3 Hours]*

*[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) Explain any three design approaches used in MMIC technology. [6]

b) What are the advantages and disadvantages of MMIC technology. [4]

**Q2)** a) Explain MMIC technology used for design of HBT device. [6]

b) Write a note on multi chip module technology. [4]

**Q3)** a) Explain the structure of multilayer directional coupler. [5]

b) What is difference between Micro strip couplers and splitters. [5]

**Q4)** a) State the Synthesis process of linear and non linear MMIC devices with example. [5]

b) Explain how matrix decomposition is performed in microwave circuit.[5]

*P.T.O.*



- Q5)** a) Explain the method of harmonic balance used in microwave circuit.[6]  
b) Explain in detail integrated CAD design environment. [4]
- Q6)** a) Discuss design steps for phase shifter circuit in detail. [6]  
b) How MMIC Measurement is carried out? Explain MMIC test system.[4]



Total No. of Questions : 8]

SEAT No. :

**P6557**

**[5872]-277**

[Total No. of Pages : 2

**M.E.(E&TC) (Microwave)  
WIRELESS COMMUNICATION SYSTEM  
(2017 Pattern) (Semester-II) (504309)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Draw a flow chart explaining the sequence of call making from Landline to Mobile. **[5]**

b) Draw a figure illustrating various call types in a typical telephone switch and define all the terms related. **[5]**

**Q2) a)** If a total of 50MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 20kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses four - cell reuse. **[5]**

b) How is the effect of earth's curvature is incorporated in two ray model? Explain with the help of mathematical expression and illustrative diagram. **[5]**

**Q3)** Write a detailed note Okumara Propagation Model for various cases, also explain its applications. **[10]**

**Q4) a)** Explain mobile hand off mechanism with the help of an illustrative diagram, also differentiate between soft and hard hand off, what are the various factor that influence hand off. **[5]**

b) Determine frequency reuse distance for a cell radius of 6 km and cluster size fo 7. **[3]**

c) Explain GSM service request operation with relevant diagrams. **[2]**

**P.T.O.**

- Q5)** a) What is intra BSC handover in GSM and explain. [2]  
 b) What are the various frame formats used in GSM traffic, describe each of them with relevant figures and numerical values. [5]  
 c) If a certain CDMA radio base station system can output a 100 W carrier signal, how much power is on the synchronization channel. [3]
- Q6)** a) Explain the functions of MAC layer and Radio Link control protocol of UMTS in detail. [5]  
 b) What are the defining parameters of a wireless standard? What are the features of the wireless standards beyond 3G? [3]  
 c) Specify the spectrum allocation, channel spacing, centre frequency for UMTS. [2]
- Q7)** a) Define spectral Efficiency. [1]  
 b) What is the difference between adjacent channel and co channel interference? [2]  
 c) What is the modulation technique implemented in CDMA and GSM. [1]  
 d) What is the channel coding and source coding implemented in CDMA and GSM. [1]  
 e) Expand following terms [3]  
 i) UMTS  
 ii) PDPC  
 iii) UTRAN  
 iv) GPRS  
 v) GMSK  
 vi) RRC  
 f) Define Doppler shift and ISI. [2]
- Q8)** a) Write Specific functions of the following channels with reference to GSM. [5]  
 i) RACH  
 ii) DCCH  
 iii) BCH  
 iv) AGCH  
 v) FCCH  
 b) Write at least five differences between Direct Spread Spectrum and Frequency Hopping Spread Spectrum. [5]



Total No. of Questions : 6]

SEAT No. :

P3134

[Total No. of Pages : 2

[5872]-278

M.E. (E & TC) (Microwave)

EMI AND EMC TECHNIQUES

(2017 Pattern) (Semester - III) (604301)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Draw the classification chart of EMI sources, and explain the electromagnetic pulse in detail and what are the effects of EMP on electronic subsystems. [5]
- b) Explain the terms of EMI and EMC. [2]
- c) Explain the various sources of EMI that effect the mobile communications. [3]
- Q2)** Explain the following EMI control techniques with illustrative examples with diagrams? [10]
- a) Grounding
  - b) Shielding
  - c) Bonding
  - d) Filtering
- Q3)** a) Draw the diagram of single rod grounding electrode and explain the function of each component, merits and demerits of the same. [5]
- b) Give the difference between radiated and conducted EMI, explain with a suitable diagrams. [5]

*P.T.O.*

- Q4)** a) Explain the following terminology with respect to EMI prediction and their relevance. [6]
- i) Class FIM
  - ii) Class TIM
  - iii) Class RIM
  - iv) Class SIM
- b) Explain the design steps of common mode and differential mode filter.[4]
- Q5)** Explain the Open Area Test Site with illustrative diagrams, specifications and measurement procedures. [10]
- Q6)** a) Draw the structural diagram of TEM cell and explain in detail. [5]
- b) Write short note on EMI/EMC standards. [5]



Total No. of Questions : 8]

SEAT No. :

P3135

[Total No. of Pages : 2

[5872]-279

M.E. (E&TC) (Microwave)

RADAR AND SATELLITE COMMUNICATIONS

(2017 Pattern) (Semester - III) (604302)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

- Q1) a) Explain any two RCS estimation methods. [5]
- b) Compare pulse radar and CW radar w.r.t. functionality, power, range and applications. [5]

- Q2) a) A pulse radar has peak power  $P_t = 2\text{KW}$  and uses two PRF given by  $\text{PRF}_1 = 5\text{KHz}$  and  $\text{PRF}_2 = 10\text{KHz}$ . Find the required Duty cycle, peak repetition intervals, pulse width for each PRF to make constant average transmitted power 1KW and pulse energy. [5]
- b) With a suitable equations explain Doppler effect. [5]

- Q3) a) Explain the different requirements of antenna beam shape in radar applications. [5]
- b) Explain the concept of search radar. [5]

P.T.O.

- Q4)** a) Explain the application of radar in Geological survey. [5]  
b) Define following terms of radar [5]  
i) Pulse repetition frequency  
ii) Frequency agility
- Q5)** a) Enlist the orbital elements used to specify the absolute coordinates of a satellite. [5]  
b) State and explain Kepler's three laws regarding planetary motion. [5]
- Q6)** a) Explain the launching steps of satellite. [5]  
b) Explain the orbital effects in communication system performance. [5]
- Q7)** a) Explain the procedure to establish satellite link for communication. [5]  
b) Draw and explain TTC & M system in satellite communication. [5]
- Q8)** a) Explain the SS-TDMA multiple access technique used in satellite communication and onboard processing. [5]  
b) Discuss the following terms of look angle calculations [5]  
i) Elevation angle  
ii) Azimuth angle  
iii) Visibility test



Total No. of Questions 8]

SEAT No. :

**P6558**

**[5872]-282**

[Total No. of Pages : 2

**M.E. (E. &T.C.) (Signal Processing)**  
**DIGITAL IMAGE & VIDEO PROCESSING**  
**(2017 Pattern) (Semester-I) (504402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five questions.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Black figures to the right indicate full marks.*
- 4) *Your answers will be valued as a whole.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data wherever necessary.*

**Q1) a)** With respect to digital image explain the following. **[6]**

- i) Connectivity between pixels
- ii) Distance measures between pixels

b) State the importance of color models. Give applications of RGB, HSI and YIQ color model and explain any two in detail. **[4]**

**Q2) a)** Write the equation and properties of 2D-DFT With the help of block diagram describe steps used in frequency domain filtering. **[6]**

b) Explain the following along with application. **[4]**

- i) Power law transformation
- ii) Vnsharp Marking

**Q3) a)** Given the probability of following symbols Find out Huffman code, Avg code length, Entropy and coding efficiency. **[6]**

$a_1$	$a_2$	$a_3$	$a_4$	$a_5$	$a_6$
0.1	0.4	0.06	0.1	0.04	0.3

b) Explain JPEG baseline encoder in detail. **[4]**

**P.T.O.**



- Q4)** a) With the help of morphological operations on binary images explain how the following operations are performed. [6]
- i) Boundary extraction
  - ii) Region / Hole filling
  - iii) Thickening
- b) What is Global thresholding? What is its drawback? How adaptive thresholding overcomes it? Write algorithm for adaptive thresholding. [4]
- Q5)** a) Explain the concept of image representation. Describe the image representation by signature & Shape number with example [6]
- b) Describe the basic concept of Fourier descriptor for representation of boundary. List its properties and advantages. [4]
- Q6)** a) What is difference between image restoration and image enhancement? Explain the image degradation model in detail. [6]
- b) Why median filter is non-linear filter? How it is useful in removing salt and pepper noise from a digital image? [4]
- Q7)** a) State the difference between analog and digital video? Explain basic video codes with suitable block diagram. [6]
- b) Explain block based motion estimation and compensation technique state advantages and disadvantages of this technique. [4]
- Q8)** a) Explain basics of color video? Hence explain color conversion into YCbCr color space along with its advantages. [6]
- b) What is Pseudo coloring and False coloring? Give its application. [4]



Total No. of Questions 6]

SEAT No. :

**P6790**

**[5872]-283**

[Total No. of Pages : 2

**M.E. (E. &T.C.) (Signal Processing)**  
**ADVANCED DIGITAL SIGNAL PROCESSING**  
**(2017 Pattern) (Semester-I) (504403)**

*Time : 3 Hours]*

*[Max. Marks : 50*

**Instruction:**

*Answer all questions.*

- Q1)** a) Explain VLIW arch. in brief. [4]  
b) Explain concept of Ergodic Processes [4]  
c) State Adaptive filters [2]

OR

- Q2)** a) Write the steps of designing IIR filter by using Bilinear Transformation. [4]  
b) Explain Booth's multiplication algorithm. [6]

- Q3)** a) Define Discrete Fourier Transform. Compute the N-point DFT of the length - N sequence.  $x(n) = \text{Cos}(2\pi rn / N)$ ,  $0 \leq n \leq N - 1$  where 'r' is an integer in the range  $0 \leq r \leq N - 1$  [5]  
b) What is Gibb's phenomenon? Write the procedure for designing FIR filter using windows. [5]

- Q4)** a) Define Down sampling Process consider a discrete time signal  $x(n) = \{1,2,3,4,5,6,7,8,9,10,11,12\}$  Determine the downsampled version of the signals for sampling rate reduction factors. [7]  
i)  $D = 2$   
ii)  $D = 3$  and  
iii)  $D = 4$   
b) Define interpolation State any two application of multirate DSP. [3]

**P.T.O.**

**Q5) a)** Draw the diagram of uniform and Gaussian Probability Density function. PDF. Also explain the same. **[8]**

b) State random signals and also state this use. **[2]**

**Q6) a)** Draw the diagram and explain Harvard architecture. **[4]**

b) Design a linear phase FIR band Pass filter to pass frequencies in the range  $0.4 \pi$  to  $0.65 \pi$  rad/sample by taking 7 samples of Hanning Window sequence. **[6]**



Total No. of Questions : 8]

SEAT No. :

P3136

[Total No. of Pages : 2

[5872]-285

**M.E. (E & TC) (Signal Processing)**  
**BIOMEDICAL SIGNAL PROCESSING**  
**(2017 Pattern) (Semester - II) (504407)**

*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) *Assumen the suitable data if necessary.*

- Q1)** a) Explain cell junction with the help of diagram. [5]  
b) Explain Einthoven's triangle for 12 Lead ECG configurations. [5]
- Q2)** a) How to use Eigen analysis for bio-signals processing. State its advantages and limitations. [5]  
b) Explain different Bio-transducers. [5]
- Q3)** a) Write note on different Medical Images. [4]  
b) Write a note on CT scan. [3]  
c) What is aliasing effect? How to minimize this effect. [3]
- Q4)** a) Explain any two properties of Radon Transform. [4]  
b) What is the purpose of PET scanning? [3]  
c) With the sequence of events and waves explain cardiac cycle and draw PQRST waveform. [3]

*P.T.O.*

- Q5)** a) What is Inverse Radon transform? Compare its equation with equation of Random Transform. [4]  
b) Compare MRI and Functional MRI techniques. [4]  
c) Define non stationary signal with example. [2]
- Q6)** a) What is adaptive Segmentation, discuss the RLS and Lattice adaptive filters used for adaptive segmentation. [4]  
b) Discuss the Autoregressive (AR) analysis. [4]  
c) What is PET Image. [2]
- Q7)** a) Explain Noise Reduction Technique. [4]  
b) Discuss the model based approach for spectral estimation. [4]  
c) Write a note on Lattice adaptive filter. [2]
- Q8)** a) Discuss the various sources due to which biomedical signals get contaminated. [4]  
b) Explain the use of autocovariance in analysis of heart rate variability.[4]  
c) What is role of Isolation amplifier. [2]



Total No. of Questions : 8]

SEAT No. :

P7250

[Total No. of Pages : 2

[5872] - 286

M.E. (E & TC) (Signal Processing)

SPEECH PROCESSING (504408)

(Semester - II) (2017 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) Use of logarithmic tables is allowed.
- 4) Assume suitable data if necessary.

- Q1)** a) Explain with block diagram the LTV mode for speech signal & write mathematical approach for same. [7]  
b) Differentiate between pitch & formants. [3]
- Q2)** a) Explain with suitable diagram the mechanism of speech production. [5]  
b) Explain spectrographic analysis of speech signal & mention all parameter of it. [5]
- Q3)** a) Explain with block diagram parallel processing approach for calculation of pitch frequency. [5]  
b) With help of block schematic, explain formant measurement using cepstrum. [5]
- Q4)** a) Define different parameters of speech signal. Explain AMDF method for pitch measurement. [5]  
b) Explain how voiced & unvoiced speech signal separated. [5]
- Q5)** a) Explain the pitch detection using LPC parameters in detail. [6]  
b) Explain the homomorphic speech processing in detail. [4]

P.T.O.

- Q6)** a) Explain forward & backward adaptive quantizer in detail. [6]  
b) Define G-726 standard for ADPCM & give example. [4]
- Q7)** a) Define cepstrum. Explain how to calculate pitch & formants using cepstrum? [6]  
b) Explain how speech signal is quantized & coding is carried out? [4]
- Q8)** Write short note on : [10]
- a) STFT
  - b) Voiced & unvoiced speech signal
  - c) DM
  - d) Pitch of signal
  - e) Mel scale & Bork scale



Total No. of Questions : 8]

SEAT No. :

P3137

[Total No. of Pages : 2

**[5872]-287**  
**M.E. (E&TC) (Signal Processing)**  
**Computer Vision**  
**(2017 Pattern) (Semester - II) (504409)**

*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) *Assume the suitable data, if necessary.*

**Q1) a)** Write Application and challenges in Computer Vision. **[5]**

b) Explain 2D and 3D transformation in Computer Vision. **[5]**

**Q2) a)** Explain block diagram of digital Camera. **[5]**

b) Explain Camera Models and Camera Calibration used for image formation. **[5]**

**Q3) a)** Write note on Bayer's Pattern. **[4]**

b) Write a note on thermal imaging. **[6]**

**Q4) a)** Explain Simple stereo system. **[4]**

b) Write a note on Eight Point Algorithm in stereo vision. **[6]**

**Q5) a)** Explain Hough Transform with graph. **[4]**

b) Write a note on RANSAC. **[4]**

c) List Stereo parameter in stereo vision. **[2]**

**P.T.O.**



- Q6)** a) Explain Motion Estimation algorithm Kalman Filter. [4]  
b) Discuss various Motion Estimation algorithm. [4]  
c) Define rectification in stereo vision. [2]
- Q7)** a) Define following: 1.Edge 2.Line.3 Points 4. Corners. [4]  
b) Explain feature alignment using least squares,write application. [4]  
c) Write a note on volumetric representation. [2]
- Q8)** a) Explain Differential based technique for motion estimation contaminated. [4]  
b) Write a short note on fitting ellipse to image data. [4]  
c) Define Motion field. [2]





Total No. of Questions : 8]

SEAT No. :

P3138

[Total No. of Pages : 2

[5872]-288

**M.E. (E&TC) (Signal Processing)**  
**STATISTICAL SIGNAL PROCESSING**  
**(2017 Pattern) (Semester - III) (604401)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions from Q.1 to Q.8*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Figures to the right side indicate full Marks.*
- 4) *Assume the suitable data, if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

**Q1) a)** Explain with example MA Processes. **[5]**

b) What is a regular Process? From spectral factorization write properties of regular processes **[5]**

**Q2) a)** Write short note on ARMA Process. **[5]**

b) Explain signal modelling with AR(p) process. **[5]**

**Q3) a)** Write short note on pade' s approximation. **[5]**

b) Find the Pade's approximation of second order to a signal x(n) which is given by  $x = [2, 1, 0, -1, 0, 1, 0, -1, 0, 1, \dots]^T$  **[5]**

**Q4) a)** Explain shank's method for signal modelling. **[5]**

b) Explain in detail Least square method of signal modelling and give its advantages as well as limitations. **[5]**

**P.T.O.**

- Q5)** a) Write short note on Levinson-Durbin algorithm. [5]  
b) Write short note on Wiener filter. [5]
- Q6)** a) Draw block diagram of adaptive filter and explain its applications [5]  
b) Explain LMS Algorithm [5]
- Q7)** a) Explain Spectral estimation, method of periodogram. [5]  
b) Explain Welch method. [5]
- Q8)** a) Write short note on Bartlett method. [5]  
b) Explain Blackman-Tukey method. [5]



Total No. of Questions : 8]

SEAT No. :

P6777

[Total No. of Pages : 2

[5872]-289

**M.E. (E&TC) (Signal Processing)**  
**STILL IMAGE & VIDEO COMPRESSION**  
**(2017 Pattern) (Semester - III) (604402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 05 questions from each question.*
- 2) *Your answers will be valued as a whole.*
- 3) *Assume suitable data, if necessary.*

**Q1) a) Compare** **[5]**

- i) Lossy and lossless compression.
- ii) Inter and intra frame compression.

b) What is vector quantization? Explain Tree structured vector quantizers. **[5]**

**Q2) a) Explain with block diagram Hybrid DPCM/DCT Video codee Model.** **[5]**

b) Explain SPIHT (Set Partitioning in Hierarchical Trees) coding algorithm in detail. **[5]**

**Q3) a) Compare Analog and Digital video? What are the different frame types used to represent Digital video in MPEG compression? Explain them in brief.** **[5]**

b) Explain layer III- mp3 coding in detail. **[5]**

**Q4) a) Compare MPEG1, MPEG2, MPEG4, MPEG7 and MPEG21 compression standards w.r.t. its coding bit rate & applications where it is deployed.** **[5]**

b) Explain the concept of motion estimation and motion compensation in MPEG - I video. Explain how motion vector coding is done. **[5]**

**P.T.O.**

**Q5) a) Explain the Hybrid scalability in detail. [5]**

b) Explain the MPEG - I decoder in detail. [5]

**Q6) Explain the following concepts. [10]**

a) Block based motion estimation & compensation.

b) Motion compensated prediction of macro block.

c) Sub-pixel motion compensation.

d) Region based motion compensation.

**Q7) a) Write short notes on [5]**

i) Layering versus scalability.

ii) Data partitioning.

b) What is Fractals? How it is used for image compression? [5]



Total No. of Questions : 8]

SEAT No. :

P3139

[Total No. of Pages : 2

**[5872]-291**  
**M.E. (E&TC)**  
**VLSI & EMBEDDED SYSTEMS**  
**504201 : Digital Cmos Design**  
**(2017 Course)**

*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 electronic pocket calculator is allowed.*
- 5) Figures to the right indicate full marks.*

**Q1) a)** How does wiring parasitic and device parasitic force limitations on speed and bandwidth of the circuit? Explain in detail. **[5]**

b) What is SPICE? Explain SPICE model of MOSFET in brief. **[5]**

**Q2) a)** What is short ckt power dissipation? Explain with suitable diagram. **[5]**

b) Give the expression for Fan-out. Explain its significance in designing. What are the ways to improve? **[5]**

**Q3) a)** Starting from the charge inside channel, derive the equation for drain current of MOSFET. Mention the equation in linear and saturation regions. **[4]**

b) Explain with suitable diagrams, layout techniques of CMOS. **[4]**

c) What is meant by transient response? **[2]**

**P.T.O.**

- Q4)** a) What are the delay estimation techniques? Explain any one in detail. [4]  
 b) What are sources of cross talk? How to minimize cross talk? [4]  
 c) Write note on delay of logic gate. [2]
- Q5)** a) Design CMOS ckt for  $Y = AB + CDEF + GH$ . Carry out the transistor sizing. [4]  
 b) What is pass transistor logic? Explain one example in detail. What are its limitations? [4]  
 c) Write note on compound gate. [2]
- Q6)** a) What are the sources of hazard? Give example. [4]  
 b) Draw and explain one bit latch using transmission gates. [4]  
 c) Explain the concept of weak/strong 0/1. [2]
- Q7)** a) Draw Cascode Voltage Switch Logic and its timing diagram. What are its merits? [4]  
 b) What is need of NORA ckt? Draw necessary timing diagram. [4]  
 c) Write note on Circuit families. [2]
- Q8)** a) Draw sense amplifier circuit and its timing diagram. Show how the weak 0/1 is amplified. [4]  
 b) What are the techniques for high speed design? [4]  
 c) Write note on dynamic ckts. [2]





Total No. of Questions : 8]

SEAT No. :

P3140

[Total No. of Pages : 2

[5872]-292

M.E. (E&TC) (VLSI and Embedded Systems)

RECONFIGURABLE COMPUTING

(504202) (2017 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

- Q1)** a) Explain five cycles of execution of an instruction on a VN computer. [5]  
b) Compare between General Purpose Processor, Application specific processor and Reconfigurable computing architecture on basis of flexibility versus performance? [5]
- Q2)** a) What is Reconfigurable computing? Explain through example. [5]  
b) Write Adaptive computing system as application of Reconfigurable computing. [5]
- Q3)** a) Explain about LUT? How many Boolean functions required to implement LUT. [5]  
b) Elaborate Garp's non-symmetrical RPF as fine-grained architecture. [5]
- Q4)** a) Explain Non-frequently reconfigurable systems and its application. [5]  
b) Explain FPGA flow design diagram? [5]

P.T.O.

