

Total No. of Questions : 8]

SEAT No. :

**P4723**

**[5355]-501**

[Total No. of Pages : 4

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

**APPLICATION OF STATISTICAL METHODS IN CONSTRUCTION**

**(2017 Credit 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.*
- 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) Define probability and Explain the Baye's theorem. **[4]**  
b) A population consists of 5 numbers 2, 3, 6, 8, 11 consider all possible samples of size 2, which can be drawn with replacement from this population find, **[5]**
- i) The mean of the population,
  - ii) Standard deviation of population,
  - iii) The mean of the sampling distributions of means,
  - iv) Standard error of means.

OR

- Q2)** a) A tenderer is bidding for construction works averagely 10 numbers in a year for the past 5 years find the probability that, **[5]**
- i) He gets at least seven works
  - ii) He gets exactly three works,
  - iii) He does not get any work,
  - iv) He gets not more than two works,
  - v) He gets all the works
- b) In an item of excavation at contractors cost for particular strata and for particular quantity of work following cost have occurred on 10 previous projects. Determine mean, standard deviation, variance, coefficient of variance, range and coefficient of range. **[4]**

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

**P.T.O.**

- Q3) a)** Explain the students t test and K-S test. [4]  
**b)** Find the line of regression for following data and estimate Y for X = 14.5 and X for Y = 29.5. [5]

X	10	14	19	26	30	34	39	38	26	25
Y	12	16	18	26	29	35	38	30	35	28

OR

- Q4) a)** Following is the frequency distribution of number of arrivals of dumper arrivals per unit of time (say interval of 10 min.) using chi-square test verify whether the arrivals follows Poisson's probability distribution. Test for the given tabulated Chi-square is equal to 12.59 [5]

Sr. no	Dumpers arriving per 10 min	Frequency
1	0	10
2	1	30
3	2	40
4	3	50
5	4	35
6	5	20
7	6	10
8	7	05

$\lambda = 3$ , Cumulative poisons probability are given as below:

X	0	1	2	3	4	5	6	7
f(x : $\lambda$ )	0.05	0.149	0.224	0.224	0.168	0.101	0.05	0.034

- b)** Based on 360° appraisal a project manager of a construction work was rated on 10 point scale by different persons for two of his important functions, [4]  
 i) General project management (GPM),  
 ii) Cost management (CM).

Persons	CM	GPM
1) Self-appraisal	6	7
2) Appraisal by GM	6	6
3) Appraisal by work manager - I	5.5	6.5
4) Appraisal by work manager - II	6	6
5) Appraisal by work manager - III	4	4
6) Appraisal by work manager - IV	6	7
7) Appraisal by Colleague I	5	6
8) Appraisal by Colleague II	9	9
9) Appraisal by Colleague III	5.5	7
10) Appraisal by Project controller	7	6

Determine, spearman's rank correlation coefficient.

**Q5) a)**

Daily Demand	8	10	12	14	16	18	20
Probability	0.07	0.15	0.2	0.19	0.18	0.13	0.08

If the lead time is 3 days. using simulation study the implication of Inventory policy of ordering 50 Units, Whenever the inventory at the end of the day is 40 units. Assume initial stock level of 80 units and run simulation for 10 days.

Consider the random numbers, 63, 78, 87, 47, 56, 22, 19, 16, 78, 03[8]

b) What are the different software's used in simulation explain in detail. [8]

OR

**Q6) a)** A bakery keeps stock of a popular brand of cake. Daily demand based on the past experience is given below, [8]

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

Consider the following sequence of random numbers 48, 78, 09, 51, 56, 77, 15, 14, 68, 09.

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

b) What is down time cost of equipment? What the different situation where the down time cost is applicable. Give suitable example. [8]

**Q7) a)** The plumber uses valves at the rate of 2500 valves per year the cost the single valve is Rs. 1, while the inventory carrying cost is Rs. 20. The valves are supplied in lots and the cost of procurement including transportation cost is Rs. 40 per order. [8]

- i) Suppose that the actual consumption of these valves increased by 500 valves over the year against the estimated requirements of 2500 valves determine the extent of loss of the plumber incurred by using the EOQ.
- ii) If the order cost including transportation cost reduces by 25% what is its effect on total cost?

b) Explain the risks involved in construction project and explain the risk mitigation in detail. [8]