- Q5)** a) What is DPGA? Draw and explain architecture of DPGA. [5]  
b) Elaborate the concept of instruction level parallelism; explain through Example. [5]
- Q6)** a) Explain Relocation and Defragmentation form RC point of view? [5]  
b) Explain J-Bit as Reconfiguration Project Design Approach. [5]
- Q7)** a) What is partially reconfigurable computing, give example of any present device? [5]  
b) Explain the transfer of System from PCB to System on Programmable chip. [5]
- Q8)** a) Explain Pattern matching by automation based text searching. [5]  
b) Explain in detail how effectively Reconfigurable computing can be used for video streaming. [5]



Total No. of Questions : 8]

SEAT No. :

P3141

[Total No. of Pages : 2

[5872]-293

**M.E. (E&TC) (VLSI and Embedded Systems)**

**EMBEDDED SYSTEM DESIGN (504203)**

**(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Draw and explain Waterfall and V design model for Embedded systems. **[5]**

b) State and explain any five design metrics used for the design of an Embedded System. **[5]**

**Q2)** a) Discuss the features, IDE and applications of Arduino Board. **[5]**

b) With the example, Explain complete design process of Embedded systems. **[5]**

**Q3)** a) Draw and explain architecture of LPC -1768. **[4]**

b) Explain the USB protocol with suitable diagram with reference to ARM CORTEX M3 microcontroller. **[3]**

c) Compare Thumb and arm instruction set of ARM Processor. **[3]**

**Q4)** a) Explain different operation modes of ARM. **[5]**

b) What are the roles of CPSR and SPSR Register in ARM Processor. **[5]**

**P.T.O.**

- Q5)** a) What is Linux Kernel configuration? Gives the steps for Linux kernel configuration. [5]  
b) Explain various storage consideration in Embedded Linux. [5]
- Q6)** a) How the space initialization is carried out in Embedded Linux. [5]  
b) Explain File Structure used in Embedded Linux System. [5]
- Q7)** a) Explain the process of EMI/RFI certification in Embedded system. [5]  
b) Discuss reliability and failure analysis in Embedded system. [5]
- Q8)** a) Explain automatic metering system in detail. [5]  
b) Explain Digital Camera in Embedded system with respect to Block diagram.  
Design considerations,  
flow chart. [5]



Total No. of Questions : 8]

SEAT No. :

P3142

[Total No. of Pages : 2

[5872]-295

**M.E. (E & TC) (VLSI & Embedded Systems)**

**ANALOG CMOS DESIGN**

**(2017 Pattern) (Semester - II) (504207)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1)** a) How does MOSFET behave as a switch, diode and active resistor?  
What are its applications? **[5]**

b) Draw a schematic diagram and equivalent small-signal model for the  
CMOS inverter. Explain the model. **[5]**

**Q2)** a) Explain the effect of channel length modulation and body effect on  
MOSFET. Also, show how these are accounted in the basic small-  
signal model. **[4]**

b) What is the need of voltage / current references? Explain in detail the  
concept of BGR with its necessity. **[4]**

c) Differentiate between the small-signal and large-signal models for the  
MOS transistor. **[2]**

**Q3)** a) Draw the schematic of the CMOS difference amplifier with the current  
mirror load. Write the expression for ICMR, CMRR and 3dB frequency.  
**[5]**

b) Write a short note on Folded cascade amplifier. **[3]**

c) Which are the dominant noises in CMOS op-amp? List the techniques  
to reduce this noise. **[2]**

**P.T.O.**

- Q4)** a) With respect to important performance parameters, compare active load, current source load and push-pull inverter. [4]
- b) What is cascade amplifier? Write its advantages and disadvantages over a single-stage amplifier. [3]
- c) What is micropower op-amp? Explain the techniques used in the micropower op-amp. [3]
- Q5)** a) What is the need of compensation in multistage amplifiers. Explain miller compensation in two stage CMOS op-amp. [5]
- b) List and explain important static and dynamic characteristics of the comparator. [3]
- c) How propagation delay is related to slew rate, derive the relation. [2]
- Q6)** a) Draw and explain single-ended and double-ended CMOS differential amplifier. [5]
- b) Write a note on the stability of op-amp and its effect on slew rate. What are different ways to improve stability? [5]
- Q7)** a) State and explain the practical considerations for Low Noise Amplifier (LNA) design. [4]
- b) Explain differential LNA with neat circuit diagram. [4]
- c) Explain spurs in mixer. [2]
- Q8)** a) What are the techniques to improve the bandwidth? How to use zeros as bandwidth enhancer? Explain shunt peaking in amplifier. Give the expression for extended bandwidth. [5]
- b) How nonlinear systems work as linear mixers. Explain square-law MOSFET mixer with neat circuits. [5]



Total No. of Questions : 8]

SEAT No. :

P3183

[Total No. of Pages : 2

[5872]-296

**M.E. (E&TC)(VLSI AND EMBEDDED SYSTEMS)**

**SYSTEM ON CHIP**

**(2017 Pattern) (Semester - II) (504208)**

*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) Enlist the various limitations of Dataflow Models? [4]

b) How to determine the hardware implementation of an FSMD? [6]

**Q2)** a) Enlist the various limitations of Control flow models? [4]

b) What is the Need for Concurrent Models? [6]

**Q3)** a) Which are the Factors Affecting Delay and Slew? [4]

b) Write a brief overview on CONTROL hazards in association with RISC Pipeline. [6]

**Q4)** a) Explain different Timing Parameters for Digital logic? [4]

b) What do you mean by Control Design? Explain in detail the Hierarchical Control design approach? [6]

**Q5)** a) Write a note on Timing parameters for digital logic? [4]

b) Write a note on Simulation - Synthesis Mismatch? [6]

**P.T.O.**

- Q6)** a) Write a note on Memory Optimization and Management? [4]  
b) Write a note on Bus Synchronization along with the Challenges in it and Enable Synchronization Method? [6]
- Q7)** a) What are the Design Issues and Techniques for image codec? [4]  
b) Enumerate on Energy Management techniques for SOC? [6]
- Q8)** a) Explain the Important Issues for Embedded Compilers? [4]  
b) Write a note on “A SOC Controller for Digital still Camera”? [6]





Total No. of Questions : 8]

SEAT No. :

P3143

[Total No. of Pages : 2

[5872]-297

**M.E. (E & TC) (VLSI & Embedded Systems)**

**EMBEDDED AUTOMOTIVE SYSTEMS**

**(2017 Pattern) (CBCS) (Semester - II) (504209)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**Q1)** a) List basic systems that make up an automobile and explain their major components and functions. [5]

b) Discuss the future trends in automotive embedded system. [5]

**Q2)** a) Describe: "Why electronics is so widely used in today's vehicles?" [5]

b) Briefly explain the working of spark plug & disk braking system with suitable diagram. [5]

**Q3)** a) What is Lambda sensor? Explain the construction and working of Lambda sensor. [5]

b) Outline the construction of flap type & Hot wire type air flow sensor with suitable example. [5]

**Q4)** a) With suitable block diagram explain automatic cruise control system. List sensors used in such system. [5]

b) With neat diagram explain working of Load Cell. [5]

**P.T.O.**

- Q5)** a) What is EGO sensor? What are desirable EGO characteristics? Explain its switching characteristics. [5]  
b) Explain electronics steering control system and automatic rain operated wiper control. [5]
- Q6)** a) What is the role of control system strategies in fine tuning of automotive systems? [5]  
b) Outline & Explain components of an electronically controlled engine with suitable diagram. [5]
- Q7)** a) Enlist various types of automotive buses. Compare any three types of automotive buses. [5]  
b) Explain black-box fault finding with suitable diagram. [5]
- Q8)** a) List the six-stage diagnostic process. Explain the same with suitable example. [5]  
b) Explain electrical diagnosis procedure in detail. [5]



Total No. of Questions : 8]

SEAT No. :

P3144

[Total No. of Pages : 2

[5872]-298

**M.E. (E&TC) (VLSI & Embedded Systems)**  
**TESTING AND VERIFICATION OF VLSI CIRCUITS**  
**(2017 Pattern) (Semester - III) (604201)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any Five questions from 8 questions.*
- 2) *Assume suitable data, if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** Explain Role of testing in VLSI realization. Process [5]

b) Differentiate the parametric tests and. Functional test with. respect to chip. [5]

**Q2) a)** Explain the various tasks involved in the simulation. [5]

b) State the "Law of Diminishing Returns". [5]

**Q3) a)** Explain the Simulation for design varification. With diagram. [5]

b) Explain the logic and time level modeling for fault simulation. [5]

**Q4)** Write short note on.

a) Observability [5]

b) Controllability [5]

**Q5) a)** Explain system level DFT approach. [5]

b) Explain various delay models of digital simulators. [5]

**P.T.O.**

- Q6)** a) Write short note on BIST. [5]  
b) Explain Digital and Analog VLSI testing. [5]
- Q7)** a) Explain the functional memory model. [5]  
b) Explain any five fault models. [5]
- Q8)** a) Explain the difficulties and the need for Embedded core testing. [5]  
b) State importance of hardware emulators in Hardware design. [5]



Total No. of Questions : 8]

SEAT No. :

P3145

[Total No. of Pages : 2

[5872]-299

M.E. (VLSI and Embedded Systems)

ASIC DESIGN

(2017 Pattern) (Semester - III) (604202)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any 5 questions out of 8.
- 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 short note on types of ASIC. [5]

b) Draw and Explain in detail ASIC Design flow. [5]

Q2) a) Explain the term. [5]

i) Constants

ii) Variable

iii) Attributes

b) i) Write VHDL code for counter. [5]

ii) Write VHDL test bench for counter.

Q3) a) Write short note on placement. [4]

b) Explain in brief system floorplanning technique in ASIC. [4]

c) Write CAD tools used in ASIC Design. [2]

Q4) a) Explain in detail system partitioning in ASIC design with example. [4]

b) Differentiate global routing and detailed routing. [4]

c) What is clock distribution technique in ASIC. [2]

P.T.O.

- Q5)** a) Explain delay estimation in ASIC design. [4]  
b) With one example describe time optimization technique. [4]  
c) Explain need of static timing analysis in ASIC. [2]
- Q6)** a) Explain in detail Signal integrity effects in ASIC Design. [4]  
b) Write short note on mixed mode design in ASIC. [4]  
c) How to design ASIC library. Comment on uses of library. [2]
- Q7)** a) Describe with one example gate level mixed mode simulation. [4]  
b) Write short note on Joint Test Action Group. [4]  
c) Explain in brief challenges in memory testing. [2]
- Q8)** a) Describe in brief Automatic Test Pattern Generator. [4]  
b) Write short note on scan test and partial test. [4]  
c) What are different faults occurred in ASIC. [2]



Total No. of Questions : 5]

SEAT No. :

P3146

[Total No. of Pages : 2

[5872]-301

M.E. (Information Technology)

Mathematical Foundation of Information Technology

(2017 Pattern) (Semester - I) (514401)

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) Using inference method, find the membership values of the triangular shapes for each of the following triangles :  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$ . [5]
- b) Explain Messy genetic algorithm with example. [5]
- c) Assume the following relationship for revenue and cost functions. Find out at what level of output  $x$ , where  $x$  is measured in tons per week, profit is maximum.  $R(x) = 1000x - 2x^2$  and  $C(x) = x^3 - 59x^2 + 1315x + 5000$ . [5]

Q2) Solve any two :

- a) Find the missing information in the following table : [5]

	A	B	C	Combined
Number :	10	8	---	24
Mean :	20	---	6	15
Geometric mean :	10	---	---	8.397

- b) Calculate the quartile deviation for the data given below : [5]

Daily wages (Rs.) :	35-36	36-37	37-38	38-39	40-41	41-42	42-43
No. of wage earners :	14	20	42	54	45	21	8

- c) Explain single point cross over and two point crossover with example. [5]

P.T.O.

**Q3)** Solve any two :

- a) Using genetic algorithm maximize  $f(x) = x^2$  over  $(0,1,2,\dots,31)$  with initial  $x$  values of  $(13, 24, 8, 16)$ . Show one crossover and mutation operation. [5]
- b) The theory predicts the proportion of beans, in the four groups A, B, C, and D should be 9:3:3:1. In an experiment among 1600 beans, the number in the four groups were 882,313,287 and 118. Does the experiment result support the theory? Apply chi square test. [5]
- c) What are the different applications of probability, tree and graphs in Computer field? [5]

**Q4)** Solve any two :

- a) The profit  $P$  earned, by a company, on some item is function of its units produced say  $X$  and is given by  $P = 800X - 2X^2$ , If the company's expenditure or interest, rent and salary of the staff be Rs. 1 lakh, show that the company will always be in loss. [5]
- b) Let  $G=(V,E)$  be an undirected graph with  $k$  components and  $|V| = n$  and  $|E|=m$ . prove that  $m \geq n-k$ . [5]
- c) Define the following terms : [5]
  - i) Mean
  - ii) Mode
  - iii) Median with example

**Q5)** Solve any two :

- a) A department store, A, has four competitors: B, C, D and E. Store A hires a consultant to determine if the percentage of shoppers who prefer each of the five stores is the same. A survey of 1100 randomly selected shoppers is conducted and the results about which one of the stores shoppers prefer are below. Is there enough evidence using a significance level  $\alpha = 0.05$  to conclude that the proportions are really the same? [5]
- b) Differentiate between geometric and harmonic mean. State the conditions when these mean are applicable. [5]
- c) Describe the concepts involved in real-coded genetic algorithm. [5]





Total No. of Questions : 7]

SEAT No. :

P3147

[Total No. of Pages : 2

[5872]-302

**M.E. (Information Technology)**

**ADVANCE SOFTWARE ENGINEERING & PROJECT  
MANAGEMENT**

**(2017 Pattern) (Semester - I) (514402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from seven 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 Descriptive Software Process Models. [5]  
b) Define the concept of Software Requirement Engineering. Give requirement elicitation in terms of Functional and non-functional requirements for Hotel Management system. [5]
- Q2)** a) Define and explain the following terms with suitable eg. [5]  
i) Refinement ii) Separation of concerns  
b) Explain Web Design pyramid with suitable diagram. [5]
- Q3)** a) Explain the life cycle of Extreme programming with suitable diagram. [5]  
b) Describe the XP concepts of refactoring and pair programming in your own words. [5]
- Q4)** a) Explain with eg. PERT and CPM techniques with respect to Project planning, scheduling and estimation. [5]  
b) Discuss various code cloning techniques with eg. [5]

**P.T.O.**

**Q5)** a) Explain why program inspections are an effective technique for discovering errors in a program. What types of error are unlikely to be discovered through inspections? [5]

b) Explain the various challenges in software project maintenance. [5]

**Q6)** a) Explain CMMI-IPPD model [5]

b) Explain Service-oriented Software Engineering with respect to case study. [5]

**Q7)** Write a short note on any two : [10]

a) User Interface Design

b) GERT

c) Ishikawa's seven tools



Total No. of Questions : 8]

SEAT No. :

P3148

[Total No. of Pages : 2

[5872]-303

M.E. (Information Technology)

APPLIED ALGORITHMS

(2017 Pattern) (Semester - I) (514403)

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) Compare Prim's and Kruskal's algorithm. [3]  
b) Write and explain an algorithm to determine whether any pair of line-segments intersects. [3]  
c) Explain the standard complexity classes with example. [4]
- Q2)** a) Write, explain and analyse Rabin-Karp algorithm. [4]  
b) What is recurrence relation? Explain master theorem to solve recurrences. [3]  
c) Explain homogeneous recurrence relation with example. [3]
- Q3)** a) Write and explain an algorithm to find a solution of 2D-Closest pair problem. Also analyze the same. [4]  
b) What is Bipartite graphs? Explain its applications. [3]  
c) Write and explain Floyd Warshall algorithm with example. [3]
- Q4)** a) Explain following terms: [3]  
i) Flow Network  
ii) Residual Capacity  
iii) Augmentation of Flow  
b) Write and Explain Johnson's algorithm for sparse graph. [4]  
c) Write a Randomized algorithm to test whether a number is a prime. [3]

P.T.O.

- Q5)** a) Write a parallel algorithm for expression evaluation. [5]  
b) Write a general framework to design an approximation algorithm for a particular problem using linear programming. Explain it with the example of vertex cover problem. [5]
- Q6)** a) Give detail proof for clique problem is NP-Complete. [5]  
b) What is online algorithm? Write and explain obstacle traversal algorithms. [5]
- Q7)** a) Explain the following terms with suitable examples : [5]  
i) NP-Hard Problem  
ii) NP-Complete Problem  
iii) Splaying  
iv) Self-adjustment in Trees  
v) Vertex Cover Problem  
b) What is persistent data structures? Write delete operation of singly linked list. [5]
- Q8)** a) What are the properties of the red-black tree? Explain delete operation with example. [5]  
b) Write short notes on : [5]  
i) PRAM model of computation.  
ii) Approximation Algorithms.



Total No. of Questions : 6]

SEAT No. :

P3149

[Total No. of Pages : 2

[5872]-304

**M.E. (Information Technology)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern) (Semester - I) (514404)**

*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) Give your understanding of a good research design. Is single research design suitable in all research studies? If not, why? [5]

b) "The task of defining the research problem often follows a sequential pattern". Explain. [5]

**Q2)** a) Distinguish between alternative hypothesis and null hypotheses. [5]

b) Define the term 'Literature Review'. Enumerate the objectives and significance of literature review. [5]

**Q3)** a) Examine the merits and limitations of the observation method in collecting material. Illustrate your answer with suitable examples. [5]

b) Discuss statistical functions: Correlation, Multiple Regression analysis. [5]

**Q4)** a) Write a short note on 'Documentation' in the context of a research report. [5]

b) What do you understand by the Research proposal? Define the criteria for evaluating the Research proposal. [5]

**P.T.O.**

- Q5)** a) What are Intellectual Property rights? Write about its importance. [5]  
b) Introduce Indian Patent laws, process of patenting a research finding, Copy right. [5]
- Q6)** a) Discuss practical and efficient three-pass method for reading research papers. [5]  
b) Discuss different types of technical papers. [5]



Total No. of Questions : 5]

SEAT No. :

**P3150**

[Total No. of Pages : 2

**[5872]-305**

**M.E. (Information Technology)**  
**CYBER SECURITY & FORENSICS**  
**(2017 Pattern) (Semester - II) (514407)**

*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) Distinguish between Authentication, Identification and authorization. Explain with example of username and password. **[5]**
- b) Write short note on : **[5]**
  - i) Social Engineering
  - ii) Phishing and Spoofing
- c) A message along with checksum travels from machine A to machine B. During the movement 3 message bits get modified. At machine B the checksum is recalculated and obviously it does not match with the checksum received along with the message. Justify with reason which security principle is violated. **[5]**

**Q2) Solve any two :**

- a) How the Reference Monitor ensures security rules. **[5]**
- b) What is State Machine Model? Explain BLP model in detail and draw multics interpretation of BLP. **[5]**
- c) Explain Chinese wall Model. What are conflicts of interest in this model. **[5]**

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

**Q3) Solve any two :**

- a) Explain cross-site request forgery attack with example. [5]
- b) Explain digital signature and X.509 certification format. [5]
- c) Explain the role of third-party arbiter in successful implementation of public key infrastructure. [5]

**Q4) Solve any two :**

- a) Explain forensic analysis and explain how to apply scientific methods to digital forensics. [5]
- b) What do you mean by hypothesis formulation? [5]
- c) What criteria the digital data should satisfy so as to used as alibi in forensics law. [5]

**Q5) Solve any two :**

- a) Explain how bit locker works against data theft in windows forensics.[5]
- b) Which attributes of NTFS master file are useful for forensic analysis?[5]
- c) Explain the evidence preservation mechanisms for digital data in forensic law. [5]





Total No. of Questions : 8]

SEAT No. :

**P3151**

[Total No. of Pages : 2

**[5872]-306**

**M.E. (Information Technology)**  
**CLOUD AND DATA TECHNOLOGIES**  
**(2017 Pattern) (Semester - II) (514408)**

*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 any Two Cloud-Enabling Technologies. [6]**

b) Explain concept of Threat Agent in Cloud Security. [4]

**Q2) a) Describe different Cloud service models and corresponding security measures. [6]**

b) Explain concept of SLA Monitor. [4]

**Q3) a) Demonstrate Multi-tier system architecture in Cloud Computing. [6]**

b) Explain Zero Downtime Architecture of cloud in detail. [4]

**Q4) a) Write a short note on Data Extraction and Visualization. [6]**

b) Write a short note on MapReduce. [4]

**Q5) a) Explain different Big data Problems. [6]**

b) Differentiate between Linear Regression and Logistic Regression in data science. [4]

**P.T.O.**

- Q6)** a) Write a brief note on : [6]  
i) k-means algorithm ii) Spam Filters.  
b) Discuss various issues and challenges in Big data. [4]
- Q7)** a) Explain concept of Dynamic Failure Detection and Recovery Architecture. [5]  
b) Demonstrate relationships of Big Data and Cloud Computing. [5]
- Q8)** a) Explain with diagram Cloud Balancing Architecture. [6]  
b) Explain Time Stamps and Financial Modeling in data Science. [4]



Total No. of Questions : 5]

SEAT No. :

P3152

[Total No. of Pages : 3

[5872]-307

M.E. (Information Technology)

ITOOR

Information Technology Oriented Operations Research

(2017 Pattern) (Semester - II) (514409)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Assume suitable data if necessary.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.

Q1) Solve Any Two.

- a) What is Operations Research? Discuss on the characteristics of the model. [5]
- b) Write short notes on "Deriving Solution from the Model". [5]
- c) Solve using Graphical Method: [5]

$$\text{Maximize } Z = 2x_1 + 3x_2$$

$$\text{Subject to : } x_1 + 2x_2 \leq 4$$

$$x_1 + x_2 \leq 3 \text{ and } x_1, x_2 \geq 0$$

Q2) Solve Any Two

[5]

- a) Solve the following LPP using Simplex method.

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

$$\text{subject to } 3x_1 + x_2 \leq 12$$

$$-5x_1 + 2x_2 \geq -10$$

$$-2x_1 - 8x_2 \geq -12 \text{ and } x_1, x_2 \geq 0$$

P.T.O.

- b) Construct the dual of the following primal: [5]

$$\begin{aligned} & \text{Minimize } Z = 3x_1 - 2x_2 + 4x_3 \\ & \text{subject to } \begin{aligned} 3x_1 + 5x_2 + 4x_3 &\geq 7 \\ 6x_1 + x_2 + 3x_3 &\geq 4 \\ 7x_1 - 2x_2 - x_3 &\geq 10 \\ x_1 - 2x_2 + 5x_3 &\leq 3 \\ 4x_1 + 7x_2 - 2x_3 &\geq 2 \quad \text{and } x_1, x_2, x_3 \geq 0 \end{aligned} \end{aligned}$$

- c) Determine the initial basic feasible solution using : [5]

- i) Northwest Corner Rule  
ii) Vogel's Approximation Method

8	7	2	9	10	40
2	5	4	4	6	60
10	1	3	9	4	50
10	20	50	40	30	

**Q3) Solve Any Two**

- a) Find the Optimal solution for the following transportation problem: [5]

2	3	2	3	2	140
1	5	6	2	2	145
4	4	4	1	3	140
75	80	85	90	95	

- b) Solve the following Assignment problem : [5]

20	16	-	22	18	17
-	16	18	15	14	19
19	15	21	14	15	-
13	-	12	18	19	20
15	17	13	22	-	16

- c) Apply the rule of dominance and find the value of game : [5]

3	3	-2	2	4	2
5	2	3	2	3	2
3	7	0	1	4	2
2	1	2	1	4	1
3	4	-1	2	4	2

**Q4) Solve Any Two :**

- a) What is Game Theory? Write short note on applications of game theory.[5]

- b) Solve the following 2×5 game using graphical method. [5]

Player B

B1 B2 B3 B4 B5

Player A	A1	4	2	5	-6	6
	A2	7	-9	7	4	8

- c) Write Short note on [5]

i. Saddle Point

ii. Value of Game

**Q5) Solve Any Two**

- a) Use Dynamic programming to solve :- [5]

$$\text{Minimize } Z = y_1^2 + y_2^2 + y_3^2$$

$$\text{Subject to } y_1 + y_2 + y_3 = 60$$

$$\text{Where } y_1, y_2, y_3 \geq 60$$

- b) Consider the following activity details for a project : [5]

Activity	1-2	1-3	2-3	2-5	3-4	3-6	4-5	4-6	5-6	6-7
Duration (Weeks)	15	15	3	5	8	12	1	14	3	14

- i) Draw network for this project.  
 ii) Find critical path and project completion time.  
 iii) Determine Total float for each activity.

- c) Discuss different time estimates used in PERT. [5]



Total No. of Questions : 7]

SEAT No. :

P3153

[Total No. of Pages : 2

[5872]-308

**M.E. (Information Technology)**

**Mobile Ad-Hoc Networks**

**(2017 Pattern) (Semester - III) (5144013)**

*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)** a) Explain the Architecture and components of a Packet Radio Network.[5]  
b) Explain Ad-hoc On-Demand Distance Vector Routing Algorithm in detail. [5]
- Q2)** a) Draw and explain the frame format for 802.11a. [5]  
b) Explain Ad-hoc Table-Driven Destination Sequenced Distance Vector in detail. [5]
- Q3)** a) What is hard state receiver-initiated multicast protocol? How it is different from soft-initiated multicast protocol? [5]  
b) Explain the operation of feedback-based TCP (TCP-F) and enlist its advantages and disadvantages. [5]
- Q4)** a) What are the major challenges in designing a transport layer protocol for Ad-hoc wireless networks? [5]  
b) Discuss the issues in designing multicast routing protocol for Ad-hoc wireless networks. [5]

**P.T.O.**

- Q5)** a) Explain the battery management protocol, which tries to increase the lifetime of the nodes by exploiting the recovery capacity effect of battery. [5]
- b) List and explain the issues and challenges in security provisioning of network layer. [5]
- Q6)** a) Explain requirements, issues, and challenges for Security in Ad Hoc Wireless Networks. [5]
- b) Explain Classification of Energy Management Schemes. Explain need for energy management in Ad-hoc wireless Networks. [5]
- Q7)** a) Explain the working of TORA with its advantages and disadvantages. [5]
- b) Explain how security provisioning in ad hoc wireless networks differs from that in infrastructure-based networks? [5]



Total No. of Questions : 7]

SEAT No. :

P3154

[Total No. of Pages : 2

[5872]-309

**M.E. (Information Technology)**  
**ADVANCED OPERATING SYSTEMS**  
**(2017 Pattern) (Semester - III) (5144014)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from seven questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Discuss the features to be considered while designing an operating system. [5]
- b) What do you mean by monolithic kernel and microkernel? Differentiate between the monolithic kernel and microkernel approaches for designing a distributed operating system. [5]
- Q2)** a) Discuss any four strategies in the design of a DSM system. [5]
- b) What are the main design issues in IPC of multi datagram messages? Describe a mechanism for handling each of these issues. [5]
- Q3)** a) What is an orphan call? How are orphan calls are handled? [5]
- b) Explain significance of global sequencer in a sequentially consistent DSM system. [5]
- Q4)** a) What are the main causes of thrashing in a DSM system? What are the commonly used methods to solve the thrashing problem in a DSM system? [5]
- b) Explain file version approach used in recovery technique. [5]

**P.T.O.**



- Q5)** a) Explain Happened Before Relation with applicable eg. or diagram. [5]  
b) What is election algorithm? Explain in brief, the functioning of Bully algorithm. [5]
- Q6)** a) Explain file caching scheme with: [5]  
i) Cache Location  
ii) Modification Propagation  
iii) Cache validation  
b) Discuss the kernel design issues in Mobile OS. [5]
- Q7)** Write short notes on following : (Any Two) [10]  
a) Deadlock Handling in Distributed Systems.  
b) Architecture of DSM  
c) Symbian OS



Total No. of Questions : 8]

SEAT No. :

P3155

[Total No. of Pages : 2

[5872]-311

M.E. (Instrumentation and control)

MATHEMATICAL METHODS IN INSTRUMENTATION

(2017 Pattern) (Semester - I) (506101)

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) Determine basis and dimension of vector's  $(3, 8, -3, -5)$ ,  $(1, -2, 5, -3)$ ,  $(2, 3, 1, -4)$  in a vector space  $V = \mathbb{R}^4$ . [4]

b) Define Euclidean inner product and Euclidean norm of a vector. [2]

c) Show that the vector  $(2, 3, -1)$ ,  $(-1, 4, 2)$ ,  $(1, 18, -4)$  is linearly Independent in  $\mathbb{R}^3$ . [4]

**Q2)** a) Show that the set  $\left(\frac{1}{5}, \frac{1}{5}, \frac{1}{5}\right), \left(\frac{-1}{2}, \frac{1}{2}, 0\right), \left(\frac{1}{3}, \frac{1}{3}, \frac{-2}{3}\right)$  is orthonormal with respect to the Euclidean inner product. Covert it to an orthonormal set by normalising the vectors. [5]

b) 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  $\mathbb{R}^3$ . [5]

**Q3)** a) Determine value of  $y$  when  $x = 0.1$  by Euler Modified method, given that

$$\frac{dy}{dx} = x^2 + y, y(0) = 1 \text{ and } h = 0.05. \quad [5]$$

b) Explain Gauss-Seidel iteration method with suitable example. [5]

P.T.O.

- Q4)** a) Obtain Newton-Raphson formula to find  
 i) Square root ii) Inverse square root of a given number. [5]  
 b) 20% of bolt's produced by a machine are defective. Determine the probability that out of 5 bolts chosen at random i) one bolt is defective ii) at most two bolts are defective. [5]
- Q5)** a) Explain Baye's theorem with suitable examples. [4]  
 b) A continuous random variable  $x$  has a probability density function given by  $f(x) = 2e^{-2x}$ ,  $x \geq 0$  and  $f(x) = 0$ ,  $x < 0$   
 Find i) Moment generating function.  
 ii) The first four moment about origin. [6]
- Q6)** a) The joint density function of two random variables  $X$  and  $Y$  is given by  
 $f(x,y) = \frac{xy}{96}$ ,  $0 < x < 4$ ,  $1 < y < 5$  and  
 $f(x,y) = 0$ , otherwise.  
 Find i)  $E(x)$  ii)  $E(Y)$  iii)  $E(XY)$  [6]  
 b) Let  $R^4$  have a Euclidean inner product, Find the cosine of angle between the vectors  $\bar{u} = (-1, 2, 3, 4)$  and  $\bar{v} = (4, 1, 2, 1)$ . [4]
- Q7)** a) Show that in a Poisson's distribution with unit mean, mean deviation about mean is  $(2/e)$  times the standard deviation. [5]  
 b) Apply Runge Kutta method of fourth order to find approximate value of  $y$  when  $x = 1$ ,  $y(0) = 1$  and  $\frac{dy}{dx} = \frac{y-x}{y+x}$ , take  $h = 0.5$ . [5]
- Q8)** a) A fair coin is tossed 500 times, find the probability the number of head will not differ from 250 by i) more than 10 ii) more than 30. [5]  
 b) The probability that a bomb dropped from a plane will strike the target is  $\frac{1}{5}$ .  
 If seven bombs are dropped, find the probability that exactly two will strike the target. [5]



Total No. of Questions : 7]

SEAT No. :

**P3156**

[Total No. of Pages : 2

**[5872]-312**

**M.E. (Process Instrumentation & Control)**

**TRANSDUCER DESIGN**

**(2017 Pattern) (Semester - I) (506102)**

*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 table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** State the classification and selection criteria of transducers and illustrate performance characteristics of transducer. **[5]**

b) Suggest the suitable non contact type transducer used to measure the speed of rotating fan, elaborate the concept with neat sketch. **[5]**

**Q2) a)** Suggest an appropriate transducer to measure vibration of vibrating platform due to speed variation of motor, justify it with neat sketch. **[5]**

b) State the difference between torque, angular velocity and power. **[5]**

**Q3) a)** Suggest suitable scheme to measure torque of a rotating shaft using strain gauge. **[5]**

b) Specify the different level measurement approach's in the industry, suggest suitable transducer used for solid level measurement. **[5]**

**Q4) a)** Explain chemical sensor in detail with neat sketch and state its applications. **[5]**

b) Write a short notes on Microelectromechanical systems (MEMS) **[5]**

**P.T.O.**

- Q5)** a) Explain nano sensors in brief and state its applications. [5]  
b) Explain : Static & Dynamic Characteristics of instruments. [5]
- Q6)** a) Explain the role of ADC in interfacing of sensor with suitable example. [5]  
b) Specify the need of signal conditioning, and explain signal level and bias changes. [5]
- Q7)** a) Describe linearization, conversation, filtering and impedance matching in detail. [5]  
b) Explain the use of piezo electric transducer for force measurement with neat sketch. [5]



Total No. of Questions : 7]

SEAT No. :

**P3157**

[Total No. of Pages : 2

**[5872]-313**

**M.E. (Part - I) (Instrumentation and Control)**

**(Process Instrumentation)**

**INDUSTRIAL AUTOMATION**

**(2017 Pattern) (Semester - I) (506103)**

*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) Comment on any two major components of the DCS. **[5]**
- b) Elaborate the data flow and number conversions involved in PLC analog operation. **[5]**
- Q2)** a) Draw a famous automation hierarchy for an industrial application. Analyze the function of each level of automation hierarchy. **[5]**
- b) Elaborate with an example 'Sequential Function Chart'. **[5]**
- Q3)** a) Analyze working principle of HART protocol in detail. **[5]**
- b) How to calibrate Profibus. State advantages of Profibus. **[5]**
- Q4)** a) Comment on Process Hazard Analysis. **[5]**
- b) Suggest suitable application of safety system and explain it. **[5]**
- Q5)** a) Analyze architecture of SCADA systems and elaborate steps for interfacing it to process hardware. **[5]**
- b) List and define the various major types of PLC analog inputs and outputs. **[5]**

**P.T.O.**

**Q6)** Develop Programmable Ladder diagram for mixing of two liquids as per below Sequence : When the start PB. is pressed, the inlet valve A switches ON till the middle level sensor has not sensed the liquid. When middle level is sensed inlet valve B switches ON till the high level sensor has not sensed the liquid. Then the motor spins the stirrer for 10 seconds for mixing of both the liquids. After this drain valve switches ON and remains on till the low level is not reached. **[10]**

**Q7)** The input sensor signal varies from 0 to 1.1 Amp. If the sensor signal exceeds 0.5 Amp blue lamp must be turn on. Further, if the sensor signal is between 0.8 to 1.1 Amperes red lamp must go on. Develop programmable ladder diagram for the same. **[10]**



Total No. of Questions : 7]

SEAT No. :

P3158

[Total No. of Pages : 2

[5872]-314

**M.E. (Instrumentation & Control Process)**

**RESEARCH METHODOLOGY**

**(2017 Pattern) (Semester - I) (506104)**

*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 side rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** What are different types of research? Give examples for each. **[5]**

b) Explain the errors in selecting a research problem. **[5]**

**Q2) a)** Write a short notes on (Any one) : **[5]**

i) Criteria of good reaserch

ii) Motivation in Reaserch

b) Enlist Static and dynamic characteristics of instruments used in experimental set up. **[5]**

**Q3) a)** List and explain method of linear regression analysis. **[5]**

b) Use following data to workout linear regression analysis. **[5]**

Sr. No	Price	Sales
1	100	118
2	120	85
3	140	97
4	160	72
5	180	79

Find linear regression equation, Coefficient of correlation.

**P.T.O.**



- Q4)** a) Write a short notes on Multiscale Modeling. [5]  
b) Write a short notes on Sensitivity theory. [5]
- Q5)** a) Distinguish between the following : [5]  
Simple hypothesis and composite hypothesis;  
b) Write a short notes on Common errors when writing research aims and objective. [5]
- Q6)** a) Explain the different sections / formats in a project proposal. [5]  
b) Enumerate the different methods of collecting data. [5]
- Q7)** a) Describe the layout of research proposal. [5]  
b) Explain different steps in writing research report. [5]



Total No. of Questions : 6]

SEAT No. :

P3159

[Total No. of Pages : 1

[5872]-315

**M.E. (Instrumentation & Control) (Process Instrumentation)**

**PROCESS DYNAMICS AND CONTROL**

**(2017 Pattern) (Semester - II) (506107)**

*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)** Two liquid ingredients A & B are to be blended in the proportion of 1:2. Draw control loop schematics to indicate the two ways in which this task can be achieved. **[10]**

**Q2)** Derive relation for setpoint tracking and disturbance rejection for Feed-forward control. **[10]**

- Q3)** a) Analyze the dynamics of second order process to identify key performance characteristics. **[5]**  
b) Comment on Decoupling of Control loops. **[5]**

**Q4)** What is the need of Mathematical Model in process control? Derive mathematical model of stirred tank heater. **[10]**

- Q5)** a) Elaborate the process reaction curve method for identifying dynamic models. **[5]**  
b) Define RGA. Elaborate procedure to find RGA matrix of 2\*2 systems. **[5]**

- Q6)** a) Analyze MIT rule and its application to a first order system. **[5]**  
b) Develop suitable Cascade Control for heat exchanger. **[5]**



Total No. of Questions : 5]

SEAT No. :

**P3160**

[Total No. of Pages : 2

**[5872]-316**

**M.E. Instrumentation and Control (Process Instrumentation)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern) (506108) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following :

- a) What is watchdog timer? Elaborate with neat block schematic watchdog timer of AVR microcontroller. **[5]**
- b) Analyze with neat schematic Port-A of AT Mega8535 AVR microcontroller. **[5]**
- c) Comment on Timer/Counter prescalers of AVR  $\mu$ C. **[5]**

**Q2)** Attempt any two of the following :

- a) Elaborate different modes of operation of ARM processor along with its advantages and disadvantages. **[5]**
- b) What is ARM-Thumb interworking, explain with example. **[5]**
- c) Discuss different ARM Development Tools. **[5]**

**Q3)** Attempt any two of the following :

- a) Write short note on ISA Bus. **[5]**
- b) Describe the four primary benefits of CAN protocol provides. **[5]**
- c) Discuss how multiple processors can be connected on RS - 485 bus.**[5]**

**P.T.O.**

**Q4)** Attempt any one of the following :

- a) Design LPC2148 based DAS for green house control. GSM and Bluetooth technology should be used for communication. Draw and explain the system with suitable block diagram and circuit diagram. Consider suitable parameters. **[10]**
- b) Design and develop DC motor speed control scheme using 8051 microcontroller which will display actual speed of the motor, set point can be enter for speed through keyboard, Input supply failure indication. **[10]**

**Q5)** Attempt any one of the following :

- a) Design complete embedded system for temperature monitoring and control using LPC2148  $\mu$ C. Consider suitable transducer. Draw the suitable block diagram and discuss interfacing circuit in detail. **[10]**
- b) Design and develop Automatic Green House Controlling and Monitoring System over GSM module using Adriano or LPC2148. Draw the suitable block diagram and explain interfacing circuit in detail. **[10]**



Total No. of Questions : 5]

SEAT No. :

P3161

[Total No. of Pages : 2

[5872]-317

**M.E. Instrumentation & Control (Process Instrumentation)**

**CONTROL SYSTEM**

**(2017 Pattern) (Semester - II) (506109)**

*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.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two Questions

- a) The response of system is  $y = bx + \frac{dx}{dt}$ . Test whether system is linear or non-linear. [5]
- b) Discuss the term Jump Resonance with frequency response curve. [5]
- c) Explain following physical non linearities; Dead zone, Saturation, Friction. [5]

**Q2)** Attempt any two Questions :

- a) Explain following points related to nonlinear system : [5]
  - i) Stable node
  - ii) Unstable node
  - iii) Saddle point
  - iv) Stable focus
  - v) Unstable focus
- b) Brief the describing function of saturation nonlinearities. [5]
- c) Test whether following signal  $y = ax^2 + e^{bx}$  is linear or Non linear. [5]

**P.T.O.**

**Q3)** Attempt any two Questions :

- a) Determine a Lyapunov function for the nonlinear system given by

$$\dot{x}_1 = -x_1 \quad \dot{x}_2 = -x_2 + x_1 x_2^2$$

Use variable gradient method. [5]

- b) Consider the nonlinear system

$$\dot{x}_1 = -x_1 - x_2^2 \quad \dot{x}_2 = -x_2$$

Investigate the stability of the equilibrium points. [5]

- c) Check the stability of the system described by [5]

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2$$

$$\dot{x}_2 = x_2$$

Use variable gradient method.

**Q4)** Attempt any two Questions :

- a) Discuss input state linearization with example. [5]

- b) Describe the term zero dynamics with example. [5]

- c) Illustrate the concept Diffeomorphisms and State Transformations. [5]

**Q5)** Attempt any one Question :

- a) Elaborate the concept of sliding mode control using  
Sliding surface, Reachability, Reaching law, chattering effect. [10]

- b) Discuss various merits and drawbacks of sliding mode control. [10]



[5872]-318

**M.E. (Instrumentation & Control)**  
**PROCESS INSTRUMENTATION**  
**Advanced Signal Processings**  
**(2017 Pattern) (Semester - III) (606101)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

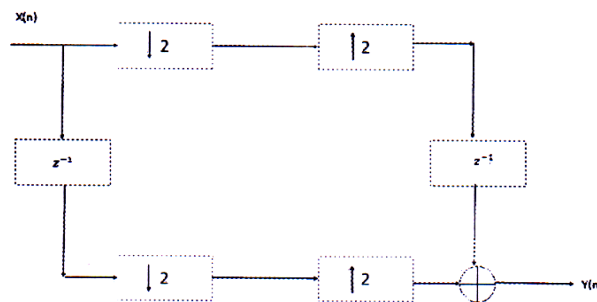
- 1) All questions are compulsory.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right candidates indicate full marks.
- 4) Use of electronic pocket calculator.
- 5) Assume suitable data, if necessary.

Q1) Attempt any two Questions :

- a) Determine output response of an LTI system whose impulse response  $h(n) = 1; 0 \leq n \leq 2$  and  $x(n) = a^n u(n); |a| < 1$  [5]
- b) Draw and explain in brief frequency response characteristics of Butterworth, Chebyshev Type-1 and Type-2 filters. [5]
- c) Explain different methods of IIR filter design. [5]

Q2) Attempt any two Questions :

- a) Consider multirate system as shown in figure, find  $y(n)$  as function of  $x(n)$ . [5]



- b) The transfer function of an FIR filter is given by  $H(z) = 0.2 + 0.7z^{-1} + 0.8z^{-2} + 0.15z^{-3} + 0.6z^{-4} + 0.32z^{-5} + 0.5z^{-6} + 0.4z^{-7} + 0.9z^{-8}$   
Obtain the poly phase decomposition of  $H(z)$  to decompose into 2 and sections. [5]
- c) Enlist various properties of STFT. Explain two in details. [5]

P.T.O.

**Q3)** Attempt any two Questions :

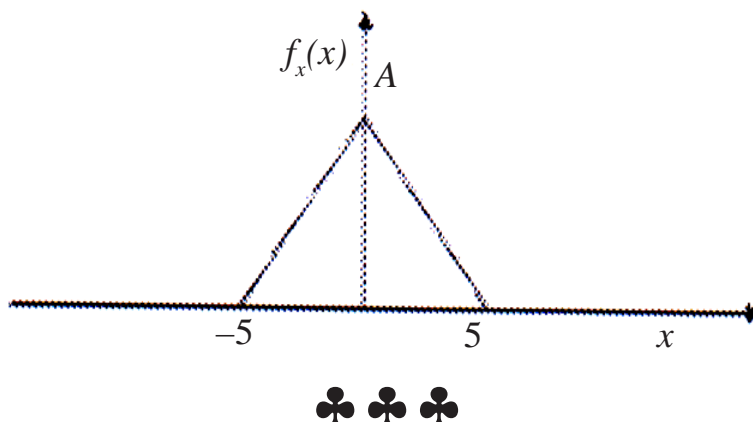
- a) Explain identities used in mutirate signal processings. [5]
- b) Consider the discrete time signal  $x(n) = \{1 \ 2 \ 3 \ 4\}$ . [5]  
Determine the up scaled version of the signal for sampling rate conversion  $I = 2, I = 3, I = 4$
- c) compare LMS and RLS filters. [5]

**Q4)** Attempt any two Questions :

- a) Determine the frequency resolution of the Bartlett, Welch and Blackman-Tukey methods of power spectrum estimates for a quality factor  $Q = 10$ . Assume that overlap in Welch's method is 50% and length of the sample sequence is 1000. [5]
- b) With basic model of speech production, explain speech parameter estimation using homomorphic deconvolution. [5]
- c) Explain AR modeling for power spectrum estimation. [5]

**Q5)** Attempt any one Questions :

- a) Explain ARMA modeling for power spectrum estimation. [10]
- b) Autocorrelation values  $\gamma_{YY}(0) = 3, \gamma_{YY}(1) = 1$  and  $\gamma_{YY}(2) = 0$  are given for a process of a single sinusoid with additive white noise. Find the frequency, its power, and variance of white noise. [10]
- c) Consider a random variable X with a pdf as shown in Figure. Find A, mean value of X, and variance of X. [10]





Total No. of Questions : 7]

SEAT No. :

**P3163**

[Total No. of Pages : 2

**[5872]-319**

**M.E. (Part - II) (Process Instrumentation & Control)**

**BUILDING AUTOMATION**

**(2017 Pattern) (Semester - III) (606102)**

*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 table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Design project management life cycle. **[6]**

b) Write a short notes on Cental processing unit of FACP. **[4]**

**Q2) a)** List various types of reader in biometric access control system, Elaborate authentication with example. **[6]**

b) Discuss in brief Role of Architect. **[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)** What is Vapour compression cycle? Explain any one type of evaporator used in vapour compression cycle. **[6]**

b) Write a short notes on Chilled water coil. **[4]**

**P.T.O.**

**Q5) a)** Explain features of primary controller and secondary controller in DDC with neat sketch. **[6]**

b) Write short notes on green building. **[4]**

**Q6)** Design guidelines for energy considerations for buildings. **[10]**

**Q7)** How to generate template in biometrics system. **[10]**



Total No. of Questions 7]

SEAT No. :

**P6559**

**[5872]-322**

[Total No. of Pages : 2

**M.E. (Mechanical -Automotive Engineering)**

**AUTOMOTIVE ENGINE DESIGN**

**(2017 Pattern) (Semester-I) (502302)**

*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 scientific calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** A four -cylinder, 2.5-liter, SI automobile engine operates at WOT on a four -stroke air-standard Otto cycle at 3000 RPM. The engine has a compression ratio of 8.6:1, a mechanical efficiency of 86%, and a stroke-to -bore ratio  $S/B = 1.025$ , Fuel is isoctane with  $AF=15$ , a heating value of 44,300 kJ/kg, and combustion efficiency = 100% at the start of compression stroke, conditions in the cylinder combustion chamber are 100k Pa and 60°C It can be assumed that there is a 4% exhaust residual left over from the previous cycle. Do a thermodynamic analysis of this engine for following parameters clearance volume, bore, stroke, temperature, pressure and volume of each state, heat added per cycle to each cylinder, indicated thermal efficiency.

**[10]**

**Q2) a)** Explain various types of combustion chambers of CI engines. **[5]**

b) Explain octane number and cetane number. **[5]**

**Q3) a)** Explain the operating variables that affect the performance of CI engine. **[5]**

b) What are the various sources of emission in engine. Name the different methods to reduce the emission from engine. **[5]**

**P.T.O.**

**Q4)** Explain in detail various forces acting on piston and steps in piston design. [10]

**Q5)** a) List and explain factors to be considered in general engine Design. [6]  
b) Explain selection of bore and stroke for various applications. [4]

**Q6)** a) What are torsional vibrations? Write the formula for natural frequency of torsional vibrations and explain the terms. [5]  
b) Explain factors considered while designing lubricating system. [5]

**Q7)** Write short notes on (Any two) [10]

- a) Selection of Lubricant.
- b) Fluid motions in combustion chamber.
- c) Catalytic converter.



Total No. of Questions : 7]

SEAT No. :

**P3164**

[Total No. of Pages : 2

**[5872]-323**

**M.E. Mechanical (Automotive Engineering)**  
**AUTOMOTIVE SAFETY AND REGULATIONS**  
**(2017 Pattern) (Semester - I) (502303)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of 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 various steps involved in crash testing of vehicle. What parameters are studied in crash test? Discuss in detail. [5]
- Q2)** a) Describe various design requirements for crash test dummies. [5]
- b) Explain various features for Hybrid III dummy used in frontal crash test. [5]
- Q3)** a) Describe head restraint geometry for horizontal and vertical measurement between head and restraint with neat sketch. [5]
- b) What are the functions of car bumper? Explain various requirements of crashworthiness of it. [5]
- Q4)** a) Explain asymmetrical beam used in head lamp. What is merits and demerits of plastic lens head lamps? [5]
- b) Explain briefly construction and working principle of head lamp used in automobile. [5]

**P.T.O.**

- Q5)** a) Explain briefly what procedure to be followed for passing a permit of commercial vehicles by regulatory authority RTO. [5]
- b) Sketch any three road signs specifying dimensions and color code as per CMVR rule. [5]
- Q6)** a) What instrument is needed to study various parameters in a crash test? Give details. [5]
- b) Describe head lamp how beam measuring screen test point grid. [5]
- Q7)** Write short notes on the following : (**Any two**) [10]
- a) Instrumentation in crash testing.
- b) Under run protection device.
- c) Testing tracks for vehicles.