OR

**Q8) a)** Perform sensitivity analysis for the  $S = 2,50,000$  bags,  $C_o = \text{Rs. } 4000$ ,  $C_u = \text{Rs. } 320$ ,  $I = 22\%$ . During execution it was observed that  $C_u$  reduces by 4% and  $I$  remain the same, determine % change in cost. **[8]**

**b)** Draw the ABC curve for the data given below, **[8]**

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



Total No. of Questions :8]

SEAT No. :

**P4724**

[Total No. of Pages : 2

[5355] - 502

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

**MANAGEMENT & PROJECT PLANNING IN CONSTRUCTION**

**(2017 Course) (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) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
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- 6) *Use of electronic pocket calculator is allowed.*

**Q1) a)** What are various management styles? Which style is mostly followed on construction sites? **[4]**

b) Write a detailed note on any software used for construction scheduling. **[5]**

OR

**Q2) a)** What is project Life cycle? Write different phases and explain them. **[5]**

b) Describe Mass Haul Diagram with neat sketch. **[4]**

**Q3) a)** Differentiate between resource scheduling and resource leveling by giving suitable example. **[4]**

b) Define standard time. How is it calculated? **[5]**

OR

**Q4) a)** List the activities that are included in site mobilization. **[5]**

b) Give a note on string diagram with neat sketch. **[4]**

**Q5) a)** Write a detailed note on Process Failure Mode and Effects Analysis (FMEA). **[8]**

b) Write any eight steps to adopt safety culture on the site by all stakeholders. **[8]**

OR

**P.T.O.**

- Q6)** a) Write a detailed note on Workmen's Compensation Act. [8]  
b) List the hazards that may occur on a tunnel site. What are the steps to control it? [8]

- Q7)** Describe merit rating w.r.t. following points: [16]  
a) Definition  
b) Objectives  
c) Methods  
d) Advantages

OR

- Q8)** What is Artificial Neural Network? What are the steps of using ANN technique for solving a particular problem? Which problems in Civil Engineering field can be solved using ANN? [16]



Total No. of Questions : 8]

SEAT No :

**P 4725**

**[5355]-503**

[Total No. of Pages : 2

**M.E. (Civil-Construction and Management)**  
**CONSTRUCTION TECHNOLOGY**  
**(2017 Credit Course) (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 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.*
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- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Write a note on shaft sinking. **[4]**
- b) What are the methods of dewatering for shallow and deep excavations and explain vacuum dewatering with neat sketch. **[5]**

OR

- Q2)** a) Enlist the methods of tunnel driving in soft soil and explain needle beam method in detail. **[5]**
- b) Explain jet grouting technique and its application. **[4]**

- Q3)** a) Enlist types of concrete pump and precautions taken in use of concrete pumps. **[4]**
- b) Explain in detail construction of precast piles with suitable sketch. **[5]**

OR

- Q4)** a) What are the problems encountered during underwater concreting and explain tremie method of underwater concreting with suitable diagram. **[5]**
- b) Explain the method of pile driving by vibration. **[4]**

**P.T.O.**

- Q5)** a) Discuss the operations involved in construction of diaphragm wall using bentonite slurry used for pedestrian tunnel. [8]
- b) Explain the sequential operations involved in construction of sheet pile cofferdam for construction of bridge pier. [8]

OR

- Q6)** a) Enlist the types of cofferdam and explain construction of single and double wall cofferdam. [8]
- b) Explain with neat sketch the sequence of operations involved in construction of earth and rock fill cofferdam. [8]
- Q7)** a) Discuss methods adopted for correction of tilting of well foundations. [8]
- b) Explain the construction procedure for box caisson with neat sketch. [8]

OR

- Q8)** a) Enlist the types of caisson and explain the construction of pneumatic caissons with neat sketch. [8]
- b) Write a detail construction procedure of well foundation. [8]





Total No. of Questions : 8]

SEAT No :

P 4726

[5355]-504

[Total No. of Pages : 2

M.E. (Civil-Construction & Management) Examination, May 2018

TQM IN CONSTRUCTION

(2017 Credit Course) (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 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.
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- 6) Use of electronic pocket calculator is allowed.

Q1) a) Give any two definition of Quality. [4]

b) Explain the contribution of Philip Crosby related to Quality. [5]

OR

Q2) a) Write note on :- P-D-C-A Cycle. [5]

b) Briefly explain use of Quality Manual in construction sector. [4]

Q3) a) Design checklist required for carrying out setting up formwork. [4]

b) Define-Benchmarking. Give advantages of Benchmarkign in quality management. [5]

OR

Q4) a) Explain in detail, technical and managerial competencies necessary for achieving quality. [5]

b) Write self explanatory note on - Quality Circle. [4]

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

b) Definition of six sigma. Explain the different stages of Six sigma. [8]

OR

P.T.O.