Total No. of Questions : 8]

SEAT No. :

P3165

[Total No. of Pages : 2

[5872]-324

M.E.

(Common to all Mechanical Branches)

RESEARCH METHODOLOGY

(2017 Pattern) (Semester - I) (502104)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Assume suitable data, if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of scientific calculator is allowed.*
- 5) *Use of standard statistical tables having normal distribution, F-test and Chisquare test are permitted.*

- Q1)** a) Explain Significance of Research. [5]  
b) Explain research process with neat block diagram. [5]
- Q2)** a) Describe some of the important research designs used in experimental hypothesis-testing research study. [5]  
b) What are the precautions to be taken while writing research proposal?[5]
- Q3)** a) The null hypothesis is that 20 per cent of the passengers go in first class, but management recognizes the possibility that this percentage could be more or less. A random sample of 400 passengers includes 70 passengers holding first class tickets. Can the null hypothesis be rejected at 10 per cent level of significance? [5]  
b) Explain conceptual and empirical research. [5]
- Q4)** a) What is uncertainty analysis? How uncertainty in the measurement is estimated? [5]  
b) Explain dependent and independent variables in research design. [5]

*P.T.O.*

- Q5)** a) Write a short note on state vector machines. [5]  
b) What do you mean by multivariate analysis? Explain how it differs from bivariate analysis. [5]
- Q6)** a) How do you estimate the budget for the proposed project? List steps for one case study. [5]  
b) Explain error analysis and methods to reduce errors in research process. [5]
- Q7)** a) How the sources of information are referenced in a journal publication? What is the significance of referencing? [5]  
b) How a suitable journal is selected for publishing research work? [5]
- Q8)** a) Explain various stages involved in review process of submitted manuscript to a particular journal. [5]  
b) What do you mean by IPR? Explain different categories of IPR in detail. [5]





Total No. of Questions : 7]

SEAT No. :

**P6560**

[Total No. of Pages : 2

[5872]-325

**M.E. (Mechanical) (Automotive Engineering)**

**ENGINE COMBUSTION TECHNOLOGY**

**(2017 Pattern) (Semester-II) (502307)**

*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)** What is enthalpy of combustion? How does it differ from the enthalpy of reaction? **[4]**

b) A fuel having chemical formula  $C_7H_{16}$  is burned with 10% excess air. Assume 90% of carbon is burnt to  $CO_2$  and remaining to CO. Determine volumetric composition of dry flue gas. **[6]**

**Q2) a)** Fuel ( $C_7H_{16}$ ) is burned with 91% stoichiometric air write **[6]**

- i) Combustion equation (Stoichiometric)
- ii) Combustion equation (Actual)
- iii) Air fuel ratio and fuel air ratio
- iv) Equivalence ratio.

b) Explain adiabatic flame temperature. **[4]**

**Q3) a)** Compare knocking in SI and CI engine. **[5]**

b) What are the requirements of good combustion chamber in SI engine. **[5]**

**Q4) a)** Explain laminar and turbulent flame propagation in engine. **[5]**

b) Discuss the effect of following engine variables on flame propagation. **[5]**

- i) Engine speed
- ii) Compression ratio
- iii) Fuel air ratio.

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

- Q5)** a) Compare induction swirl and compression swirl. [5]  
b) What are the different method to control the emission? Explain any one method. [5]
- Q6)** a) With neat sketch explain combustion chamber geometry bringing out the various zones that play part in the process of combustion. [5]  
b) Describe briefly factors affecting combustion chamber design in gas turbine. [5]
- Q7)** Write short notes on (Any two) [10]  
a) Lean burn engines  
b) Flame tube cooling.  
c) Diesel smoke and control.



Total No. of Questions : 7]

SEAT No. :

**P3166**

[Total No. of Pages : 2

**[5872]-327**

**M.E. (Mechanical-Automotive Engineering)**

**AUTOMOTIVE CHASSIS DESIGN**

**(2017 Pattern) (Semester - II) (502309)**

*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) Describe with suitable sketch components of suspension system. [5]  
b) Explain with neat sketch construction of semi elliptical leaf spring used in automobile suspension system. [5]
- Q2)** a) What is mean by self-levelling suspension? Explain construction and working of self-levelling suspension system. [5]  
b) What is an interconnected suspension system? Draw a neat Sketch and describe working of it. [5]
- Q3)** a) Explain function and requirement of steering system used in automobile. [5]  
b) Explain meaning of Toe-in and Toe-out. Illustrate your answer with neat sketch. [5]
- Q4)** a) Explain with suitable sketch four wheel steering and describe function of reversibility of steering. [5]  
b) Describe various tyre trade patterns used on automobile wheel, explain design considerations of it. [5]

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

- Q5)** a) Explain with neat sketch construction of radial tyre used on vehicles. **[5]**  
b) Describe with neat sketch construction and working of a drum brake system. **[5]**
- Q6)** a) Explain construction and working of hydraulic brake system. What are various parts of it? **[5]**  
b) What do you understand by Scammell vehicles? Explain how they are classified. **[5]**
- Q7)** Write Short note on the following (Any two) : **[10]**  
a) Centre point steering  
b) Rubber spring- types and applications.  
c) Double trailing link suspension



Total No. of Questions : 7]

SEAT No. :

**P6561**

[Total No. of Pages : 2

**[5872]-328**

**M.E. (Mechanical) (Automotive Engineering)**

**VEHICLE DYNAMICS**

**(2017 Pattern) (Semester-III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** A vehicle of mass 860 kg has a wheelbase of 2m. The center of gravity is 1.4 m behind the front axle and 60 cm above ground level. The frontal area of the vehicle is 2.4 m<sup>2</sup> and the aerodynamic drag coefficient is 0.22. The coefficient of rolling resistance is given by  $f_r = 0.01 + 0.37 \times 10^{-7} V^2$ , where V is the speed of the vehicle in kilometers per hour. The rolling radius of the tires is 30 cm. The coefficient of road adhesion is 0.8. Estimate the possible maximum speed of the vehicle on level ground as determined by the maximum tractive effort that the tire-road contact can support if the vehicle is (a) rear-wheel drive, and (b) front-wheel-drive. Plot the resultant resistance versus vehicle speed, and show the maximum thrust of the vehicle with the two types of drive. **[10]**

**Q2)** Determine the geometry that would be necessary to achieve 100% anti-squat in the rear suspension and 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 265 and 169 lb/in respectively. The CG height is 18 inches and wheel base is 109. **[10]**

**Q3)** Determine the pitch and bounce frequencies and the location of oscillation centers of an automobile described in Q1) with  $r_y = 1.2$  m;  $k_f = 33$  kN/m;  $k_r = 37$  kN/m. **[10]**

**P.T.O.**

**Q4)** Write Short Notes on any two of the following. **[10]**

- a) Modelling of springs
- b) Two degrees of freedom vehicle model for pitch and bounce
- c) Effect of wheelbase in road and suspension modelling

**Q5)** Draw neat sketch of idealized automobile suspension (single dof) system approaching half sine speed bump. Write governing differential equation, base input displacement, velocity and acceleration function when vehicle is on the speed bump. **[10]**

**Q6)** Explain any two of the following. **[10]**

- a) Curvature response of neutral steer, understeer and Oversteer vehicles
- b) Steady - state handling characteristics of a two-axle vehicle
- c) Handling behavior of car without vehicle stability control system

**Q7)** Explain overturning moment, rolling resistance moment and aligning torque with the help of neat sketch. **[10]**



Total No. of Questions : 7]

SEAT No. :

**P3167**

[Total No. of Pages : 2

**[5872]-329**

**M.E. Mechanical (Automotive Engineering)**

**AUTOTRONICS**

**(2017 Pattern) (Semester - III) (602314)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Discuss the role of electronics in the automobile in context with MEMS. **[5]**

b) Discuss the high side and low side drivers. **[5]**

**Q2)** a) What is Reference Voltage Sensor? Explain the Throttle position sensor in computer controlled Engine. **[5]**

b) Explain sequential fuel injection system. **[5]**

**Q3)** a) Discuss purpose, concept, procedure and interpretation of logic probes. **[5]**

b) 'Electronic control of fuel injection is feasible and may easily provide the control flexibility necessary for optimum overall engine performance' Justify. **[5]**

**Q4)** a) Discuss the constant volume Sampling Procedure. **[5]**

b) Explain how the six Stage diagnostic process is used by giving simple example. **[5]**

**P.T.O.**

- Q5)** a) Discuss the Various elements and operation of compressor drive system for air-conditioning system. [5]  
b) Classify Communication Networks in vehicular communication system. [5]
- Q6)** a) Explain the mechanism to reduce roll moment. [5]  
b) Explain Electronic Stability program system in vehicle. [5]
- Q7)** Write short Note (Any two)
- a) MAP (Manifold Absolute Pressure) Sensor. [5]  
b) Tire pressure Sensor. [5]  
c) Gas Analyser. [5]  
d) Air Bag system Sensor. [5]





Total No. of Questions : 7]

SEAT No. :

P3168

[Total No. of Pages : 2

[5872]-332

**M.E. (Mechanical) (CAD Manufacture & Engineering)**

**ADVANCE MACHINE DESIGN**

**(2017 Pattern) (Semester - I) (502402)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Derive the compatibility equations in Cartesian co-ordinate systems.[5]

b) Explain with examples the plain stress and strain problems. [5]

**Q2)** a) Investigate what problem of plane stress is represented by the function.[5]

$$\phi = \frac{3F}{4h} \left( xy - \frac{2Ry^3}{3h^2} \right) + \frac{P}{2} y^2$$

Where 'h' is half depth of beam, and 'F' as the concentrated load

b) Explain fundamental assumptions made in the theory of elasticity and explain strain energy theory. [5]

**Q3)** a) Explain Galerkin's method with its important characteristics. [5]

b) Explain the following theories of failures with graphical representation and applications. [5]

i) Distortion energy theory

ii) Maximum elastic strain theory

**P.T.O.**

- Q4)** a) Explain high cycle and low cycle fatigue. [5]  
 b) Mohr's theory of failure in detail. [5]
- Q5)** a) For an alloy steel the following creep rate is observed at 700°C [5]  
 Stress = 21 MPa, creep rate = 0.128% per 1000hr.  
 Stress = 28 MPa, creep rate = 0.640% per 100hr.  
 Determine the creep rate per 1000hrs for stress value of 15 MPa by using both exponential and hyperbolic laws of creep. Which of the two methods a designer will prefer?
- b) What is true stress and true strain? Assuming exponential relation for stress and true strain derive the expression to estimate time of rupture. [5]
- Q6)** a) What is the hybrid material and discuss its applications? [5]  
 b) A single-row deep groove ball bearing has a dynamic load capacity of 40500 N and operates on the following work cycle: [5]  
 Radial load of 5000 N at 500 rpm for 25% of the time  
 Radial load of 10000 N at 700 rpm for 50% of the time; and  
 Radial load of 7000 N at 400 rpm for the remaining 25% of the time.  
 Calculate the expected life of the bearing in hours.
- Q7)** a) Explain the four-element Maxwell-Kelvin model. [5]  
 b) Describe transverse shear effect in composite laminates. [5]



Total No. of Questions : 8]

SEAT No. :

P3169

[Total No. of Pages : 2

[5872]-333

M.E. (Mechanical) (CADME)

COMPUTER AIDED DESIGN

(2017 Pattern) (Semester - I) (502403)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Use of non-programmable calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain the wire frame models with neat sketches. [5]

b) Explain the functions of modeling and viewing. [5]

**Q2)** a) Explain the properties of the B spline curves. [5]

b) Differentiate between Bezier curves and Bezier surface. [5]

**Q3)** a) Differentiate between Ruled and Tabulated surface. [5]

b) Explain different types of coordinate systems. [5]

**Q4)** Explain the Parametric representation of plane surface with neat sketch and explain its need and applications

A polygon ABCD with vertices A (50, 20), B (70, 20), C (60, 40) and D (50,30) is to be scaled by a factor of 0.5 about arbitrary point X (10, 10).

Determine [10]

- a) Composite transformation matrix
- b) Coordinate of the vertices for a scaled triangle

**Q5)** Explain the modeling operation strategy used during Drafting and assembly with suitable examples. [10]

**P.T.O.**

- Q6)** a) Explain the Parent child relationship used during Assembly Modeling. [5]  
b) Draw the flow chart for represent shading and rendering algorithm. [5]
- Q7)** a) Explain role of AI in product Design. [5]  
b) Explain the principles and approaches used in collaborative engineering. [5]
- Q8)** a) Explain the analysis and synthesis stage of the design procedure. [5]  
b) Explain, how collaborative product design enhances the productivity using tools and design systems. [5]



Total No. of Questions : 7]

SEAT No. :

**P6562**

[Total No. of Pages : 2

**[5872]-335**

**M.E. (Mechanical) (Computer Aided Design,  
Manufacturing & Engineering)**

**COMPUTER INTEGRATED MANUFACTURING (CIM)  
(2017 Pattern) (Semester - II) (502407) (Theory)**

*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) 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)** Discuss the elements of CIM? How product is developed through CIM brief with case study. **[10]**

**Q2)** Discuss the requirements of Data Base Management in CIM? Elaborate. **[10]**

**Q3)** What is Flexible Manufacturing System? Discuss various components of FMS with neat sketches. **[10]**

**Q4)** Discuss the cellular manufacturing and Just in Time Japanese manufacturing Philosophy. **[10]**

**Q5)** Explain web based manufacturing for Casting and forming process with one applications. **[10]**

**P.T.O.**

**Q6)** Explain Collaborative manufacturing technology, its characteristics and its use for specific product. **[10]**

**Q7)** Elaborate :

a) PLM **[5]**

b) The Supply Chain Management **[5]**



Total No. of Questions : 7]

SEAT No. :

**P3170**

[Total No. of Pages : 1

**[5872]-336**

**M.E. Mechanical (Computer Aided Design, Manufacture & Engineering)**

**INDUSTRIAL PRODUCT DESIGN & PRODUCT LIFE CYCLE MANAGEMENT**

**(2017 Pattern) (Semester - II) (502408)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 5 questions from following.*
- 2) Neat diagrams indicate wherever necessary.*
- 3) Figures to the right side indicate full marks.*
- 4) Assume suitable data if necessary.*

*Q1) Explain challenges in new product development with example. [10]*

*Q2) Explain concept generation techniques & process? [10]*

*Q3) What is benchmarking? How to do effective competitive analysis & explain with example. [10]*

*Q4) Explain PLM strategy to develop product data & Work how in PLM. [10]*

*Q5) What are the threads of PLM & Explain in details. [10]*

*Q6) With your automobile product, show detailed product life cycle & technology life cycle of that particular product & explain in details. [10]*

*Q7) How you will do Financial analysis is collaborative product development.[10]*



Total No. of Questions : 8]

SEAT No. :

P3171

[Total No. of Pages : 2

[5872]-337

M.E. (Mechanical) (CADME)

**AUTOMATED MANUFACTURING SYSTEM  
MODELLING (502409)**

**(2017 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 non-programmable calculator is allowed.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Explain in brief the advanced automation functions. [5]

b) Explain levels of Automations with one industrial example. [5]

**Q2)** a) Explain the opportunities for automation and computerization in Production System. [5]

b) Enlist the issues involved in Planning and Implementation of FMS. [5]

**Q3)** A 20-station transfer line is divided into two stages of 10 stations each. The ideal cycle time of each stage is  $T = 1.2$  min. All of the stations in the line be the same probability of stopping,  $p = 0.005$ . We assume that the downtime  $s$  constant when a breakdown occurs,  $T_d = 8.0$  min. Compare line efficiencies and production rates for the following cases, assuming an infinite buffer capacity: (a) No storage buffers (b) One buffer. [10]

**Q4)** a) Explain the jet destruction devices used for pneumatic / hydraulic circuits. [5]

b) Explain pneumatic sensors and amplifiers used pneumatic circuits. [5]

*P.T.O.*



- Q5)** a) Explain how Fuzzy decision and control is used for Manufacturing Plant Automation. [5]
- b) Explain the steps used for building Mathematical Model for the manufacturing Plant. [5]
- Q6)** Explain the physical configurations for achieving the motions of Probe in CMM. [10]
- Q7)** a) Explain the concept data optimization and security used in system models. [5]
- b) Write short notes on queuing used in system modeling. [5]
- Q8)** Explain Markov Model of transfer lines with an example. [10]



Total No. of Questions : 7]

SEAT No. :

**P6563**

[Total No. of Pages : 2

**[5872]-338**

**M.E. (Mechanical) (Computer Aided Design,  
Manufacturing & Engineering)  
SIMULATION & MODELING  
(2017 Pattern) (Semester - III) (602413)**

*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 pocket calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain and Justify linear congruential method as technique for random number generation. [5]

b) Explain in brief Uniform Distribution model. [5]

**Q2)** a) Limitations and Advantages of simulation modeling. [5]

b) Explain in brief Gamma Distribution model. [5]

**Q3)** a) Describe in brief System and Environment with suitable example. [5]

b) Explain Output analysis in model building. [5]

**Q4)** Explain the concept of random variate in simulation with suitable example. [10]

**Q5)** Discuss the concept of acceptance - rejection for Poisson distribution. [10]

**Q6)** Explain different Performance Measures used in Manufacturing System Modeling. [10]

**P.T.O.**

**Q7)** A marketing firm producing detergents is interested in studying the consumer behavior in the context of purchase decision of detergents in a specific market. It would like to know in particular whether the income level of the consumers influence their choice of the brand. Currently there are two brands in the market. Brand 1 is the premium brand while Brand 2 is the economy brand.[10]

Income level was classified as Lower. Middle. Upper Middle and High and random sampling procedure was adopted covering the entire market. A sample of 300 consumers participated in this study. The following data emerged from the study. Analyze the data using chi-square test and draw your conclusions.

Income level	Brand 1	Brand 2
Lower	25	65
Middle	30	30
Upper Middle	50	22
High	60	18



Total No. of Questions : 7]

SEAT No. :

P3172

[Total No. of Pages : 2

[5872]-339

**M.E. (Mechanical) (Design Engineering)**  
**OPTIMISATION TECHNIQUES**  
**(2017 Pattern) (Semester - III) (602414)**

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

**Q1)** a) What do you mean by optimisation? State different applications of engineering optimisation? **[5]**

b) Explain the characteristics mathematical models? **[5]**

**Q2)** Minimize  $f(x)=4x^3+x^2-7x+14$  within the interval  $[0, 1]$  using golden section method with  $n=5$ . **[10]**

**Q3)** Maximize the following function with simple simplex method. **[10]**

$$\text{Maximize } Z=60 X_1+50 X_2$$

$$\text{Subject to, } X_1+2X_2\leq 40$$

$$3X_1+2X_2\leq 60$$

$$X_1, X_2\geq 0$$

**P.T.O.**

**Q4)** Explain in brief following methods of optimization. (any 2) **[10]**

- a) Simulated Annealing
- b) Genetic Algorithm
- c) Particle Swarm optimization
- d) Fuzzy algorithm

**Q5)** Write a short note on **[10]**

- a) Evolutionary structural optimization for displacement or stiffness.
- b) Evolutionary structural optimization based on stress level.

**Q6)** a) What is topology optimization? Explain with suitable example. **[5]**

b) Write a short note Bi-Directional evolutionary optimization? **[5]**

**Q7)** Minimize the function  $f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65x \tan^{-1} (1/x)$  using Newton-Raphson method with start point  $x_1 = 0.1$  and step size  $\Delta x = 0.01$ . Use  $|f'(x_{i+1})| \leq \epsilon$  for checking convergence. Take  $\epsilon = 0.01$ . **[10]**



Total No. of Questions : 7]

SEAT No. :

P3173

[Total No. of Pages : 2

[5872]-342

**M.E. (Mechanical) (Energy Engineering)**

**ADVANCED THERMODYNAMICS**

**(2017 Pattern) (Semester - I) (502502)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Write down the vander waal's equation of state. What is the physical significance of the two constant that appear in this equation. [5]

b) Explain generalized compressibility chart & Define compressibility factor. [5]

**Q2)** a) Write short note on the steam table and mollier diagram. State its use.[4]

b) A 1 m<sup>3</sup> tank contains 2.841 kg of steam at 0.6 MPa. Determine the temperature of the steam using [6]

- i) ideal gas equation
- ii) the vander waal's equation
- iii) the steam tables

Take  $R = 0.4615 \text{ kJ/m}^3\text{kgK}$   $T_{cr} = 647.3 \text{ K}$   $P_{cr} = 22.06 \text{ MPa}$

**Q3)** a) Explain Nernst heat theorem and third law of thermodynamics. [4]

b) One kg of ice at  $-5^\circ \text{C}$  is exposed to the atmosphere which is at  $20^\circ \text{C}$ . The ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe. Take  $C_p$  of ice =  $2.093 \text{ kJ/kg K}$  & latent heat of fusion of ice =  $333.33 \text{ kJ/kg}$ . [6]

*P.T.O.*

- Q4)** a) Explain the term [5]  
 i) Exray destruction  
 ii) Dead state  
 b) Derive the first and second Tds equation using Maxwell relations. [5]

- Q5)** a) Derive the relation. [6]

$$C_p - C_v = -T \left( \frac{\partial V}{\partial T} \right)_P^2 \left( \frac{\partial P}{\partial V} \right)_T$$

- b) Write note on clausius-clayperon equation. [4]
- Q6)** a) What is adiabatic flame temperature. [4]  
 b) Determine the enthalpy of combustion of liquid octane ( $C_8H_{18}$ ) at  $25^\circ C$  & 1 atm. Using enthalpy of formation data. Assume that water in the products is in the liquid form take [6]

Substance	$h^{\circ}f$ kJ/Kmol
$C_8H_{18} (l)$	-249950
$CO_2$	-393520
$H_2O (l)$	-285830

- Q7)** Write notes on (any two) : [10]  
 a) Dalton's law of partial pressure.  
 b) Gibb's phase Rule.  
 c) Fugacity and Activity.



Total No. of Questions : 8]

SEAT No. :

**P6564**

[Total No. of Pages : 2

**[5872]-343**

**M.E. (Mechanical) (Energy Engineering)**

**Non-Conventional Energy Sources**

**(2017 Pattern) (Semester - I) (502503)**

*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 non programmable calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain different types of energy sources in brief. **[5]**

b) What is the scenario of renewable energy sources at present in our country?  
**[5]**

**Q2) a)** Explain solar energy principle. **[5]**

b) Write a note on: **[5]**  
i) Solar availability and limitations  
ii) Solar cell arrays

**Q3) a)** Explain a central solar thermal power station. **[5]**

b) Describe the factors to be considered while selecting a site for wind power stations. **[5]**

**Q4) a)** Explain in detail the microhydel power plant. **[5]**

b) Explain biomass conversion. **[5]**

**P.T.O.**



- Q5)** a) What are the merits and limitations of Geothermal energy? [5]  
b) Describe working of any one type of OTEC power plant with diagram.[5]
- Q6)** a) Write a note on wave energy conversion? [5]  
b) Explain various methods of tidal power generations. [5]
- Q7)** a) Explain hydrogen fuel cell energy system. [5]  
b) What is the need of hybrid systems? [5]
- Q8)** Write a short note on any two: [10]  
a) Diesel PV system  
b) Wind PV system  
c) Solar wind system



Total No. of Questions : 8]

SEAT No. :

**P6565**

[Total No. of Pages : 4

**[5872]-345**

**M.E. (Mechanical-Energy Engineering)  
ADVANCED HEAT TRANSFER  
(2017 Pattern) (Semester - II) (502507)**

*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 the following terms :

**[10]**

- a) Variable Thermal Conductivity
- b) Thermal Contact Resistance
- c) Thermal diffusivity
- d) Overall Heat Transfer Coefficient
- e) Lumped capacitance

**Q2)** 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/m<sup>2</sup> K. 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]**

**Q3)** a) What are Heisler charts? Explain its significance in solving transient conduction problems? **[5]**

b) Explain Chilton-Colburn analogy. **[5]**

**P.T.O.**

- Q4)** 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. [8]

$$\text{Use } Nu_D = 0.027 Re_D^{0.805} Pr^{0.33} \text{ for circular tube}$$

$$Nu_D = 0.102 Re_D^{0.675} Pr^{0.33} \text{ for square tube}$$

- b) Explain the significance of Nusselt Number. [2]

- Q5)** In a staggered tube bank, water is passed through the tubes while the air is passed in cross flow over the tubes. There are seven rows of tubes in the air flow direction. The temperature and velocity of air are 15°C and 6 m/s respectively. The longitudinal and transverse pitches are both equal to 20.5 mm. The tube outside diameter is 16.4 mm and the tube surface temperature is 70°C. Calculate the air side heat transfer coefficient and the pressure drop across the tube bundle. [10]

- Q6)** a) Write a note on Atmospheric and Solar radiation. [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]

$$\text{Take Properties of Air - } \beta = 1/300 \text{ K}^{-1}$$

$$\nu = 15.89 \times 10^{-6} \text{ m}^2/\text{s}$$

$$K = 26.3 \times 10^{-3} \text{ W/mK}$$

$$Pr = 0.707$$

- Q7)** a) Explain : [6]

- i) Physical significance of Grashoff Number  
ii) Drop wise condensation correlations

- 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]

- Q8)** 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]

Table 1 : Properties of Air

Temperature (°C)	$\nu$ (m <sup>2</sup> /s)	K(W/mK)	Pr	$\rho$ (Kg/m <sup>3</sup> )
42.5	$17.4 \times 10^{-6}$	$2.74 \times 10^{-2}$	0.705	1.217
77	$20.92 \times 10^{-6}$	$3 \times 10^{-2}$	0.7	1.215

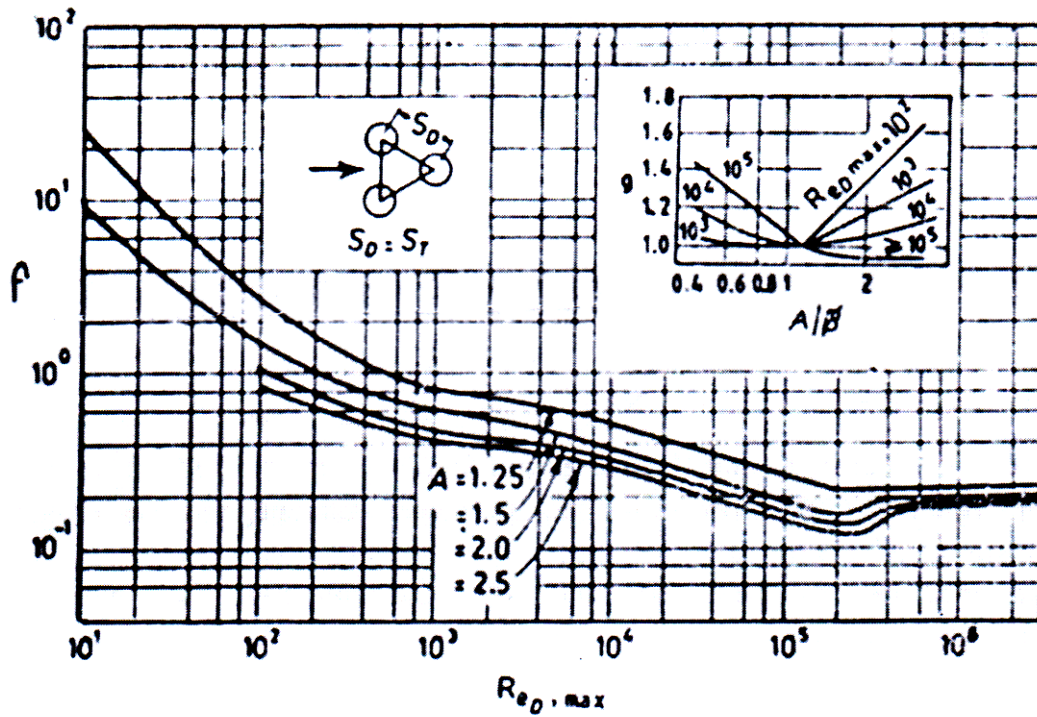


Fig. Friction Factor,  $f$ , and Correction Factor,  $g$ , for Staggered Tube Bank Arrangement.

Table 2: Correction Factor  $C_2$

$N$	1	2	3	4	5	6	7	8	9
In Line	0.64	0.80	0.87	0.90	0.92	0.94	0.96	0.98	0.99
Staggered	0.68	0.75	0.83	0.89	0.92	0.95	0.97	0.98	0.99

Table 3: Correction Factor C2

Arrangement	$\frac{S_L}{D}$	$S_{T,D}$							
		1.25		1.50		2.0		3.0	
		$C_1$	$n$	$C_1$	$n$	$C_1$	$n$	$C_1$	$n$
In-line	1.25	0.348	0.592	0.275	0.608	0.100	0.704	0.0633	0.752
	1.50	0.367	0.586	0.250	0.620	0.101	0.702	0.0678	0.744
	2.0	0.418	0.570	0.299	0.602	0.229	0.632	0.198	0.648
	3.0	0.290	0.601	0.357	0.584	0.374	0.581	0.286	0.608
Staggered	0.6	—	—	—	—	—	—	0.213	0.636
	0.9	—	—	—	—	0.446	0.571	0.401	0.581
	1.0	—	—	0.497	0.558	—	—	—	—
	1.125	—	—	—	—	0.478	0.565	0.518	0.560
	1.250	0.518	0.556	0.505	0.554	0.519	0.556	0.522	0.562
	1.500	0.451	0.568	0.460	0.562	0.452	0.568	0.488	0.568
	2.0	0.404	0.572	0.416	0.568	0.482	0.556	0.449	0.570
	3.0	0.310	0.592	0.356	0.580	0.440	0.562	0.428	0.574



Total No. of Questions : 8]

SEAT No. :

P6566

[Total No. of Pages : 2

[5872]-346

**M.E. (Mechanical - Energy Engineering)**  
**ENERGY CONVERSION & ENVIRONMENT**  
**(2017 Pattern) (Semester-II) (502508)**

*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 method for measuring moisture, volatile matter and ash content in the coal. **[4]**

b) Explain wind to electricity conversion with neat diagram. **[6]**

**Q2)** The following particulars refer to a stage of a parson's steam turbine comprising one ring of fixed blades and one ring of moving blades; mean diameter of blade ring = 75cm, R.P.M. = 3500, steam velocity at exit of the blades 170 m/s, Blade outlet angle = 20°, steam flow through blades = 8kg/s. **[10]**

Dram the velocity diagram and find the following:

- a) Blade inlet angle,
- b) Tangential force on the ring of moving blades,
- c) Power developed in a stage.

**Q3) a)** Describe lean burn engine. **[4]**

b) Explain Variable valve timing diagram of I C Engines. **[6]**

**P.T.O.**

- Q4)** a) Enumerate the formulation of standards for nuclear protection. [5]  
b) Explain heat pump with example. [5]
- Q5)** a) Explain capacity of the compressor and various efficiencies of the compressor. [5]  
b) What you understand by performance evaluation of Fans. Explain? [5]
- Q6)** a) Describe advantages of adopting Diesel power plants. [5]  
b) Explain Energy Saving Opportunities in Diesel plants. [5]
- Q7)** a) Explain Thermal pollution and define TDI. [5]  
b) Explain Energy and Environmental policies. [5]
- Q8)** Write a short note on any two : [10]  
a) HCCI Engine  
b) STAG Combined cycle  
c) HVAC systems



[5872]-347

**M.E. (Mechanical-Heat Power)**  
**ADVANCED FLUID MECHANICS**  
**(2017 Pattern) (Semester - II) (502509)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates :*

- 1) Answer any five questions.
- 2) Drawn Diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume Suitable data if wherever necessary.

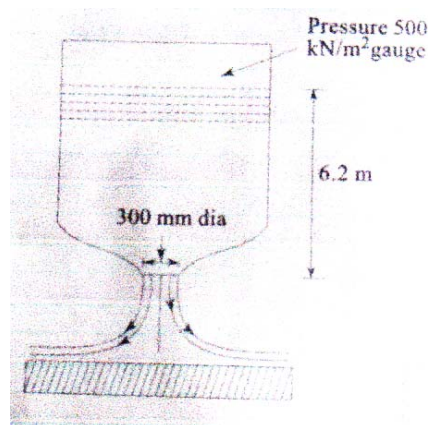
**Q1) a)** Derive a generalized expression for total derivative and deduce the same for velocity, density, temperature and pressure. [5]

b) Find the acceleration and vorticity components at a point (1,1,1) for the following flow field.  $u= 2x^2+3y$ ,  $v = -2xy + 3y^2 + 3zy$ ,  $w=-3/2z^2+2xz-9y^2z$ . [5]

**Q2) a)** Derive an expression for conservation of momentum equation in following form; [5]

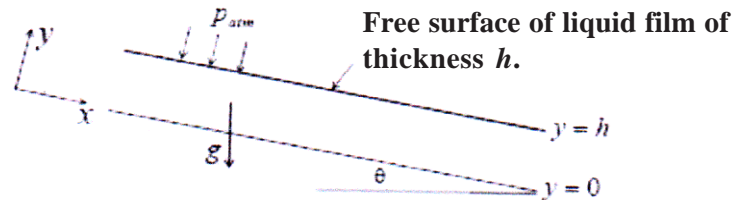
$$\rho \frac{D\bar{V}}{Dt} = \bar{f}$$

b) Find the net vertical force acting on the circular plate shown in fig. if the water spreads radially on it. Neglect the weight of water on the plate. Assume the height of free water surface from the discharge plane to remain constant. [5]





- Q3)** a) Derive an expression of velocity profile for fully developed laminar flow through pipe. [5]
- b) Derive an expression for velocity and shear stress profile for fully developed flow down an inclined plane as shown in fig. Also estimate maximum shear stress for  $\theta = 30^\circ$ ,  $h = 10 \text{ mm}$ , dynamic viscosity of liquid =  $0.4 \text{ kg/m.s}$ ,  $\rho = 920 \text{ kg/m}^3$  [5]



- Q4)** a) A 300 mm diameter circular cylinder is rotated about the axis in a stream of water having a uniform velocity of 5 m/s. Estimate the rotational speed when both the stagnation point coincide. Estimate the lift force experienced by the cylinder under such conditions, density of water may be assumed to be  $1000 \text{ kg/m}^3$  [5]
- b) Derive an expression for lift on rotating cylinder. (Kutta-Joukowski theorem) [5]

- Q5)** a) Derive an equation of boundary layer over flat plate. [5]
- b) Assume that the velocity profile in a boundary-layer flow can be

approximated by a parabolic velocity profile  $\frac{u}{U_\infty} = A + By + Cy^2$

Calculate the boundary-layer thickness and the wall shear stress. [5]

- Q6)** a) Derive an expression of velocity profile in a smooth pipe for turbulent flow. [5]
- b) Explain different types of free turbulent flows. What is a need of turbulence modeling [5]

- Q7)** a) Derive an expression for speed of sound. What is the Mach number of flow of air of velocity 200 m/s at 400K? State the types of flow. [5]
- b) A normal shock wave in air Mach number is 1.8. The static pressure and temperature of the air upstream of the shock wave are  $100 \text{ kN/m}^2$  and  $15^\circ\text{C}$  respectively, determine the Mach number, pressure and temperature downstream of the shock. [5]



Total No. of Questions : 8]

SEAT No. :

**P6568**

[Total No. of Pages : 2

**[5872]-348**

**M.E. (Mechanical) (Engineering)  
ENERGY MANAGEMENT  
(2017 Pattern) (Semester - III) (602513)**

*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 electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain the objective of Energy Management. **[5]**

b) Explain the various types of sources of energy in world energy market. **[5]**

**Q2) a)** Explain the various instruments used in Energy Audit. **[5]**

b) Discuss the types of Energy Audit briefly. **[5]**

**Q3) a)** List a few types of air conditioning systems in use. **[5]**

b) Explain with a sketch the working principle of a vapor compression Refrigeration plant. **[5]**

**Q4) a)** Explain any one method of condensate heat recovery. **[5]**

b) Write note on thermal fluids. **[5]**

**Q5) a)** Discuss the need of Waste heat recovery. **[5]**

b) What are the commercial Options in Waste-heat-recovery Equipment. **[5]**

**P.T.O.**

- Q6)** a) What are the typical billing components of the two-part tariff structure of industrial utility? [5]
- b) What is power factor and what are the effects of power factor improvement. [5]
- Q7)** a) Explain why power is generated at lower voltage and transmitted at higher Voltages. [5]
- b) Explain Energy Audit Procedure. [5]
- Q8)** Write a short note on (any two) : [10]
- a) Waste Heat Source and Sink
- b) Electrical measurements
- c) Shell and tube heat exchangers



Total No. of Questions : 7]

SEAT No. :

P6569

[Total No. of Pages : 2

[5872]-349

**M.E. (Mechanical) (Energy Engineering)**  
**ENERGY SYSTEMS MODELING AND OPTIMIZATION**  
**(2017 Pattern) (Semester - III) (602514)**

*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 scientific calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** a) What is a system? Explain the concept of system and system environment with an example. [5]

b) Explain in brief discrete and continuous system. [5]

**Q2)** a) Explain in detail different types of similarities. [5]

b) Explain the technique of simulation and its advantages and limitations. [5]

**Q3)** A firm produces three products. These products are processed on three different machines. The time required manufacturing one unit of each of the three products and the daily capacity of the three machines are given in the table below. It is required to determine the daily number of units to be manufactured for each product. The profit per unit for product 1, 2 and 3 is Rs. 4, 3 and 6 respectively.

Machine	Time per unit (minutes)			Machine Capacity (minutes/day)
	Product 1	Product 2	Product 3	
M <sub>1</sub>	2	3	2	440
M <sub>2</sub>	4	--	3	470
M <sub>3</sub>	2	5	--	430

It is assumed that the entire amount produced is consumed in the market. Formulate the mathematical (Linear Programming) model that will maximize the daily profit. [10]

*P.T.O.*

**Q4) a)** Maximize  $f(x) = 20x - 3x^2 - x^4$  by using 1-Dimensional search procedure. [4]

**b)** Maximize:  $Z = 2x_1 + x_2$ . By using Graphical Method. [6]

Subject to :  $x_1 + 2x_2 \leq 10$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1$$

$$x_1, x_2 \geq 0$$

**Q5) a)** Explain in details search techniques Univariate method. [5]

**b)** The objective function for an optimization problem is taken as the total income, which involves an income of five units on item A and seven units on item B. The former requires 2.5 hours of cutting and 1.5 hours of polishing, whereas item B requires 4 hours of cutting and 1 hour of polishing. If the total labor hours available for cutting are 4000 and for polishing 2000, formulate the optimization problem and solve it by the simplex algorithm to obtain the optimum. [5]

**Q6)** Minimize  $f = -3x_1 - 4x_2$  [10]

Subject to

$$3x_1 - x_2 + x_3 = 12$$

$$3x_1 + 11x_2 + x_4 = 66$$

$$x_i \geq 0, i = 1 \text{ to } 4$$

all  $x_i$  are integers

**Q7)** Explain with an example, the simulation procedure for analyzing a system. [10]



[5872]-351

M.E. (Mechanical-Mechatronics)

**SYSTEM MODELLING, IDENTIFICATION & SIMULATION**  
**(2017 Pattern) (Semester - I) (502801)**

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)** Discuss in detail, the advantages offered by state space modelling approach. [5]

b) Using suitable example, explain the working of Extended Kalman Filter. [5]

**Q2) a)** Draw the block diagram for below differential equation. Consider  $\tau$  to be the input to the block diagram and  $\theta$  to be the output. [5]

$$\tau = J\ddot{\theta} + b\dot{\theta} + k\theta$$

b) Draw a suitable flowchart and explain the process involved in Black Box Identification. [5]

**Q3) a)** Determine the EOM of mechanical system (Fig. Q. 3 (a)) using the Lagrangian approach. [5]

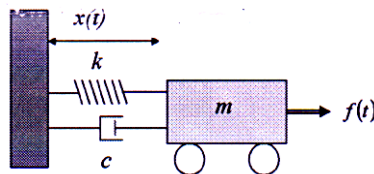


Fig. Q.3 (a)

b) Write the generic state space model of a MDOF system in Jordan form and explain its advantages. [5]

P.T.O.

**Q4) a)** Using suitable example explain the criteria for selection of measured signal for identification process. [5]

b) Using a suitable block diagram explain the process of identification of a time domain model. [5]

**Q5) a)** Differentiate between supervised and un-supervised learning. [5]

b) List 3 types of fuzzy logic membership functions and explain their selection process. [5]

**Q6) a)** Using suitable example, explain the working of Unscented Kalman Filter. [5]

b) Using suitable example explain the process of linearization of non-linear system using graphical approach. [5]

**Q7) a)** Draw the bond graph for the electrical system shown in figure Q. 7 (a). [5]

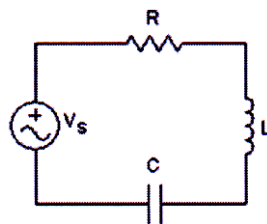


Fig. Q.7 (a)

b) Identify a straight line model for below dataset. [5]

x	8	2	11	6	5	4	12	9	6	1
y	3	10	3	6	8	12	1	4	9	14



Total No. of Questions : 8]

SEAT No. :

P3174

[Total No. of Pages : 2

[5872]-352

**M.E. (Mechanical-Mechatronics)**  
**CONTROL SYSTEMS - I**  
**(2017 Pattern) (Semester - I) (502802)**

*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 Routh-Hurwitz Stability Criterion with example. [5]

b) Discuss the design of an LQR type control. [5]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -3.96 & -3.42 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

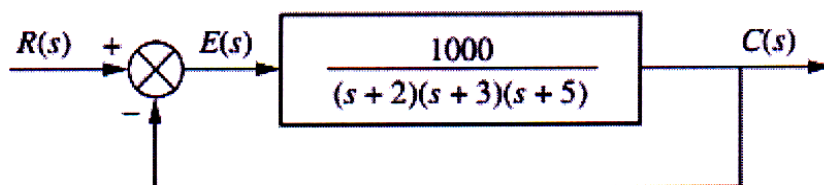
$$y = [407 \quad 372.8] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + [0]u$$

**Q2)** a) Explain Effect of feedback on Overall Gain. [4]

b) Explain Quadratic Poles and Zeros with example. [6]

**Q3)** a) Why does full state feedback control require a system to be observable as well as controllable? Explain. [4]

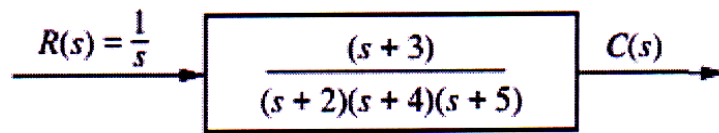
b) Make the Routh table for the system shown in Figure [6]



*P.T.O.*

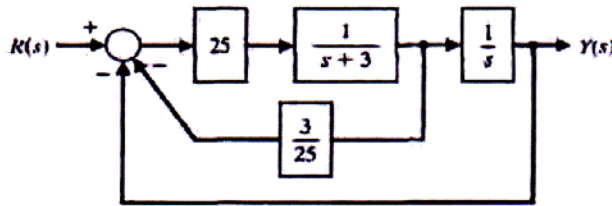


Q4) a) Evaluating Response Using Poles [5]



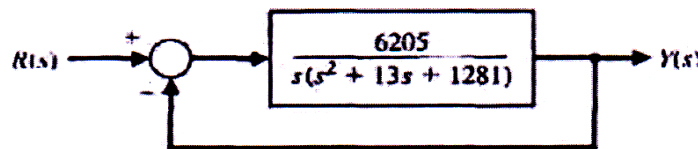
b) Discuss the effect of condition number on controllability and observability of a system. [5]

Q5) A system has a block diagram as shown in Figure. Determine a state variable model and the state transition matrix. [10]



Q6) A closed-loop control system is shown in Figure [10]

- Determine the transfer function  $T(s) = Y(s)/R(s)$ .
- Determine the poles and zeros of  $T(s)$ .
- Use a unit step input,  $R(s) = 1/s$  and obtain the partial fraction expansion for  $Y(s)$  and the value of the residues.



Q7) a) Draw a block diagram for a control system made up of the plant, the observer and the compensator. [5]

b) What is the Block diagram Representation in control system? [5]

Q8) a) Using a suitable block diagram, discuss the design of a reduced order observer. [5]

b) Determine the number of right-half-plane poles in the closed-loop transfer function. [5]

$$T(s) = \frac{10}{s^5 + 7s^4 + 6s^3 + 42s^2 + 8s + 56}$$



Total No. of Questions : 7]

SEAT No. :

P3175

[Total No. of Pages : 2

[5872]-353

**M.E. (Mechanical-Mechatronics)**  
**SENSORS, TRANSDUCERS & INTERFACING**  
**TECHNIQUES**  
**(2017 Pattern) (Semester - I) (502803)**

*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) *Assume suitable data if necessary.*
- 5) *Use of non-programmable scientific calculator is allowed.*

- Q1) a)** Define following terms : **[5]**
- i) Mean
  - ii) Deviation & standard deviation
  - iii) Variance
  - iv) Precision & accuracy
  - v) Error
- b) Explain the significance of uncertainty analysis in primary stages of experimentation. **[5]**
- Q2) a)** Explain in detail the operation of photo-conductive transducer. **[5]**
- b) Compare analog instruments with digital instruments. **[5]**
- Q3) a)** With the help of diagram explain LDA. **[5]**
- b) Discuss the working, advantages & drawbacks of bridgeman gauge. **[5]**
- Q4) a)** State the different methods of flow measurement & explain any one in detail. **[5]**
- b) Write notes on : **[5]**
- i) Pressure probes
  - ii) Application of flow meter

**P.T.O.**

- Q5)** a) Discuss the different methods of temperature measurement using neat diagrams. [5]
- b) Explain the significance of : [5]
- i) Dry-bulb temperature
- ii) Wet-bulb temperature
- Q6)** a) Using neat diagram explain the working of Rossette strain gauge. State the various applications of strain gauge. [5]
- b) What is need of temperature compensation in strain gauge? [5]
- Q7)** a) What are the objectives of data acquisition system? Draw a neat block diagram of two-channel DAS & explain function of each block. [5]
- b) Enlist important specifications of ADC & DAC. [5]



Total No. of Questions : 8]

SEAT No. :

P3176

[Total No. of Pages : 3

[5872]-355

**M.E. (Mechanical-Mechatronics)**  
**PLC PROGRAMMING**  
**(2017 Pattern) (Semester - II) (502807)**

*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 type of output devices can be controlled by an output module that uses relays for the switching device. **[4]**
- b) State three other functions, in addition to simple logic processing, that PLC processors are capable of performing. **[6]**
- Q2)** a) List out advantages that PLCs offer over the conventional relay control system. **[4]**
- b) Describe the main function of each of the following main component parts of PLC. **[6]**
- i) Processor module (CPU)
  - ii) I/O modules
  - iii) Programming device
- Q3)** a) Convert each of the following binary numbers to decimal numbers: **[4]**
- i) 10
  - ii) 100
  - iii) 111
  - iv) 1011

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

- b) Draw the logic symbol. construct a truth table, and state the Boolean equation for each of the following: [6]
- i) Two-input AND gate
  - ii) Three-input OR gate
  - iii) NOT function

- Q4)** A pump is to be used to fill two storage tanks. The pump is manually started by the operator from a START/STOP station. When the first tank is full, the control logic must be able to automatically stop flow to the first tank and direct flow to the second tank through the use of sensors and electric solenoid valves. When the second tank is full, the pump must shut down automatically. Indicator lamps are to be included to signal when each tank is full. [10]
- a) Draw a sketch of the process.
  - b) Prepare a typical PLC program for this control process.