- Q6)** a) Highlight the importance of third party quality audits in construction. **[8]**  
b) Explain Non Conformity reports (NCR) and give remedial strategy for reducing NCR's. **[5]**

- Q7)** a) Explain the different principles of ISO 9001. **[8]**  
b) Explain the different documents required for ISO 9001 preparation. **[8]**

OR

- Q8)** a) Explain in detail- DMAIC & DMADV. **[8]**  
b) Justify - Application of Six Sigma tool to RCC Work in building. **[8]**



Total No. of Questions : 8]

SEAT No :

P 4727

[Total No. of Pages :2

[5355]-505

M.E. (Civil)

(Construction Management)

CONSTRUCTION CONTRACTS ADMINISTRATION AND MANAGEMENT

(2017 Credit Course) (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 and Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*
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- Q1)** a) Explain Void and voidable contract. [4]  
b) Comment on comparative statement and deviations in conditions. [5]

OR

- Q2)** a) Explain Pre-bid meeting and pre-qualification system. [4]  
b) What is Breach of contract and explain its effects. [5]

OR

- Q3)** a) Write note on model forms of contract. [4]  
b) Explain the FIDIC conditions regarding R.A. bills and final bills. [5]
- Q4)** a) Explain Design & Build contract. [4]  
b) What are the Particular conditions in contract? Explain in detail. [5]

**P.T.O.**

- Q5)** a) Define in detail 'Claims'. Enumerate the different event/circumstances. What are their short term and long term implications? [10]  
b) Explain term claim settlement with suitable example. [6]

OR

- Q6)** a) What are the causes of disputer? Explain the role of dispute resolution board. [10]  
b) Explain: i) Conciliation ii) mediation. [6]

- Q7)** a) Explain: Composition of the arbitral tribunal. [8]  
b) What are the duties and power of arbitrator? [8]

OR

- Q8)** a) Discuss on provisions made for conciliation in Act. [8]  
b) Explain: i) Ground for challenge, ii) Procedure of appeal against the awards. [8]



Total No. of Questions : 8]

SEAT No. :

**P5283**

**[5355]-506**

[Total No. of Pages : 3

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

**PROJECT ECONOMICS & FINANCIAL MANAGEMENT**

**(2017 Credit Course) (501028) (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 and Q.7 or Q.8.
- 2) Use suitable data if necessary.

**Q1) a)** Discuss in brief about role of GST Bill in construction industry and its implications. **[5]**

b) Explain the term 'Corpus Fund' and its importance. **[4]**

OR

**Q2) a)** Explain 'Working Capital management' with importance. **[4]**

b) Discuss the requirements of credit & cash management. **[5]**

**Q3) a)** Discuss with case example of 'Break even analysis' in housing project. **[5]**

b) Write about the cash flow analysis & Risk management. **[4]**

OR

**Q4) a)** Explain in short 'Appraisal Criteria Methods' & Break even analysis with its importance in relation to Financial management. **[5]**

b) Different in between 'Direct Taxes' and 'Indirect Taxes'. **[4]**

**P.T.O.**

**Q5) a) Discuss in brief about Public deposit and Dividend Policies. [6]**

**b) The Financial details of ABC as on 2017 & 2018 are as under : [10]**

Liabilities	2017	2018	Assets	2017	2018
Equity Share Capital	1,00,000	1,25,000	Land and Buildings	50,000	75,000
General Reserve	12,500	15,000	Plant & machinery	57,500	55,000
Profit & Loss A/c	10,000	7,500	Stock	7,500	10,000
Creditors	5,000	6,250	Debtors	5,000	7,500
Bills payable	3,750	7,500	Cash & Bank	2,500	5,000
O/s expenses	1,250	3,750	Bill receivable	7,500	5,000
Provident funds	7,500	5,000	Preliminary Expenses	10,000	12,500
	1,40,000	1,70,000		1,40,000	1,70,000

**Profit & Loss Account**

Particulars	2017	2018	Particulars	2017	2018
To Op. Stock	5,000	10,000	By Sales	62,500	1,12,500
To Purchase	37,500	47,500	By Closing stock	10,000	12,500
To Office Exp.	7,500	10,000	By Profit on Selling		
To Selling Exp.	5,000	12,500	of Furniture	2,500	-
To Fin. Exp.	2,500	15,000			
To Net profit	17,500	30,000			
	75,000	1,25,000		75,000	1,25,000

Find out :

- 1) Current ratio.
- 2) Stock turnover ratio.
- 3) Liquidity ratio.
- 4) Return on equity capital employed.