- Q5)** Draw the electrical symbol used to represent each of the following PLC output control devices: [10]
- a) Pilot light
  - b) Relay
  - c) Motor starter coil
  - d) OL relay contact
  - e) Alarm
  - f) Heater
  - g) Solenoid
  - h) Solenoid valve
  - i) Motor
  - j) Horn

- Q6)** Write the ladder logic program needed to implement each of the following:[10]  
(assume inputs A, B, and C are all normally open toggle switches):
- a) When input A is dosed, turn ON and hold ON outputs X and Y until A opens.
  - b) When input A is dosed and either input B or C is open, turn ON output Y. Otherwise, it should be OFF.
  - c) When input A is dosed or open, turn ON output Y.
  - d) When input A is dosed, turn ON output X and turn OFF output Y

- Q7)** a) Name the forms of PLC counter instructions, and explain the basic operation of each. [4]
- b) Write a program that will latch on a light 20 s after an input switch has been turned on. The timer will continue to cycle up to 20 s and reset itself until the input switch has been turned off. After the third time the timer has timed to 20 s, the light will be unlatched. [6]
- Q8)** a) What are the two methods commonly used to represent a timer within a PLC's ladder logic program? [6]
- b) State the method used to reset the accumulated time of each of the following: [4]
- i) TON timer
  - ii) TOF timer



Total No. of Questions : 7]

SEAT No. :

P7003

[Total No. of Pages : 3

[5872]-356

**M.E. (Mechanical-Mechatronics)**  
**CONTROL SYSTEMS - II**  
**(2017 Pattern) (Semester - II) (502808)**

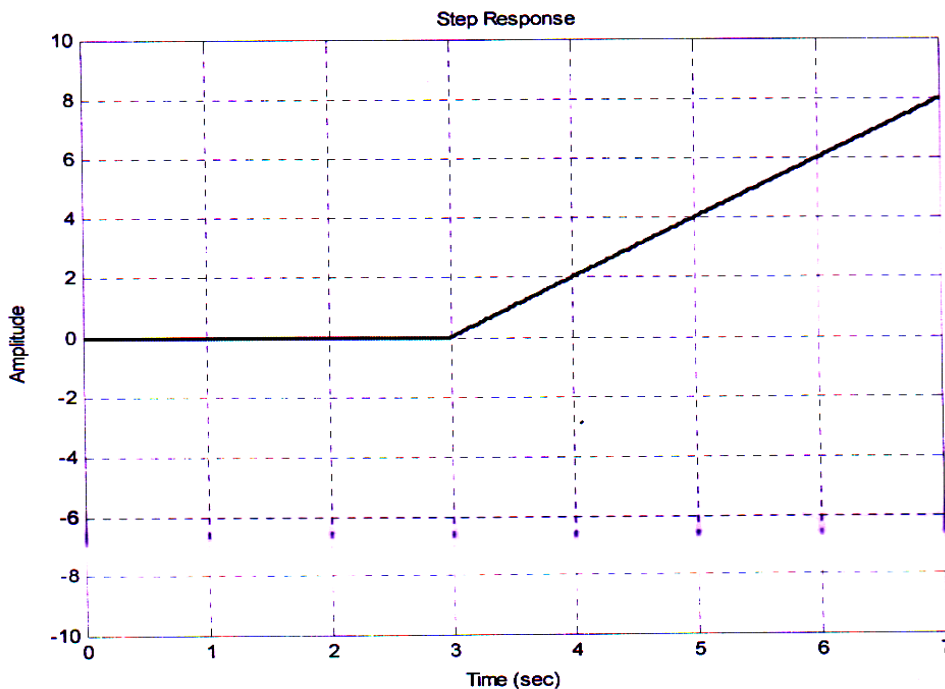
*Time : 3 Hours]*

*[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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

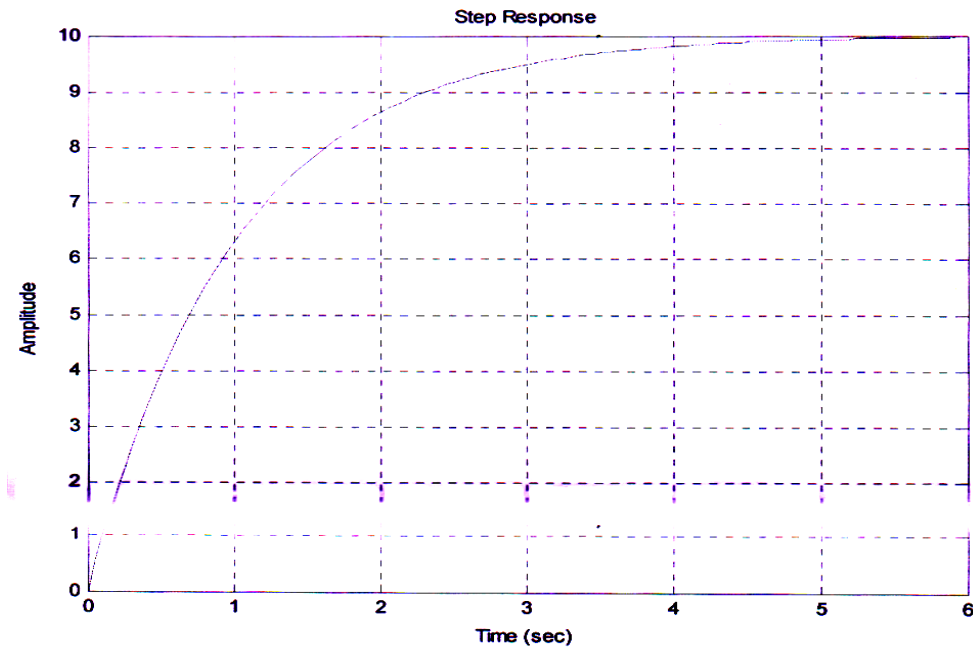
**Q1)** a) The step response of a model is shown below. Using suitable technique identify the model. **[5]**



b) Write a short note on nyquist Stability Criterion. **[5]**

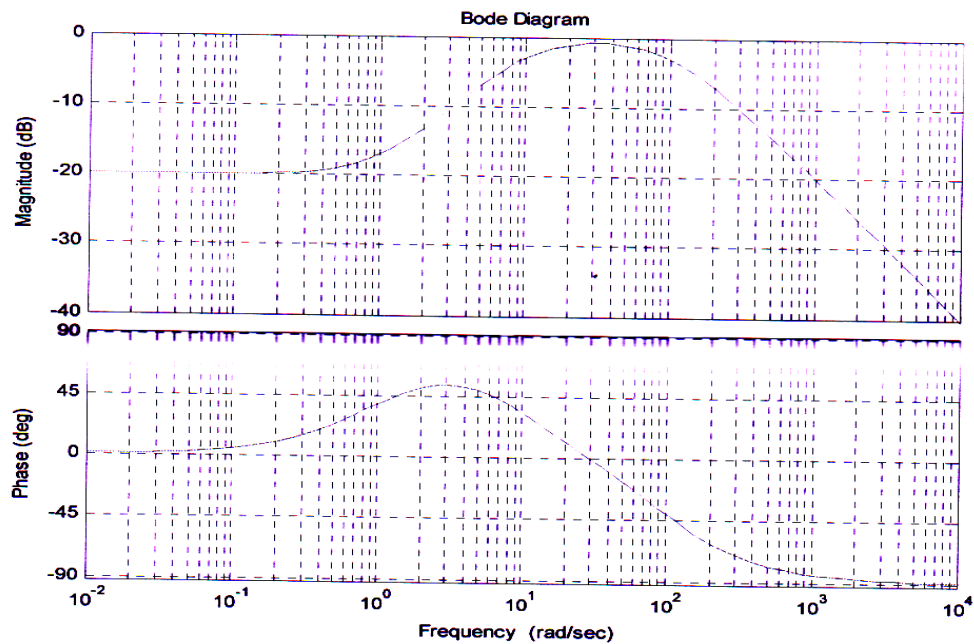
*P.T.O.*

Q2) a) The step response of a model is shown below. Using suitable technique identify the model. [5]



b) List the procedure for sketching the Bode Plot. [5]

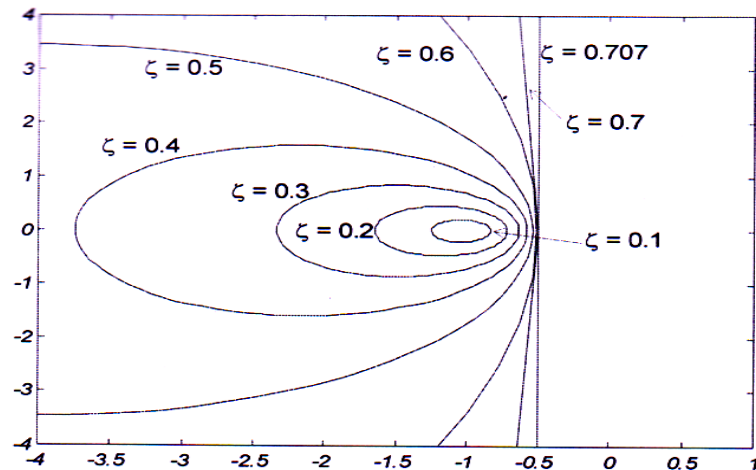
Q3) a) Determine the approximate value of Gain and the Phase margin from below plot. [5]



b) Discuss the importance of the "Integral" term in a PID control? [5]



- Q4)** a) Determine the maximum amplitude of the closed loop for below values of damping. [4]



- b) Derive the transfer function of a Proportional derivative control in parallel form. [6]

- Q5)** a) Write a short note on Actuator Windup. [5]

- b) Using the ZN step response method determine the gains as well as the transfer function of the PID control. Assume  $a=0.218$  and  $L=0.806$ . [5]

- Q6)** a) Write a short note on Internal Model Controller. [5]

- b) Write a short note on Loop Shaping. [5]

- Q7)** a) Write down the equations for, and discuss the relationship between Sensitivity and Gain Margin. [4]

- b) Discuss the advantages offered by Kappa Tau tuning technique W.R.T the ZN tuning. [6]



Total No. of Questions : 8]

SEAT No. :

P6571

[Total No. of Pages :2

[5872]-357

**M.E. Mechanical (Mechatronics)**  
**INDUSTRIAL DRIVES & ACTUATORS**  
**(2017 Pattern) (Semester-II) (502809)**

*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 generalized treatment of Speed torque conventions and multi quadrant operation of Electric Drive. **[10]**

**Q2) a)** Explain Constant torque constant speed characteristics of separately excited DC motor. **[5]**

b) Explain Working principle of DC servo drive. **[5]**

**Q3) a)** Explain basic principle of operation of three phase induction motor and draw its equivalent circuit. **[5]**

b) Explain variable voltage variable frequency speed control method of three phase induction motor. **[5]**

**Q4) a)** Explain construction and working principle of synchronous motor. **[5]**

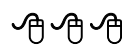
b) Explain the considerations in matching power Electronic converter and motor for selecting Electric Drive. **[5]**

**Q5) a)** Explain any four center positions of direction control valve with significance. **[5]**

b) Explain bleed off circuit with applications and limitations. **[5]**

**P.T.O.**

- Q6)** a) Enlist any four significant factors to be considered while choosing hydraulic fluid medium. [6]
- b) Explain the effect of incorrect alignment of hydraulic cylinder during installation. [4]
- Q7)** a) Explain the application of sequence valve and pressure relief valve in industrial hydraulic circuits. [5]
- b) Comparison between Air motor and electric motor. [5]
- Q8)** Answer any two: [10]
- a) What do you mean Active and Passive torque? Explain it briefly.
- b) Explain Constant torque constant speed characteristics of DC series motor.
- c) Comparison between Air motor and electric motor.
- d) Write a short note on Unloading Valve.



Total No. of Questions : 8]

SEAT No. :

P3177

[Total No. of Pages : 2

[5872]-358

**M.E. (Mechatronics) (Mechanical)**

**MICROCONTROLLER APPLICATIONS IN EMBEDDED  
SYSTEMS**

**(2017 Pattern) (Semester - III) (602813)**

*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) Explain with neat diagram block diagram of PIC18F microcontroller.[6]

b) List and explain the instructions used for logic operations of PIC microcontroller. [4]

**Q2)** a) What is Integrated Development Environment (IDE)? What are the different tools in IDE? [5]

b) With neat diagram explain support devices of PIC18F microcontroller.[5]

**Q3)** a) What are different types of conditional and unconditional branch instructions? [6]

b) Explain the result after the execution of the following instructions. Identify the status of flags. [4]

MOVLW 5AH

ADDLW 9FH

*P.T.O.*

- Q4)** a) What is subroutine? Illustrate with example. [5]  
b) With neat circuit diagram, explain interfacing of seven segment display to PIC microcontroller. [5]
- Q5)** a) With neat circuit diagram, how push buttons are interfaced to PIC microcontroller? [5]  
b) What are Interrupts? Explain different types of interrupts. [5]
- Q6)** a) List different timers used in PIC18F microcontroller. [5]  
b) Why Digital to Analog conversion is required? Explain any one method in detail. [5]
- Q7)** a) Explain basic concepts in serial communication. [5]  
b) Explain with block diagram Serial Peripheral Interface serial protocol.[5]
- Q8)** a) Discuss the software aspect of Embedded system design by considering Time and Temperature monitoring System (TTMS) as a case study.[6]  
b) Explain the features of embedded systems. [4]



Total No. of Questions : 8]

SEAT No. :

**P6572**

[Total No. of Pages : 2

**[5872]-359**

**M.E. Mechanical (Mechatronics)  
FLEXIBLE MANUFACTURING SYSTEMS  
(2017 Pattern) (Semester - III) (602814)**

*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) a)** Explain briefly material handling function that must be provided in a manufacturing system. **[5]**

b) Explain features of NC machining center used to reduce nonproductive time in work cycle. **[5]**

**Q2) a)** Explain the effect of poor quality parts on the performance of an automated assembly system. **[4]**

b) Why are continuous work transport systems uncommon on automated production lines? **[6]**

**Q3) a)** What is difference between a hierarchical structure and chain-type structure in classification and coding scheme. **[4]**

b) Five machines constitute a GT cell. The From/To data for machines are shown in the table. **[6]**

i) Determine the most logical sequence of machine for this data and construct the network diagram, showing where and how many parts enter and exit the system.

ii) Compute the percentage of in-sequence moves, bypassing moves, and backtracking moves in the solution.

**P.T.O.**

iii) Develops a feasible layout plan for the cell based on the solution.

	To				
From	1	2	3	4	5
1	0	10	80	0	0
2	0	0	0	85	0
3	0	0	0	0	0
4	70	0	20	0	0
5	0	75	0	20	0

**Q4) a)** Write short notes on quantitative Analysis of FMS. [5]

b) Explain the terms Process Variability and Process capability with suitable example. [5]

**Q5) a)** Enlist Applications and Benefits of FMS. [5]

b) Explain the procedure used for quantitative analysis of Cellular Manufacturing. [5]

**Q6)** Write NC part program for the part shown in Fig.1. Assume suitable data. [10]

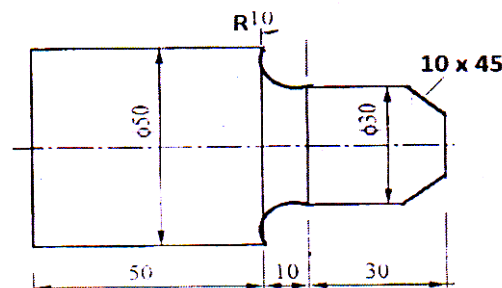


Fig. 1. Q.No. 6

**Q7) a)** Explain the role of Taguchi Method in Quality Engineering. [5]

b) Explain P-chart and C-chart in Quality Control. [5]

**Q8)** Write short notes on :

a) Material Requirement Planning. [5]

b) Shop Floor Planning. [5]



Total No. of Questions : 3]

SEAT No. :

**P6767**

[Total No. of Pages : 2

**[5872]-361**

**M.E. (Printing Engineering & Graphic Communication)**

**PROBABILITY, STATISTICS AND REGRESSION  
ANALYSIS**

**(2017 Pattern) (Semester - I) (508101)**

*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 Random Variables and it's functions. **[18]**

OR

For a Printing firm, a group needs to be formed comprising of 3 Shift Incharge, 4 Operators, 2 Statisticians and 1 Production Manager. **[18]**

- a) What is the probability that each of 4 is represented in the group.
- b) What is the probability that the group comprises of 1 Production Manager and at-least 1 Shift Incharge.

OR

Plot Main Effect for the following : **[18]**

Anilox Volume (cm <sup>3</sup> /m <sup>2</sup> )	Coat Volume (cm <sup>3</sup> /m <sup>2</sup> )	$\Delta E_{ab}$
4.5	6.3	8.65
4.5	6.3	8.99
4.5	6.3	8.81
4.5	6.3	8.88
4.5	6.3	8.85
5	12.5	7.08
5	12.5	7.43
5	12.5	7.1
5	12.5	5.73
5	12.5	6.84

**P.T.O.**



OR

Explain the correlation between the input variables (Press Speed and Viscosity) and output response (Density) [18]

Press Speed (m/min.)	Viscosity (sec)	Density
100	18	1.57
100	20	1.66
100	22	1.73
200	18	1.55
200	20	1.65
200	22	1.69
300	18	1.5
300	20	1.58
300	22	1.63

Q2) Correlate between CTP's and CTQ's with an example. [16]

OR

Calculate and Plot the X-Bar and R-Bar for the following. [16]

Sample No.	1	2	3	4	5	6	7	8
Bond Strength	530	598	660	599	553	617	650	618

Subgroup Size : 2,  $A_2 = 1.88$ ,  $D_3 = 0$ ,  $D_4 = 3.267$ ,  $d_2 = 1.128$

Q3) Explain in detail different methods of Design of Experiments. [16]

OR

Explain the importance of DOE in Printing. [16]

□□□

Total No. of Questions : 3]

SEAT No. :

**P7005**

[Total No. of Pages : 1

**[5872]-365**  
**M.E. (Printing)**  
**COLOUR SCIENCE**  
**(2017 Pattern) (Semester - II) (508107)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Assume suitable data wherever necessary.*
- 3) Figure to the right indicate full marks.*
- 4) All questions are compulsory.*

**Q1)** Write short notes on :

**[18]**

- a) Acceptability versus perceptability.
- b) Assessment method using instruments.

**Q2)** Explain following with diagram :

**[16]**

- a) Formation of an image by human eye
- b) Simultaneous contrast

**Q3)** a) What are causes of metamerism?

b) What are effects of metamerism?

c) What is degree of metamerism?

d) What is index of metamerism?

**[16]**



Total No. of Questions :6]

SEAT No. :

**P7004**

**[5872]-366**

[Total No. of Pages : 1

**M.E. Printing Technology**  
**WEB HANDLING ON PRESS**  
**(2017 Pattern) (Semester-II) (508108)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

- Q1) a)** State different problems occurring due to static on any web press. Explain working of an antistatic device to be used for these problems. [9]
- b) What is the significance of corona treatment? Explain any one methodology of treatment done for plastic films. [9]

OR

- Q2) a)** Write short notes on: [8]
- i) Load cells
  - ii) Brakes in infeed
  - iii) Dancer rollers for web tension

- Q3) a)** Explain procedure to check and control registration during printing in a gravure press. [8]
- b) Where is the position of compensator roller? State the significance of the compensator roller for registration purpose. [8]

OR

- Q4) a)** What is the purpose of web guide rollers in a gravure press. How do metal surface rollers and rubber surface rollers differ in web tensions? [16]

- Q5) a)** What is Static and Dynamic balancing. How is it measured and calculated? [16]

OR

- Q6) a)** State the surface structures of rollers used as web transport rollers. [8]
- b) How is the deflection in the transport rollers measured? What problems occur due to deflection in rollers. [8]



Total No. of Questions : 6]

SEAT No. :

P6573

[Total No. of Pages : 1

[5872]-367

**M.E. (Printing Engg. & Graphic Communication)**

**SUBSTRATES AND INKS**

**(2017 Pattern) (Semester - II) (508109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Solve Questions Q1 or Q2, Q3 or Q4 and Q5 or Q6.*
- 3) *Assume suitable data, wherever necessary.*
- 4) *Figures on right indicate marks.*

**Q1) a)** Explain Paper manufacturing and dewatering stages with suitable diagrams. **[9]**

b) What is Hydrogen bonding mechanism & What is outcome? **[9]**

OR

**Q2) a)** What are Fluorescent Inks? **[9]**

b) Give typical formulation of Gravure ink. **[9]**

**Q3)** What is costing? State and explain various elements of costing with appropriate examples. **[16]**

OR

**Q4)** Calculate the total quantity of paper required in the size  $45.5 \times 58.5$  cms for printing monthly magazine 500 copies in the size  $210 \text{ mm} \times 297 \text{ mm}$  assuming the magazine contains 32 pages. **[16]**

**Q5)** Comment on VOC and its significance in printing inks. **[16]**

OR

**Q6)** State & Explain Quality control Tests for Substrare and Ink. **[16]**



Total No. of Questions : 3]

SEAT No. :

**P6768**

[Total No. of Pages : 1

**[5872]-368**

**M.E. (Printing Engineering and Graphic Communication)**

**608101 : PRINTED ELECTRONICS AND RFID**

**(2017 Pattern) (Semester - III)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn wherever necessary.*
- 2) Assume suitable data, wherever necessary.*
- 3) Figures on right indicate marks.*

**Q1) a) Comment on following (any three) [12]**

- i) Wearable Electronics.
- ii) Traditional Electronics manufacturing Methods.
- iii) Screen printing parameters for printing electronics.
- iv) Inkjet printing methods for electronics manufacturing.

**b) Discuss functional layers used in printing electronics. [6]**

**Q2) Discuss Identifying and Tagging Everything with upcoming changes in technology. [16]**

**Q3) Discuss use of printed electronics as POS. [16]**



[5872]-371

**M.E. (Production Engineering (CAD/CAM) /Production  
Engineering (Manufacturing & Automation)  
MATHEMATICS AND STATISTICS  
(2017 Pattern) (Credit System) (Semester - I) (511101)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates :*

- 1) Answer any 5 questions out of 8 questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figure 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 an analytic function with constant magnitude is constant. [5]

b) Evaluate,  $\int_C \frac{2z+1}{z(z+1)} dz$  where C is the circle  $|z| = \frac{1}{2}$ . [5]

**Q2)** a) A mass, suspended at the end of a light spring having spring constant  $k$ , is set into vertical motion. Use Lagrange's equation, to find the equation of motion of the mass. [5]

b) Find the extremals of the functional [5]

$$\int_{x_1}^{x_2} (y'^2 / x^3) dx$$

**Q3)** a) Solve the partial differential equation [5]

$\nabla^2 u = -10(x^2 + y^2 + 10)$  over the square  
with sides  $x = 0 = y$ ,  $x = 3 = y$  with  $u = 0$   
on the boundary and the mesh length = 1.

b) Write-down the General second order partial differential equation and its classification in two independent variables.

Also classify the following equation

$$u_{xx} + 4u_{xy} + 4u_{yy} - u_x + 2u_y = 0 \quad [5]$$

P.T.O.

**Q4)** a) By using series expression for  $J_n(x)$  derive

$$J_n(x) = \frac{x}{2n} [J_{n-1}(x) + J_{n+1}(x)] \quad [5]$$

b) Show that Rodrigueg's formula is given by

$$P_n(x) = \frac{1}{n!2^n} \frac{d^n}{dx^n} (x^2 - 1)^n \quad [5]$$

**Q5)** a) A machinist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts show a mean diameter 0.742 inch with a standard deviation of 0.04 inch. On the basis of this sample, would you say that the work is inferior? Given that  $t$  at 5% level of significance for 9 degrees of freedom is  $t_{0.05} = 2.262$ . [5]

b) A set of five similar coins is tossed 320 times and the result is

No of heads :	0	1	2	3	4	5
Frequency :	6	27	72	112	71	32

Test the hypothesis that the data follow a Binomial distribution

Given for 5 degrees of freedom  $\chi_{0.05}^2 = 11.07$  [5]

**Q6)** a) Discuss the transformation [5]

$$w = \sqrt{z}$$

b) The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured, find the probability that [5]

- i) Exactly two will be defective
- ii) At least two will be defective

**Q7)** a) Fit a Poisson distribution to the set of observations : [5]

$x:$	0	1	2	3	4
$f:$	46	38	22	9	1

b) Prove that the following function

$$u = e^x \cos y + x^2 - y^2 \text{ is harmonic}$$

Also find the conjugate function  $v$  and corresponding analytic function  $u+iv$ . [5]

**Q8)** a) A continuous random variable has probability density function

$$f(x) = ke^{-x/5}, x \geq 0$$

= 0 else where,

Find the value of  $k$  [5]

b) Find the mean recurrence time for each state of the following Markov chain

$$P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.4 & 0.4 \\ 0.1 & 0.5 & 0.4 \end{bmatrix} \quad [5]$$





Total No. of Questions : 8]

SEAT No. :

P3178

[Total No. of Pages : 2

[5872]-373

M.E. (Production) (CAD/CAM)

COMPUTER AIDED DESIGN

(2017 Pattern) (Credit System) (Semester - I) (511301)

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 is parametric representation of geometrical entities used in CAD software? Explain your answer with non-parametric and parametric equations of appropriate geometric entity. [5]

OR

Q2) Discuss the stages in product life cycle and the importance of each stage. [5]

Q3) What is Homogeneous Coordinate System? Explain the necessity of Homogeneous Coordinate System for transformation of geometric entities using suitable examples. [5]

OR

Q4) Differentiate between STEP and IGES. [5]

Q5) The coordinates of four points are given by  $P_0 = [2 \ 2 \ 0]^T$ ,  $P_1 = [2 \ 3 \ 0]^T$ ,  $P_2 = [3 \ 3 \ 0]^T$ ,  $P_3 = [3 \ 2 \ 0]^T$ . Find the equation of Bezier curve. Also find the points on the curve for  $u = 0, 0.25, 0.5, 0.75$  and 1, also plot the curve for the given data. [7]

OR

Q6) Write the mathematical representation, application & limitations of the following surfaces. [7]

- a) Spherical surfaces
- b) Composite surface

P.T.O.

- Q7)** a) Discuss in brief the basic elements of CSG model. Explain the main building operation of CSG scheme with examples. [8]  
b) What is Z-buffer algorithm for B-REP and CSG model? [7]
- Q8)** Write short note on any three : [18]  
a) Wire frame modeling  
b) Hidden line removal algorithm  
c) CAD/CAM integration  
d) Parametric programming  
e) Types of animations



Total No. of Questions : 6]

SEAT No. :

P3179

[Total No. of Pages : 2

[5872]-374

**M.E. (Production) (CAD/CAM)**  
**COMPUTER AIDED MANUFACTURING**  
**(2017 Pattern) (Semester - I) (511302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

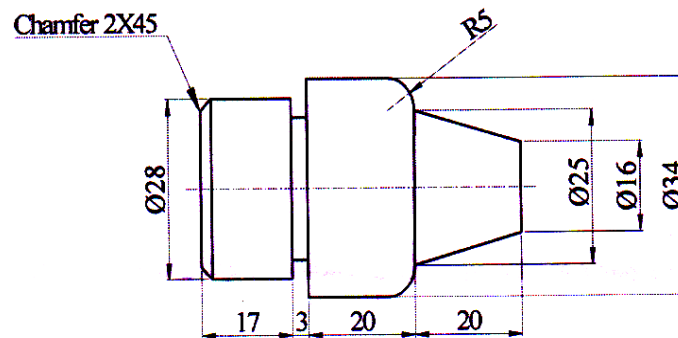
- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, and Q.5 & Q.6 are compulsory.*
- 2) *Assume suitable data, if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** a) Explain in short virtual manufacturing. **[5]**

b) Explain principle of rolling guide ways in CNC machines. **[5]**

OR

**Q2)** Write NC program for the following job and also explain the meaning of each step (block). **[10]**



**Q3)** a) Explain CNC-Press in detail. **[5]**

b) Explain working principle of automatic welding machine with block diagram. **[5]**

OR

*P.T.O.*

- Q4)** a) Explain various types of conveyors used in automated material handling system. [5]
- b) Explain Automated Guided Vehicle (AGV) system. [5]
- Q5)** a) Write short note on machine vision. [7]
- b) What is mean by automatic inspection? Explain in short contact and non-contact method of inspection. [8]
- Q6)** a) Explain use of bar code system for shop floor data collection. [8]
- b) Write note on future automated factory and its impact on society. [7]



Total No. of Questions : 8]

SEAT No. :

P3180

[Total No. of Pages : 2

[5872]-375

**M.E. Production (CAD/CAM)/Production (Manufacturing  
and Automation)**

**COMPUTER INTEGRATED MANUFACTURING**

**(2017 Pattern) (Semester - II) (511305)**

*Time : 3 Hours]*

*[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) *Q.7 and Q.8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self - explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data if necessary.*

**Q1)** What are the different levels of Integration against evolution of CIM? Explain. [5]

OR

**Q2)** What are the components of PLM software? Explain. [5]

**Q3)** What is a relational database? Describe the architecture of database management system. [5]

OR

**Q4)** What are the benefits of GT to the manufacturing industry? [5]

**Q5)** What is a FMC? How does FMC ensure flexibility in manufacturing? [7]

OR

**Q6)** Which are the typical sensors that are normally used in robot? Explain. [7]

**P.T.O.**

**Q7) a)** What are the components of small local area network in CIM setup? Explain. [8]

b) What are the communication interfaces used in computer-to-computer communication? Explain in brief. What are the commonly used interface cards? [7]

**Q8) Write short notes on any three :** [18]

a) GKS implementation in a CAD workstation

b) ESPRIT - CIM OSA model

c) Data associated with FMC

d) ASRS



Total No. of Questions : 8]

SEAT No. :

P3181

[Total No. of Pages : 3

[5872]-376

**M.E. Production (Manufacturing & Automation) /  
Production (CAD/CAM)**

**ARTIFICIAL INTELLIGENCE AND ROBOTICS (511306)**

**(Semester - II) (2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Explain the following terms associated with robot : **[6]**

i. Program resolution ii. Control resolution iii. Precision

b) Explain with neat sketch SCARA robot configuration. **[4]**

**Q2) a)** The coordinates of the point p on the body are given by [1, 2, 3] T. Rotate the body about y axis by  $60^\circ$  and then about x axis by  $30^\circ$ . Find the new coordinates of the point p with respect to the fixed frame. **[4]**

b) Carry out forward kinematic analysis of 3 DOF serial planar manipulator. **[6]**

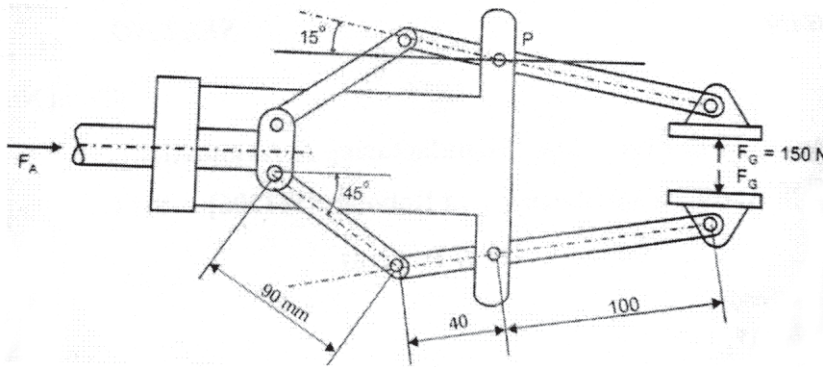
**Q3) a)** For a pick and place type of robot, the link parameters table is given below. Determine the location of the end point of the link 3 w.r.t. to the base. **[6]**

i	$\alpha_{i-1}$	$a_{i-1}$	$d_{i-1}$	$\theta_{i-1}$
1	90	2	0	$45^\circ$
2	0	0	2	$60^\circ$
3	0	10	0	$30^\circ$

**P.T.O.**

- b) It is desired to have the first joint of a six axis robot to go from initial angle of  $20^\circ$  to a final angle of  $65^\circ$  in 7 seconds. Using a third order polynomial, calculate the joint angle at 1, 2, 3 and 4 seconds respectively. Draw suitable graph. [4]

- Q4) a)** Fig. Shows linkage mechanism and the gripper dimensions used to handle a work-piece for a machining operation. The gripping factor is required to be 150N. Calculate this required actuating force  $F_A$  applied to plunger. P is pivot point in a mechanism. [7]



- b) Explain working principle of magnetic gripper. [3]

- Q5) a)** Describe the Trajectory planning schemes. [4]

- b) Write and explain a robot program for nut and bolt assembly. [6]

- Q6) a)** The  $7 \times 87$  array of pixels indicating each element as the gray level of pixel is given below. i) Construct the histogram and find threshold value. ii) Convert it into black and white image. iii) Perform shape analysis (first and second order moments, centroids, run length encoding, principal angle [6]

13	13	10	15	15	14	11
9	11	14	16	15	15	14
8	13	14	17	15	15	11
7	11	15	16	15	15	14
7	14	14	14	14	14	14
8	7	6	12	12	8	8
96	7	8	10	11	12	13



- b) Write a short note on passive sensors. [4]
- Q7)** a) Explain briefly various robot teaching methods. [6]  
b) How Does AI Works? Explain with suitable example. [4]
- Q8)** a) Explain with neat sketch the working of optical encoder. [5]  
b) Write not on artificial neural networking. [5]



Total No. of Questions : 6]

SEAT No. :

P3182

[Total No. of Pages : 2

[5872]-377

**M.E. (Production) (CAD/CAM)**  
**COMPUTATION TECHNIQUES IN CAD/CAM**  
**(2017 Pattern) (Semester - II) (511307)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, and Q.5 & Q.6 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 in short the steps in static analysis. [4]**

b) Describe dynamic analysis in FEA. [6]

OR

**Q2) a) Explain in short photoelastic method of stress analysis. [5]**

b) What are classification of fatigue testing machines and explain any one? [5]

**Q3) a) What is discretization? Any one method of numerical discretization. [5]**

b) Explain in short numerical method for convection. [5]

OR

**Q4) a) Solve the following differential equation using Euler's method [5]**

$$\frac{dy}{dx} = 1 + xy$$

Given :  $y(0) = 1$  and

Also find  $y$  for  $x = 0 (0.1) 0.5$

**P.T.O.**

- b) Apply Runge Kutta method of 4<sup>th</sup> order to solve differential equation [5]

$$\frac{dy}{dx} = x + y^2, \quad y(0) = 1$$

to find  $y$  for  $x = 0.2$  with  $h = 0.1$

**Q5)** Write short note on (any three) [15]

- a) Integer programming.
- b) Gradient base method.
- c) Direct search methods.
- d) Point elimination methods.

**Q6)** a) Solve the following unconstraint non-linear optimization problem using Simulated Annealing (SA) (only one Iteration) [7]

$$\min(z) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2 + 0.1[(x_1 - 3)^2 + (x_2 - 2)^2]$$

Subjected to :

$$-6 \leq x_1, x_2 \leq 6$$

b) Minimize [8]

$$f(x_1, x_2) = x_1^2 + x_2^2 - 2x_1 - 4x_2 + 5$$

Such that

$$0 \leq x_1, x_2 \leq 4$$

Using Steepest Descent (Cauchy) method. Perform first iteration only.

Assume initial point as  $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$



Total No. of Questions : 6]

SEAT No. :

**P3184**

[Total No. of Pages : 2

**[5872]-379**

**M.E. (Production) (CAD/CAM)**  
**COMPUTER AIDED PROCESS PLANNING**  
**(2017 Pattern) (Semester - III) (511311)**

*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) Discuss briefly types of forecast errors. [5]  
b) Describe the software used for design of facility layout. [5]

OR

- Q2)** a) Explain application of rank order clustering algorithm. [5]  
b) State the purpose of design rationalization with suitable application. [5]

- Q3)** a) Briefly describe various measures of performance in multiple machine scheduling problem with independent jobs. [5]  
b) Explain with neat block diagram of MRP-II and its component. [5]

OR

- Q4)** a) What is capacity planning? Explain with suitable example. [6]  
b) Discuss MRP-I (Manufacturing Resource Planning). [4]

*P.T.O.*

- Q5)** a) The demand for the product for last 10 years is given below. Estimate the demand for next two years by regression method. **[8]**

Year	2010	2011	2012	2013	2014	2014	2015	2016	2017	2018	2019	2020
Units	152	145	124	169	179	157	112	172	171	170	172	172

- b) Explain ERP system model. **[7]**
- Q6)** Write short notes on the following : **[15]**
- a) Exponential Smoothing Generic model for ERP.
  - b) Distributed control system.
  - c) Data collection techniques.



Total No. of Questions : 8]

SEAT No. :

P6575

[Total No. of Pages : 2

[5872]-382

**M.E. (Production Engineering) (Manufacturing and Automation  
Engg.) (CAD/CAM)**

**RESEARCH METHODOLOGY  
(2017 Pattern) (Semester - I) (511102)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
- 2) *Figure to the right indicates full marks.*
- 3) *Neat diagrams should be drawn whenever necessary.*
- 4) *Assume Suitable data, if necessary.*
- 5) *Use of Logarithmic tables slide rule is Electronic pocket calculator is allowed.*

**Q1)** a) What do you mean by "Research"? Explain its significance in modern times. [4]

b) Describe the different types of research, clearly pointing out the difference between an "experimental" and a "survey". [5]

OR

**Q2)** a) Write a short note on a "Criteria of a good research". [4]

b) Compare types of research approaches. [5]

**Q3)** a) Explain the "meaning" and "significance" of a research design. [4]

b) Explain the meaning of the following in the context of 'Research design'. [5]

- i) Extraneous variables
- ii) Confounded relationship
- iii) Experimental and control groups.

OR

**Q4)** a) Discuss on Design of Experiment. Why it is required. [4]

b) Compare methods of research design with each other. [5]

*P.T.O.*

- Q5)** a) Elaborate various types of data collection methods. [8]  
b) Brief on choice of data collection methods. [8]

OR

- Q6)** a) Brief on devices used in data collection. Explain any two devices. [8]  
b) What is sampling theory,? Describe its significance. [8]

- Q7)** a) Describe matrix approach. in detail. [8]  
b) What is layout of research report? How its study is significant? [8]

OR

- Q8)** Write a short notes on (Any 2) : [16]  
a) TOPSIS  
b) Significance of report writing  
c) Genetic algorithms.,  
d) Analytical Hierarchy Process (AHP)



Total No. of Questions : 8]

SEAT No. :

**P3185**

[Total No. of Pages : 2

**[5872]-383**

**M.E. (Production Engineering)**

**ADVANCED MANUFACTURING PROCESSES**

**(2017 Pattern) (Semester - I) (511103)**

*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) Explain with sketch mechanism of melting and solidification during sand casting. [4]
- b) Explain briefly injection blow molding process with neat sketch. [4]
- c) List out the limitations of conventional machining processes. [2]
- Q2)** a) Explain with neat sketch working principle of ultrasonic machining. [4]
- b) Describe important characteristics of heat affected zone in EDM. [4]
- c) List out important blow molding defects with their remedies. [2]
- Q3)** a) Explain with neat sketch working principle of Electro discharge machining. [4]
- b) Explain any four arc welding defects with their causes and remedies. [4]
- c) Differentiate between destructive and Non-destructive testings. [2]
- Q4)** a) Describe principle of material removal, advantages and limitations of ECM. [5]
- b) Explain various arc welding defects with their causes and remedies. [5]

*P.T.O.*



- Q5)** a) A wire of 20 mm diameter is to be reduced to 10 mm diameter. The die angle is  $15^\circ$  and the coefficient of friction at dies and wire interface is 0.5. The flow stress of wire material is  $340 \text{ N/mm}^2$ . Determine drawing stress and drawing load if the drawing speed is 0.7 m/s. [4]
- b) Explain metal high speed hot forging with neat sketch. [4]
- c) List out various the non-conventional forming processes. [2]
- Q6)** a) Explain metal stretch forming with neat sketch. [4]
- b) Explain high energy rate forming with neat sketch. [4]
- c) Differentiate between hot forming and cold forming. [2]
- Q7)** a) Explain important process parameters of electro-hydraulic forming. [4]
- b) A tube of 20 mm external diameter and 1.5 mm thickness is to be reduced to 16 mm external diameter and 0.5 mm thickness. The die angle is  $24^\circ$  and plug angle is  $16^\circ$ . The coefficients of friction at die and tube interface and tube and plug (mandrel) interface is 0.5. The flow stress of tube material is  $340 \text{ N/mm}^2$ . The tube drawing is carried at a speed of 0.4 m/s. Calculate the fixed plug. [4]
- c) What is high speed blanking? [2]
- Q8)** a) Explain forming limit diagram. [5]
- b) Explain various rolling problems. [5]



Total No. of Questions : 8]

SEAT No. :

P3186

[Total No. of Pages : 2

[5872]-384

**M.E. (Production Engineering) Manufacturing and Automation**  
**INDUSTRIAL AUTOMATION**  
**(2017 Pattern) (Semester - I) (511104)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*
- 4) *Use of logarithmic Tables, Slide rule is Electronic pocket calculator is allowed.*
- 5) *Solve any 5 questions.*

**Q1) a)** For a swash plate type of pump following data operates: [6] Number of pistons = 6 Piston diameter = 25 mm Pitch circle diameter of the cylinder = 180 mm. Input power = 8 KW.  $\gamma$  Volumetric efficiency = 90% Mechanical efficiency = 89 Calculate theoretical pump displacement and angle of swash plate if maximum pressure and speed at which pump operates is 200 bar and 1000 rpm respectively. [6]

b) Explain with neat sketch pressure compensated flow control valve. [4]

**Q2)** Draw the suitable pneumatic circuit using cascade system to actuate cylinder 'A', cylinder 'B' and cylinder 'C' as per following sequence: i) Cylinder A extends ii) Cylinder B extends iii) Cylinder C extends iv) Cylinder A retracts v) Cylinder C retracts vi) Cylinder B retracts [10]

**Q3)** Write short notes on :

a) Design aspects of hydraulic accumulator. [5]

b) Selection criteria for P, PI, and PID controllers. [5]

**P.T.O.**

- Q4)** a) A feeder selector device at one of the stations of an automatic assembly machine has a feed rate of 25 parts/min and provides a throughput of one part in four. The ideal cycle time of the machine is 10 sec. The feeder stops for 20 parts in feed track and will starts while 10 parts in feed track. Determine how long will it take for the feeder to turn on once it is turned off and how long it will take to turn off once it is turned on? [6]
- b) List Out the Different Types of Feeder. [4]

**Q5)** Write a short note on following :

- a) Automated Guided Vehicles. [5]
- b) Design aspects of hydraulic accumulator. [5]

- Q6)** a) Describe in brief Robot co-ordinate systems, Position, path and speed control systems. [6]
- b) Explain robot programming languages. [4]

**Q7)** Explain the Concept of the Following :

- a) Selection criteria for P, PI, and PID controllers. [5]
- b) Working Principle of PLC in packing of Ice can [5]

**Q8)** Write short notes on:

- a) Explain AI in manufacturing systems. [5]
- b) Collision free motion planning for robots. [5]



Total No. of Questions : 8]

SEAT No. :

**P3187**

[Total No. of Pages : 2

**[5872]-387**

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

**ADDITIVE MANUFACTURING**

**(Credit System) (2017 Pattern) (Semester - II) (511109)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of electronics pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a) Classify the different additive manufacturing processes. [4]**

b) Explain STL format, how it works for additive manufacturing. [5]

OR

**Q2) a) What are the different tooling used in additive manufacturing? [4]**

b) Explain the use of plastic as additive manufacturing material. [5]

**Q3) a) Explain the tool path generation in additive manufacturing? [4]**

b) Explain the different materials used in additive manufacturing. [5]

OR

**Q4) a) Explain the model reconstruction in additive manufacturing. [4]**

b) Explain with neat sketch different steps in additive manufacturing. [5]

**Q5) a) Explain solid ground curing process with respect to its principle, advantages, disadvantages and applications. [8]**

b) Explain the medical and Bio-Additive manufacturing applications, advantages and disadvantages. [8]

OR

**P.T.O.**

- Q6)** a) Differentiate between three dimensional printing and selective laser sintering process. [8]  
b) Write short note on Laser Engineered Net Shaping (LENS) [8]

- Q7)** a) Explain the Stereo-lithography with reference to its working process, advantages and disadvantages. [8]  
b) Explain with neat sketch three dimensional printing process. [8]

OR

- Q8)** a) Explain the solid based additive manufacturing process with reference to its principle, working, advantages and disadvantages. [8]  
b) Explain the Computer Aided Tissue Engineering. [8]



[5872]-388

**M.E. (Production Manufacturing & Automation)**  
**COMPUTATIONAL INTELLIGENCE IN TOOL DESIGN**  
**(2017 Pattern) (Semester - III) (611101)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

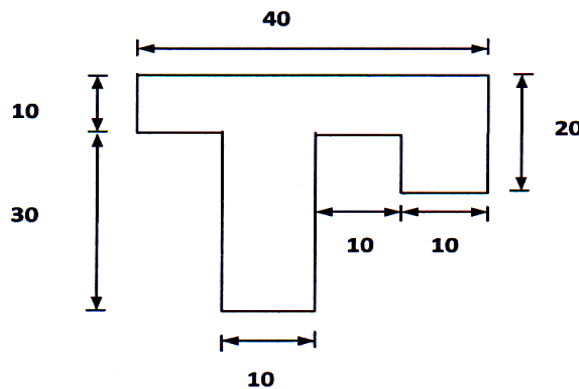
- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** a) Explain different principles to be followed while locating the surfaces with neat sketch. [6]

b) Explain applications of Computer Aided Fixture Design. [4]

**Q2)** a) For the component shown in figure 1. Calculate Percentage utilization of the strip. [6]

(Assume Strip length = 2440 mm, Thickness of strip = 1 mm, shear strength of material 250N/mm<sup>2</sup>)



**Figure 1**

b) For the component shown in figure 1. Calculate Cutting force and Press tonnage. [4]

- Q3)** a) Explain important process variables in forging. [6]  
b) Explain design procedure to design blocking impression in forging. [4]
- Q4)** Write short notes on : [10]  
a) Springback in bending  
b) Types of Strip layout
- Q5)** a) Explain feed system design of Injection molding. [6]  
b) Explain types of cavity and cores of Injection molding. [4]
- Q6)** a) Explain gating system design of die casting process. [6]  
b) Explain elements of Cycle time required for die casting process. [4]
- Q7)** a) Describe optimal design of cooling system of sand casting. [6]  
b) Describe functions of risers in sand casting. [4]
- Q8)** Write short notes on : [10]  
a) Computer aided injection mold design.  
b) Types of die casting dies.