OR

**Q6) a)** From the following information prepare the Balance Sheet of Abhishek Ltd. **[10]**

	Rs.
Paid up capital =	75,000
Plant & Machinery =	1,85,000
To sales (p.a.) =	7,00,000
Gross Profit = 20%	
Annual credit sales = 70% of net sales	
Current ratio = 2, inventory turnover = 4	
Fixed asset Turnover = 2, Sales return = 15% of sales	
Avg. collection period = 90 days, Bank credit to trade = 2	
Cash to inventory = 1 : 20, Total debt to current liabilities = 3.	

**b)** Write a short note on Budget manual & Accounting information system. **[6]**

**Q7)** Draft a detailed project appraisal report of any infracture project in relation to technical economic, financial, social, environmental analysis under PPP model. **[16]**

OR

**Q8)** Draft a detailed report of rising of Funds for ‘Smart City Pune’ project through Central, State governments and local bodies with their respective shares. **[16]**



Total No. of Questions : 8]

SEAT No. :

**P4728**

[Total No. of Pages : 5

[5355] - 507

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

**OPERATIONS RESEARCH**

**(2017 Credit Course) (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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data if necessary and clearly state.*
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- 6) *Use of electronic pocket calculator is allowed.*

**Q1) a)** Define-Operations Research. Explain the necessity of Operations Research in Civil Engineering. **[4]**

b) Solve the Following Linear Problem using Graphical method: **[5]**

$$\text{Max. } Z = 20x_1 + 50x_2$$

$$\text{Subject to } 6x_1 + 3x_2 \leq 1500$$

$$2x_1 + 5x_2 \leq 1000$$

$$x_1 + x_2 \leq 450$$

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

OR

**Q2) a)** A Firm produces three products. These products are processed on three different machines. The time required manufacturing one unit of each three products and the daily capacity of the three machines are given below. **[4]**

*P.T.O.*



Machine	Time per unit (minutes)			Machine Capacity (minutes/day)
	Product-1	Product-2	Product-3	
M1	2	3	2	440
M2	4	---	3	470
M3	2	5	---	430

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, Rs.3 and Rs.6 resp. It is assumed that all the amounts produced are consumed in the market. Formulate the mathematical L.P model that will maximize the daily profit.

- b) For each of the following function show whether it is convex, concave or neither [5]

i)  $f(x) = 15 - x^2$

ii)  $f(x) = x^4 + 6x^2 + 10x$

- Q3) a) The unit cost of transporting cement from 3 factories to 4 warehouses is given in following table, along with the availability at each factory and the requirement of each warehouse. Find only initial feasible solution by [4]

- i) North West Corner Method

- ii) Least cost Method

Factories	Ware Houses				Supply
	1	2	3	4	
1	3	7	6	4	5
2	2	4	3	2	2
3	4	3	8	5	3
Demand	3	3	2	2	10

- b) It is proposed to develop hydropower by building Dams across 3 possible river sites. The total financial resource available is 8 money units. The return functions for each of the possible investment are given below. The available resource is to be allocated optimally to these developments. Using DP, determine the maximum return and give the allocation to various sites. [5]

Resource Allocated	Return from site		
	1	2	3
0	1	0	0
2	12	14	30
4	75	55	50
6	91	70	70
8	98	80	75

OR

- Q4) a) A sale manager has assign salesman to 4 cities. He has 4 candidates of varying experience and capabilities and access the possible profit for each salesman in each district as given below. Find the assignment which maximizes the profit. [5]

Salesman	Cities			
	A	B	C	D
1	35	27	28	37
2	28	34	29	40
3	35	24	32	33
4	24	32	25	28

- b) Define the terms- [4]
- i) Unimodal function
  - ii) Global and Local optima

**Q5) a)** Use the Lagrange multiplier method [8]

$$\text{Minimize } f(x) = 3x_1^2 + 4x_2^2 + 5x_1x_2 - 8x_2$$

$$\text{Subject to } x_1 + x_2 = 4$$

b) Maximize  $Z = 6x_1 - 2x_1^2 + 4x_2 - 2x_2^2 - 2x_1x_2$  with initial value (1, 1) using Steepest Ascent/Descent Method. [8]

OR

**Q6) a)** Maximize  $Z = 6x_1 - x_1^2 + 6x_2 - 3x_2^2$  with initial value as  $x^0 = (2, 2)$  Use Newton's Modified Method to solve above problem. [8]

b) Maximize  $f(x) = 3x_1 + x_1x_2 - x_1^2 - x_2^2$  with initial value (0, 0) using Steepest Ascent/ Descent Method. [8]

**Q7) a)** Solve the following sequencing problem to find minimum time of completion. [8]

Job	A	B	C
1	13	6	18
2	10	8	19
3	11	12	14
4	17	9	12
5	14	11	17

b) A firm is considering replacement of machine, whose cost price is Rs. 12,200 and the scrap value is Rs. 200. The running (maintenance and operating) costs are found from experience to be as follows: [8]

Year	1	2	3	4	5	6	7	8
Running Cost	200	500	800	1200	1800	2500	3200	4000

When should the machine to be replaced?

OR

Q8) a) Reduce the following game by dominance and find the game value. [8]

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

b) A sample of 100 arrivals of automobiles at a toll booth is found to be according following distribution. [8]

Time of Arrivals in minutes	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Frequency	2	6	10	24	20	15	10	7	4	2

A study of service time reveal the following distribution

Service in time in minutes	0.5	1	1.5	2.0	2.5
Frequency	13	22	37	20	8

Estimate the average waiting time, percentage waiting time of the vehicle, average idle time and percentage idle time of the server for 10 arrivals. Use the following Random No.

Arrivals	16	77	23	02	77	28	06	24	25	93
Service time	56	65	05	61	86	90	92	10	79	80

*EEE*

Total No. of Questions : 8]

SEAT No. :

**P4729**

**[5355]-511**

[Total No. of Pages : 2

**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 Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
- 2) *Figures to the right indicates full marks.*
- 3) *Draw neat figures wherever necessary.*
- 4) *Assume necessary data.*
- 5) *Use of scientific calculators is allowed.*

- Q1)** a) Write legal sampling procedures for ambient air quality analysis. [4]  
b) Write and explain principles and elements of environmental management plan. [5]

OR

- Q2)** a) Write precautionary and polluter pays principle. [4]  
b) Write powers and functions of regulatory agencies in Air Act, 1981. [5]

- Q3)** a) Write rules and regulations for siting an industry. [4]  
b) Explain relevant provision in Indian forest act. [5]

OR

- Q4)** a) Write objectives and importance of Environmental Protection Act, 1986. [4]  
b) Write role of judiciary and NGO in environmental protection. [5]

- Q5)** a) Write and explain provision about collection, transportation and disposal of Hazardous waste mentioned in Hazardous waste (management and Handling) Rules, 1989. [8]  
b) Write and explain the notifications issued by Govt. of Maharashtra for the protection and improvement of environment. [8]

OR

- Q6)** a) Write and explain provision about collection, transportation and disposal of Hazardous waste mentioned in Bio-Medical Waste (M & H) Rules, 2016. [8]  
b) Write important powers and functions of the MPC board under both the water and air acts. [8]

**P.T.O.**

- Q7)** a) Explain the procedure of public hearing for obtaining Environmental Clearance with any case study. [8]
- b) Write responsibilities of generators and role of Pollution Control Boards in hazardous waste management. [8]

OR

- Q8)** a) Explain role of NGO in Nature Conservation with an example. [8]
- b) Write and explain responsibilities of pollution control boards under Hazardous waste rules. [8]



Total No. of Questions :8]

SEAT No. :

P4730

[Total No. of Pages : 2

[5355] - 512

**M.E. (Civil - Environmental Engineering)**  
**ENVIRONMENTAL CHEMISTRY & MICRO-BIOLOGY**  
**(2017 Credit Course) (501062) (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 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) Explain colloidal dispersion in liquids. [4]

b) What are the effects of temperature & solar radiation on air pollutants? [5]

OR

**Q2)** a) What are the effects of radiation on humans. [5]

b) Discuss rain scrubbing with respect to air pollutants. [4]

**Q3)** a) Explain the chemistry of hydrocarbon decay. [4]

b) Give classification of detergents and explain each in detail. [5]