Total No. of Questions : 6]

SEAT No. :

P3189

[Total No. of Pages : 2

[5872]-389

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

**MECHATRONICS**

**(2017 Pattern) (Semester - III) (611102)**

*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 side indicate full marks.*
- 4) *Use of non-programmable calculator is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)* a) Give the significance of mechatronics in day to day life. [5]  
b) Describe the working of Strain Gauges with a neat sketch. [5]

OR

- Q2)* a) Describe force weight sensor with application. [5]  
b) In a certain system, an electric heating element was found to increase the temperature of a piece of metal  $15^\circ$  for each ampere of current. The metal expands 0.001 in /degree and pushes on a load sensor which outputs 1 V/0.005 in. of compression. Find the transfer function of three components and draw block diagram and also determine overall transfer function. [5]

- Q3)* a) Draw pin diagram of a Microcontroller. [3]  
b) Develop a conceptual design of a Light sensors based control system for counting a number of tea packets being packed for dispatch. Assume suitable data if necessary. [7]

OR

*P.T.O.*



- Q4)** a) Describe briefly memory scan and program scan in Programming Logic Controllers. [6]  
b) Explain with suitable example latch circuit. [4]
- Q5)** a) Construct a ladder logic diagram and outline narrative sequence for pneumatic cylinders sequencing as A+B+B–A. [6]  
b) Explain application of PLC system for traffic signal. [9]
- Q6)** Write short notes on the following : [15]  
a) PLC and microcontroller  
b) Microprocessor instruction sets  
c) Advance mechatronics system



Total No. of Questions : 8]

SEAT No. :

P6576

[Total No. of Pages : 2

[5872]-403

M.E. (Artificial Intelligence and Data Science)

ARTIFICIAL INTELLIGENCE

(2020 Pattern) (Semester - I) (510501)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

Q1) Draw and describe the architecture of utility based agent? How it is different from model based agent? [9]

OR

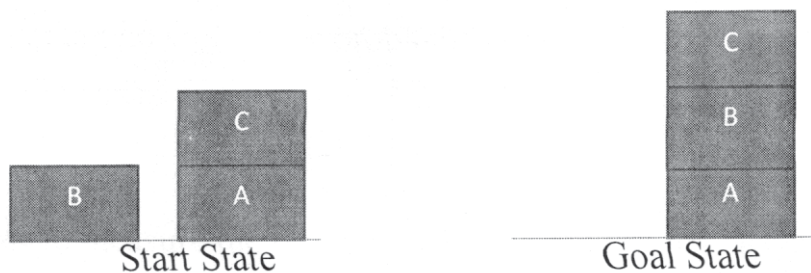
Q2) What are the axioms of Probability? Explain how to derive the useful facts from the basic axioms with a suitable example? Why the probability axioms are reasonable? [9]

Q3) Explain Hill Climbing algorithm. Explain plateau, ridge, local maxima and global maxima. [9]

OR

Q4) What is Reinforcement Learning explain it with example? Elaborate the differences among Reinforcement, Supervised and Unsupervised Learning. [9]

Q5) a) State and explain the partial order plan for the following blocks-word – problem [8]



P.T.O.

- b) Explain the following in the first order logic with a suitable example. [8]
- i) Terms
  - ii) Atomic sentences
  - iii) Complete Sentences
  - iv) Universal Quantifiers
  - v) Existential Quantifiers
  - vi) Nested Quantifiers
  - vii) Connection between Universal and Existential Quantifiers
  - viii) Equality

OR

- Q6) a) Write short Note on [8]
- i) AI application in Healthcare systems
  - ii) AI Application in Banking
- b) Describe the recommendation system. How the recommendation system is implemented using collaborative filtering? [8]

- Q7) a) Comment on Non-Linear Planning and hierarchical Planning. [8]
- b) Explain how planning problem is expressed in STRIPS. [8]

OR

- Q8) a) How to measure the problem solving performance. Explain the depth - limited search performance. [8]
- b) Define Heuristics. Explain 8 Sliding Tile puzzle problem and state the heuristic for 8 Sliding Tile puzzle problem. [8]



Total No. of Questions : 12]

SEAT No. :

P7256

[Total No. of Pages : 2

[5872]-407

M.E.

**VIRTUAL REALITY AUGMENTED REALITY**  
**Artificial Intelligence & Data Science**  
**(2020 Pattern) (Semester - II) (510504)**

*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 the right indicates full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Which major organization used AR as navigation tools? [4]  
b) What is EWK? How its useful in AR? [4]

OR

- Q2)** a) How 2D rotation and 3D rotation works? [4]  
b) Who to Axis angle representation is done? [4]

- Q3)** What is visual Perception and why its important? [8]

OR

- Q4)** How does visual perception used in every day life? [8]

- Q5)** a) What is Instant tracking? Why its important? [5]  
b) What is SLAM? [4]

OR

- Q6)** a) What do you understand outdoor tracking? [5]  
b) How ARVR markers works? [4]

**P.T.O.**

**Q7)** Enlist the advantages of disadvantages of marker based augmented reality? [8]

OR

**Q8)** Explain what is Template marker with example? [8]

**Q9)** Write a short note on : [9]

- a) Unity IDE
- b) VR content creation

OR

**Q10)** Describe overview of game development in unity IDE with examples. [9]

**Q11)** Explain open VR SDK with its Applications. [8]

OR

**Q12)** What do you mean by VR SDK & AR Toolkit? [8]



[5872]-410

**M.E. (Artificial Intelligence and Data Science/Computer Engineering Master of Data Science)**

**DATA SCIENCE**

**Mathematical Foundations for Data Science  
(2017 Pattern) (Semester - I) (510301)**

*Time : 3 Hours]*

*[Max. Marks : 50*

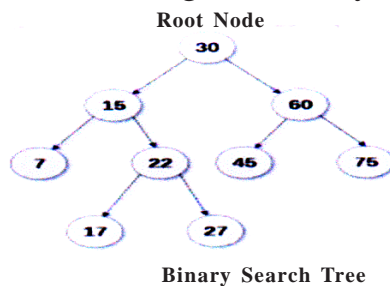
*Instructions to the candidates:*

- 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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a) Prove the following by using Venn diagram [6]**

- i)  $(A \cap B) \cap C = A \cap (B \cap C)$
- ii)  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

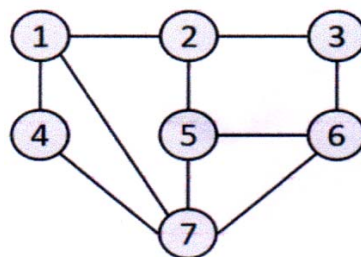
**b) Write Preorder traversal of given Binary Search Tree [3]**



OR

**Q2) a) In a group of 100 persons, 72 people can speak English and 43 can speak French. How many can speak English only? How many can speak French only and how many can speak both English and French? [3]**

**b) Represent following given Graph using adjacency list or Adjacency Matrix. Write Depth First Search Traversal of given graph considering 2 as starting vertex. [6]**



- Q3)** a) For given attribute marks values : [4]  
13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35,  
35, 35, 36, 40, 45, 46, 52, 70.

Compute mean, median, mode standard deviation

- b) Compare Poisson distribution and binomial distribution. [4]

OR

- Q4)** a) Explain following for numerical data using example. [6]

i) Quantile

ii) Five Number summary

- b) A bag contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the bag, if at least one black ball is to be included in the draw? [2]

- Q5)** a) For given attribute marks values : [5]

10, 90, 30, 20, 50, 30, 60, 40, 70, 40, 30, 60, 80, 20

Compute standard deviation, Range, Inter Quartile Range (IQR), five number summary plot it using boxplot.

- b) Explain concept and application of Skewness & Kurtosis. [4]

OR

- Q6)** a) Compute covariance of age and glucose values given below [4]

(Age-1.5, 2, 1.6, 1.2, 1.1) (Glucose -1.7, 1.9, 1.8, 1.5, 1)

- b) Explain any two graphical representation methods for qualitative data. [5]

- Q7)** a) Use these methods to normalize the following group of data :

200, 300, 400, 600, 1000 [4]

1) sz-score normalization, 2) z-score normalization using mean absolute deviation instead of standard deviation

- b) Explain any one Probabilistic models with hidden variables using example. [4]

OR

- Q8)** a) Find correlation of following data set  $x=\{2, 5, 6, 8, 9\}$ ,  $y=\{4, 3, 7, 5, 6\}$ . [3]  
 b) Consider following dataset, predict the class label using naive Bayesian classification for tuple (T, T, T). [5]

A1	A2	A3	Class
T	F	T	P
T	T	F	P
T	T	T	N
T	F	F	P
T	T	T	P
F	F	F	N
F	F	T	N
F	F	F	N
T	T	T	P
T	F	F	N

- Q9)** a) Solve the following system of equations using LU Decomposition method : [4]

$$X_1 + X_2 + X_3 = 1, \quad 4X_1 + 3X_2 - X_3 = 6, \quad 3X_1 + 5X_2 + 3X_3 = 4$$

- b) List the applications of chain rule and discuss any one in detail. [4]

OR

- Q10)** a) Find the eigenvalues of the matrix [4]

$$\begin{bmatrix} 2 & 2 \\ 5 & -1 \end{bmatrix}$$

- b) Explain two forms of Chain Rule. [4]

- Q11)** a) Overfitting and Multicollinearity with respect to regression. [4]

- b) Find linear regression equation for the following two sets of data : [4]

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14



OR

**Q12)** Suppose we have the following dataset with one response variable  $y$  and two predictor variables  $X_1$  and  $X_2$ . Fit a multiple linear regression model to this dataset. **[8]**

$X_1$	60	62	67	70	71	72	75	78
$X_2$	22	25	24	20	15	14	14	11
Y	140	155	159	179	192	200	212	215



Total No. of Questions : 12]

SEAT No. :

P6578

[Total No. of Pages : 2

[5872]-411

**M.E. (Computer Engineering)**  
**BASICS OF DATA SCIENCE**  
**(2017 Pattern) (Semester - I) (510302)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) What is the role of a Data Scientist in the industry? [5]

b) Explain the following data types with examples [4]

- i) Structured and Unstructured Data
- ii) Quantitative and Categorical Data

OR

**Q2)** What is data science? Explain the data science process. [9]

**Q3)** What is Spearman's rank correlation? Calculate the Spearman's rank correlation for the following data and discuss the relationship between sub1 and sub2. [8]

Roll no	Sub 1	Sub 2
1	35	24
2	20	35
3	49	39
4	44	48
5	30	45

OR

**Q4)** Define exploratory data analysis. Explain with an example. [8]

*P.T.O.*

**Q5)** What is simple linear regression? Explain with example. [8]

OR

**Q6)** Write K-nearest Neighbours algorithm. Explain with an example. [8]

**Q7)** a) What is visual encoding in data? Why is it important? [4]

b) Explain types of Data Visualisation. [5]

OR

**Q8)** Explain following bivariate data visualization techniques. [9]

a) Line plot

b) Bar plot

c) Scatter plot

**Q9)** What is recommender system? Explain any one type of recommender system with example. [8]

OR

**Q10)** Explain following similarity with example. [8]

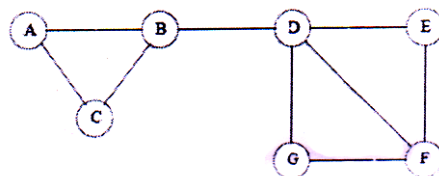
a) Jaccard similarity

b) Pearson similarity

**Q11)** Explain Girvan-Newman Algorithm with example. [8]

OR

**Q12)** Calculate the credit of each edge in Girvan-Newman Algorithm for following graph. Start with vertex E. [8]



Total No. of Questions : 12]

SEAT No. :

**P6579**

[Total No. of Pages : 2

**[5872]-412**

**M.E. (Computer)**

**(Data Science)**

**BIG DATA ANALYTICS**

**(2017 Pattern) (Semester - I) (510303)**

*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) *Figures to the right indicate full marks.*

**Q1)** List the phases of Data Analytics Life Cycle. Explain the Discovery phase in detail with suitable example. **[9]**

OR

**Q2)** In real world data, types with missing values for some attributes are a common occurrence. Discuss the various method of preprocessing for handling this problem. **[9]**

**Q3)** Explain the parallel computing techniques to process & manage Big data produced of high velocity. **[9]**

OR

**Q4)** Explain the working of Apache Hadoop with HDFS & Map Reduce. **[9]**

**Q5)** Explain the following with their significance in Hadoop Ecosystem. **[8]**

- a) Apache flume
- b) Pig
- c) Oozie
- d) Zookeeper

OR

**Q6)** Explain the data analysis of Big data along with the use and description of the Hive & Impala in short. **[8]**

**P.T.O.**

**Q7)** Explain the Apache Spark architecture along with the various components. Describe the Driver manager component in brief. [8]

OR

**Q8)** Write a short note on the following : [8]

- a) Spark context
- b) Resilient Distributed Datasets (RDD)

**Q9)** What are the different cluster managers available in Apache spark? Explain each in brief. [8]

OR

**Q10)** Explain in brief the transformation and action in Apache Spark? With suitable example. [8]

**Q11)** List the challenges of Data Visualization. Explain the types of visualization in brief. [8]

OR

**Q12)** List the few data visualization tools and discuss any two applications of data visualization along with the use of suitable example with Python/R. [8]



Total No. of Questions : 12]

SEAT No. :

**P7006**

[Total No. of Pages : 3

**[5872]-414**

**M.E. (Computer) (Data Science)**  
**DATA WAREHOUSING & MINING**  
**(2017 Pattern) (Semester - II) (510308)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 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)** How are the top-down and bottom-up approaches for building a data warehouse are different? Suppose you are the data analyst on the project team building a data warehouse for an insurance company. List the possible data sources from which you will bring the data into your data warehouse. State your assumptions. **[9]**

OR

**Q2)** Define data warehouse? What are the key characteristics of a data warehouse? Explain the couple of data warehouse solutions which are widely used in the industry currently. **[9]**

**Q3)** List the three major areas in the data warehouse? Explain technical architecture of the data warehouse. How does it relate to the individual architectural components. **[9]**

OR

**P.T.O.**

**Q4)** Why do you think metadata is important in a data warehouse environment?  
List six processes in which metadata is significant for IT and explain its need. [9]

**Q5)** Suppose that a data warehouse for a big university consists of the four dimensions student, course, semester and instructor and two measures count and avg grade. At the lowest conceptual level (e.g. for a given student, course, semester and instructor combination), the avg grade measure stores the actual course grade of the student. At higher conceptual levels, avg grade stores the average grade for the given combination. Draw a snowflake schema diagram for the data warehouse. [9]

OR

**Q6)** Explain ETL process in data warehouse? What are the most commonly used ETL tools and explain any one tool in brief. [9]

**Q7)** Explain the need of multidimensional analysis and list the characteristics of OLAP and types of OLAP models. [9]

OR

**Q8)** Describe briefly two major features of the web-enabled data warehouse? How can you use the web as a data source for your data warehouse? What types of information can you get from the web? [9]

**Q9)** What is cluster Analysis in Data Mining? What are the different properties of clustering? Explain any one clustering method in detail. [9]

OR

**Q10)** A database has five transactions

Let min-sup = 60% and min-conf = 80%

(support)

(confidence)

Find frequent item set and association rule.

TID	Items - Bought
T1	{M, O, N, K, E, Y}
T2	{D, O, N, K, E, Y}
T3	{M, A, K, E}
T4	{M, U, C, K, Y}
T5	{C, O, O, K, I, E}

[9]

*Q11)*What are the components that make up the physical model? How are these related to components of the logical model? [5]

OR

*Q12)*List the types of statistics collected for monitoring the functioning of the data warehouse. How do the statistics help in fine - tuning the data warehouse?[5]





Total No. of Questions : 12]

SEAT No. :

P7251

[Total No. of Pages : 2

[5872]-415

**M.E. (Computer Engineering)**

**MACHINE LEARNING**

**(2017 Pattern) (Semester - II) (510309)**

*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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) What is Machine Learning? Enlist and explain types of Machine Learning. [5]

b) Differentiate between predictive and descriptive machine learning. [4]

OR

**Q2)** a) Enlist and explain Models of Machine learning. [5]

b) What is reinforcement learning? Explain it with example. [4]

**Q3)** a) Explain Probably Approximately Correct (PAC) learning with example. [4]

b) Differentiate Feature Extraction Feature Selection with suitable example. [4]

OR

**Q4)** What is Linear discriminate analysis? Explain in detail. [8]

**Q5)** a) What is Regression? Explain with suitable example. [4]

b) Discuss functioning of perceptron with suitable diagram of perceptron. [5]

OR

*P.T.O.*

**Q6)** a) What is soft margin of Support Vector machine. Discuss with suitable diagram. [5]

b) Write and explain K-nearest neighbor algorithm. [4]

**Q7)** Write an algorithm of ID3. Explain each step in detail. [8]

OR

**Q8)** Write and explain K-means clustering algorithm with example. [8]

**Q9)** Discuss Expectation Maximization methods in detail. [8]

OR

**Q10)** Draw and explain, Bayesian network with suitable example. [8]

**Q11)** Write a short note on : [8]

a) Diagnosis of human disease

b) Author identification

OR

**Q12)** Write a short note on : [8]

a) Learning to rate vulnerabilities and predict exploits

b) Prediction and forecasting



Total No. of Questions : 12]

SEAT No. :

P7257

[Total No. of Pages : 2

[5872]-416

**M.E. (DATA SCIENCE)**

**Soft Computing**

**(2017 Pattern) (Semester - II) (510310)**

*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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full Marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain features and components of Soft Computing in detail. [5]  
b) What is meant by hybrid method in Soft Computing? [4]

OR

**Q2)** a) Represent the fuzzy sets operations using Venn diagram. [5]  
b) Explain the advantages of neural Networks. [4]

**Q3)** a) The elements in two sets A and B are given as {2, 4} and {a, b, c} Find the various Cartesian products of these two sets. [5]

b) Explain the features of Fuzzy Membership functions. [4]

OR

**Q4)** a) Explain two defuzzification methods. [5]

b) What is Fuzzification process. Give with an example. [4]

**Q5)** Compare genetic algorithm and natural evolution. [8]

OR

**Q6)** Explain the general genetic algorithm steps with flowchart. [8]

*P.T.O.*

*Q7)* Explain in brief, the terminologies of neural network : Bias, Weight, Threshold and learning rate. [8]

OR

*Q8)* Explain perceptron neural network with architecture and learning rule. [8]

*Q9)* Give the working of content addressable memory (CAM). [8]

OR

*Q10)* How the bidirectional associative memory is used in Artificial Neural Network? [8]

*Q11)* What is Neuro Fuzzy Hybrid systems? Explain its characteristics. [8]

OR

*Q12)* Explain with block diagram genetic neuro hybrid system. [8]



Total No. of Questions : 12]

SEAT No. :

P6580

[Total No. of Pages : 2

[5872]-420

M.E. (Cyber Security)

MATHEMATICAL FOUNDATION FOR CYBER SECURITY

(2017 Pattern) (Semester - I) (510401)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10, Q11 or Q12.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** What are different binary operations? Explain with example. [8]

OR

**Q2)** Discuss set of linear equations. Where these equations are applicable in cyber security. [8]

**Q3)** Define Groups? What do you mean by cyclic groups, cosets? Explain with suitable examples. [8]

OR

**Q4)** Discuss classification of fields; and explain structure of finite fields in detail. [8]

**Q5)** What is relative prime? How to check primeness of number. [8]

OR

**Q6)** Explain AKS method of primality test. [8]

*P.T.O.*

*Q7)* What are various factorization methods? Explain any one with suitable example. [8]

OR

*Q8)* Elaborate CRT & its applications. [8]

*Q9)* Explain conditional probability with examples. [9]

OR

*Q10)* Explain Monte-Carlo algorithms. [9]

*Q11)* Write a short note on : [9]

- a) Equivalence of codes
- b) Linear codes

OR

*Q12)* What is Syndrome decoding. Discuss Generator matrices & parity check matrices in detail. [9]



Total No. of Questions : 7]

SEAT No. :

P6581

[Total No. of Pages : 2

[5872]-421

M.E.

CYBER SECURITY

Modern Cryptography

(2017 Pattern) (Semester - I) (510402)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q.No. 7 is compulsory, solve any five from Q.No. 1 to Q.No. 6.*
- 2) *Figures to the right indicates full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume Suitable data, if necessary.*

**Q1)** What is Cryptanalysis? Describe "One-Time Pad" and "Shannon Cipher" with its cryptanalysis. [8]

**Q2)** What is Chosen Plaintext Attack (CPA)? Elaborate AES security mechanism against chosen Plaintext Attack (CPA). [8]

**Q3)** Write Short Note on : [8]

- a) Elliptic Curve Cryptography (ECC)
- b) Diffie Hellman Key Exchange.

**Q4)** Describe Digital Signature Algorithm (DSA) in detail. List down the advantages and disadvantages of DSA. [8]

**Q5)** Write Short note on : [8]

- a) Cyber Security laws and Regulations.
- b) Cyber Security Evolution.

**P.T.O.**

**Q6)** Differentiate Cryptography and Steganography. Classify the types of steganography. **[8]**

**Q7)** Elaborate Cyber Security Catalog Approach with Catalog format. Explain Cyber Security Policy Taxonomy. **[8]**





Total No. of Questions : 8]

SEAT No. :

P6582

[Total No. of Pages : 2

[5872]-422

M.E. (Cyber Security)

SECURE SOFTWARE DESIGN, CODING PRACTICES AND  
ETHICS

(2017 Pattern) (Semester - I) (510403)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain the principles of software engineering ethics. [5]  
b) Explain the objective of software security. [4]

OR

- Q2)** a) Why is security a software issue? [5]  
b) Explain the principles of software assurance. [4]

- Q3)** a) Discuss the most common requirements Elicitation Techniques. [5]  
b) What elicitation techniques can be used with SQUARE? [4]

OR

- Q4)** a) What are the common approaches followed for developing high-level and detailed requirements using SQUARE? [5]  
b) Explain architecture risk management, with example. [4]

- Q5)** a) Explain OWASP Software assurance maturity model. [8]  
b) What is the secure software development life cycle (SDLC)? [8]

OR

*P.T.O.*

- Q6)** a) What are secure coding principles? [8]  
b) Explain security breach. What are the three main causes of security breaches? [8]

- Q7)** a) What is penetration testing software? What are the 5 stages of penetration testing? [8]  
b) Explain the any four main methodologies of threat modeling? [8]

OR

- Q8)** a) Describe the common methods for managing vulnerabilities. How do you manage vulnerability management? [8]  
b) Explain risk-based testing strategy with different approaches in cyber security? [8]



Total No. of Questions : 8]

SEAT No. :

P7260

[Total No. of Pages : 2

[5872]-501

M.E. (Civil-Structures)

**DESIGN OF RCC & Pr.CC BRIDGES**  
**(2013 Pattern) (601014) (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) *Figure to the right indicates full marks.*
- 4) *Use of IRC - 5, 6, 18, 27, 45, 78 & 83 codes IS 1343, IS 456 - 2000 is allowed. Mere reproduction of theory from IS or IRC codes as answer will not get full credit.*
- 5) *Assume any other data if necessary.*
- 6) *Electronic pocket calculator is allowed.*

**Q1)** a) Write note on classification of bridges. [5]

b) Explain role of impact factor in design of Highway Bridge. [5]

**Q2)** a) What are the factors affecting the span of bridge? [5]

b) Explain IRC Class A and Class B standards of loadings. [5]

**Q3)** Explain the stepwise procedure to design slab culverts. [10]

**Q4)** Explain the stepwise procedure to design the deck slab. [10]

*P.T.O.*

**Q5)** Design R.C.C Rigid Frame Bridge for the following data. **[10]**

- a) Clear span - 16m.
- b) Road width - 7.5m between kerbs.
- c) Foot path 1.5 on each side.
- d) Height - 7.5m.
- e) End condition-hinged.
- f) Loading IRC AA or IRC A which gives maximum effect.
- g) Coeff. of linear expansion of concrete ---  $6.5 \times 10^{-6}$
- h)  $E_c = 25 \text{ KN/sq.mm}$  use M 25 & Fe 500.

**Q6)** a) Explain with neat sketches various types of expansion joints used in bridges. **[5]**

b) What is meant by an expansion joint? Enlist its various limitations. **[5]**

**Q7)** Check the Stability of the RCC Retaining wing wall of height 5m which carries a surcharge of 10 KN/Sq.m acting 2m away from the wall the backfill material is having density 16 KN/Cu-m and angle of repose as 30 degrees the coefficient of friction as 0.45. Use M25 and Fe 500. **[10]**

**Q8)** a) Explain the forces acting on wing wall for bridges. **[5]**

b) Enlist various steps to design wing wall. **[5]**