OR

**Q4)** a) Discuss the problems due to DDT. [5]

b) What are the effects of lead and its compounds on humans. [4]

**Q5)** a) Explain microbial cell structure with sketch. [8]

b) Explain High Performance Liquid Chromatography. [8]

OR

**Q6)** a) Discuss the scope of environmental microbiology. [8]

b) State the principle & working of flame photometer. [8]

**P.T.O.**

- Q7)** a) Write a note on staining techniques. [8]  
b) What is 'Bioremediation of contaminated soil' and explain its principle and microbiology? [8]

OR

- Q8)** a) Explain measurements and isolation of microorganism. [8]  
b) Discuss the biological processes of wastewater treatments. [8]





Total No. of Questions : 8]

SEAT No. :

P4731

[Total No. of Pages : 2

[5355]-513

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

**Physico-Chemical Processes For Water and Waste Water  
Treatment**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

- Q1)** a) Discuss with neat sketch plug flow reactor. [5]  
b) Write down various Design steps for design of tube settler. [5]

OR

- Q2)** a) Two primary settling basins 26.0 m in diameter with 2.1 side water depth. Single effluent weirs are located on the peripheries of the tank. For water flow of 26000 m<sup>3</sup>/day, Calculate [5]  
i) Detention period  
ii) Volume  
iii) Surface area of tank  
iv) Overflow rate  
v) Weir loading  
b) Compare the destabilization in wastewater by Al(III) and Fe(III). [5]
- Q3)** a) A water treatment consists of following unit processes: coagulation, flocculation, sedimentation, filtration and disinfection. The suspended solids concentration in raw water is 500 mg/l and plant treats 36400 m<sup>3</sup>/d of water. Alum used as a coagulant with dose of 50 mg/l. Compute the sludge solids produced daily if complete reaction of alum to aluminium hydroxide occurs and 98 percent total solids are removed by sedimentation / filtration. [8]  
b) Comment on UV radiations as a disinfectant. [2]

**P.T.O.**

OR

- Q4)** a) Explain various variables affecting the disinfection. [8]  
b) What is Loss of head in filter? [2]

- Q5)** a) Determine the amount in kg/day as well as in m<sup>3</sup>/day of primary sludge solids generated in a domestic wastewater treatment plant for population equivalent of 20000, with an efficiency of TSS removal of 60%. Also find the density of primary sewage sludge if it is 2% dry solids. Use per capita sewage flow = 225 L/day. [7]  
b) Describe with the help of neat sketch, gravity sludge thickener. [8]

OR

- Q6)** a) Discuss sludge lagooning and farm land spreading methods for the final disposal of treated sludge. [7]  
b) Design the sludge drying beds for digested sludge from an activated sludge plant serving 200000 people. [8]

- Q7)** a) Discuss limitations of Oxidative processes in wastewater treatment.[7]  
b) Enlist and explain various oxidizing agents used in water and wastewater treatment. [8]

OR

- Q8)** a) Discuss the fundamental concept of Chemical Oxidation by considering oxidation reduction reactions and half reaction potentials. [7]  
b) Describe the concept of Osmosis and osmotic Pressure and how it is used in water and wastewater treatment. [8]



Total No. of Questions : 12]

SEAT No. :

P4732

[Total No. of Pages : 2

[5355]-514

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

**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 answers will be valued as a whole.*
- 3) *Assume suitable data, if necessary.*

**Q1)** How the Micro-organisms plays the role in communicable diseases. [5]

OR

**Q2)** Give the note on Diseases communicated by discharges of intestines. [5]

**Q3)** Give short note on [5]

- a) Insects Control
- b) Rodent Control

OR

**Q4)** Explain in details any two Fly control methods [5]

**Q5)** Discuss the Study of factors required in industrial Sanitation? [5]

OR

**Q6)** What is Industrial poisons? Explain. [5]

**P.T.O.**

**Q7)** Explain how Population habits and environmental conditions affect the rural sanitation? [5]

OR

**Q8)** Discuss the latest rural sanitation improvement schemes. (Any Two). [5]

- Q9)** a) Discuss the One-Pipe System and Two pipe system in detail. [7]  
b) Give note on factors affecting the design of Water supply in buildings. [7]

OR

- Q10)**a) Discuss in details about Break pressure tank system and Hydro-pneumatic system. [7]  
b) What are the steps involved in Design of Water pipes? [7]

- Q11)**a) Explain with suitable sketches about Gully Traps and Intercepting Traps. [8]  
b) Give note on Flushing Cistern, Wash Basin, Lavatory Basin, Sink. [8]

OR

- Q12)**a) Discuss the Principles governing Design of Building Drainage in detail. [8]  
b) Give note on Drainage design of high rise buildings. [8]



Total No. of Questions : 12]

SEAT No. :

P4733

[Total No. of Pages : 2

[5355]-515

**M.E. (Civil - Environmental Engineering)**  
**INDUSTRIAL WASTE WATER TREATMENT AND**  
**MANAGEMENT**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Explain how Toxicity and Bioassay tests carried out. **[5]**

OR

**Q2)** Explain the following in details : **[5]**

- a) Aerobic biological Treatment.
- b) Anaerobic biological Treatment.

**Q3)** Discuss in detail Membrane Separation Process. **[5]**

OR

**Q4)** Give detail note on Chemical oxidation and Ozonation. **[5]**

**Q5)** Explain Manufacturing process of dairy industry in detail. **[5]**

OR

**Q6)** Suggest and explain the method of disposal of effluent for fertilizer industry. **[5]**

**P.T.O.**

**Q7)** Explain the method of disposal of effluent for Pharmaceutical industry. **[5]**

OR

**Q8)** Tabulate the Characteristics and composition of effluent of Tanneries industry. **[5]**

**Q9) a)** Discuss in details common problems encountered in management of Common Effluent Treatment Plants. **[7]**

b) Explain in details about Zero effluent discharge systems **[7]**

OR

**Q10)a)** Give note on General Design considerations and principles of Common Effluent Treatment Plants. **[7]**

b) How the waste water can be reuse? What are the low cost techniques involved in it? **[7]**

**Q11)a)** Explain in details about the Treatment with polymer coagulation. How it is differ from other methods? **[8]**

b) What are the design components required for wastewater treatment plant for Petroleum industry? **[8]**

OR

**Q12)a)** Give note on Dye stuff and dye manufacturing industries and their effluent standards. **[8]**

b) Explain the adsorption phenomena and its application in wastewater treatment. **[8]**



Total No. of Questions :8]

SEAT No. :

**P5289**

**[5355]-516**

[Total No. of Pages : 2

**M.E. (Civil) (Environmental Engineering)**  
**AIR POLLUTION AND CONTROL**  
**(2017 Course) (Semester-II)**

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

- Q1)** a) Write four formulas to estimate plume rise. [4]  
b) Explain effect of topography on pollutant dispersion. [5]

OR

- Q2)** a) Explain relationship between metrological parameters and pollutant dispersion. [4]  
b) Explain models of dispersion air pollutants-Eulerian model and Dense gas model. [5]

- Q3)** a) Write formulae to determine velocity of particle and diameter of particle in settling chamber. [4]  
b) Explain removal gaseous pollutants through wet absorption. [5]

OR

- Q4)** a) What are different methods to control NO<sub>x</sub> and explain any one method to control NO<sub>x</sub>? [4]  
b) A horizontal parallel plate electrostatic precipitator consisting of three gas passages 4.8 m height x 4.8 m deep with 30 cm plate spacing is to treat 540 m<sup>3</sup>/min of air. Due to a rapid expansion before inlet to the precipitator, the velocity profile is not fully developed. As a result, the volume rate of flow in the middle duct is twice that of the outer duct. Calculate the collection efficiency. Use migration velocity of 0.08 m/sec. [5]

**P.T.O.**

- Q5)** a) Explain environmental management plan. Write ambient air quality standards. [8]
- b) Explain quality assurance and quality control in national air quality monitoring. [8]

OR

- Q6)** a) Explain procedure for ambient air quality analysis for particulate matter and gas pollutants. [8]
- b) Differentiate existing and revised environmental guidelines for siting of industries with examples. [8]

- Q7)** a) Explain control air pollution from automobiles through control of crankcase emissions and control of exhaust emission. [8]
- b) Explain different methods to control odour with its principle, advantages and limitations. [8]

OR

- Q8)** a) Explain control air pollution from automobiles through control of evaporation emissions and alternatives to the gasoline engines. [8]
- b) Explain sick building syndrome and its control. [8]

✓ ✓ ✓



Total No. of Questions : 8]

SEAT No. :

P4735

[Total No. of Pages : 2

[5355]-521

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

**ADVANCE SOIL MECHANICS**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Assume suitable data, if necessary.*

**Q1)** Explain the total stress field on any three dimensional element by giving suitable matrix form and with suitable sketches. Explain independent shearing stress and normal stresses acting on an element. **[9]**

OR

**Q2)** Explain the terms (a) Frictional strength and (b) Cohesive strength. How they are evaluated using mohr-coulomb theory **[9]**

**Q3)** Explain Rebhannans Graphical method for determination of active earth pressure on retaining walls with inclined face. Also, state the assumptions made in the theory. **[9]**

OR

**Q4)** Explain the process of three-dimensional consolidation by the construction of sand drains. Also, explain the design aspects of sand drains. **[9]**

**Q5)** a) Explain the terms **[8]**  
i) Critical damping  
ii) Geometric damping &  
iii) Enternal damping  
b) How would you determine mass spring constant and damping factor for a vibrating system. **[8]**

**P.T.O.**

OR

- Q6)** a) How would you determine the natural frequency of a machine foundation soil system. [8]
- b) Explain the terms : [8]
- i) Magnification
  - ii) Transmissibility
  - iii) Resonance
- Q7)** a) Explain the two-dimensional Analysis of a foundation of a rotary machine by amplitude method. [8]
- b) Explain the (i) Geometric isolation and (ii) Mechanical isolation methods to control vibrations. [8]

OR

- Q8)** a) Explain the design criteria for the design of foundations of impact type machines as per B code. [8]
- b) Write a short note on constructional details of machine foundations. [8]



Total No. of Questions : 8]

SEAT No. :

P4730

[Total No. of Pages : 2

[5355]-522

M.E. (Civil - Geotechnical)

Ground Improvement Techniques

(2017 Pattern)

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.
- 4) Use of Scientific Calculator is allowed.
- 5) Assume suitable data, if necessary, clearly stating the same.

- Q1)** a) How is identification of clay minerals carried out? [4]  
b) State the different methods of chemical stabilization, explaining any one in detail. [5]

OR

- Q2)** a) Write short note on clay-water relations. [5]  
b) How is granular stabilization carried out at site? [4]
- Q3)** a) How is laboratory testing for bituminuous stabilisation carried out?[4]  
b) Describe thermal stabilisation of soils. [5]

OR

- Q4)** a) Write note on ash and slag stabilisation. [5]  
b) Describe the preloading technique of soil stabilisation. [4]
- Q5)** a) Explain how granular trench stabilisation carried out? [8]  
b) Discuss the design criteria for line column foundations. [8]

OR

P.T.O.

- Q6)** a) Describe criteria for determination of bearing capacity of lime group. [8]  
b) Discuss means of stabilisation for soft soils, explaining any one in detail. [8]
- Q7)** a) How is quality control achieved and testing carried out as per IS code for a grouting program. [8]  
b) Write short note on the various grouting techniques and explain any two of them. [8]

OR

- Q8)** a) Discuss criteria for design of soil grouting program. [8]  
b) Describe the procedure of permeation and hydrofracture grouting. [8]



Total No. of Questions : 8]

SEAT No. :

P4737

[Total No. of Pages : 2

[5355]-523

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

**ROCK MECHANICS**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

- Q1)** a) Enlist the field of application of rock mechanics. What is the significance of rock mechanics in tunnel construction? [6]  
b) Enlist the various types of rock blasting and explain the cushion blasting in detail. [4]
- Q2)** a) What are the objectives and limitations of rock grouting? [6]  
b) Write a note on rock bolting technique. [4]
- Q3)** a) Explain the flat jack method for determining initial stress in rock. Draw the neat sketch. [6]  
b) State and represent diagrammatically the stresses around circular hole for homogeneous, isotropic and linear elastic medium. [4]
- Q4)** a) Explain the influence of time on rock deformation. Also explain the creep in rock. [6]  
b) Write a note on Structural discontinuities in rock masses. [4]
- Q5)** a) Explain the failure propagation of jointed rocks? [5]  
b) Explain the Griffith's theory of fracture initiation in rock masses. [5]

**P.T.O.**

- Q6)** a) Explain the principal of limit equilibrium method for the analysis of rock structure. [5]  
b) Explain the rock parameters required for the analysis of underground structures. [5]
- Q7)** a) Write a note on deep foundation in rock. [5]  
b) What are the modes of failure of a footing on rock? [5]
- Q8)** a) Enlist the rock parameters required for the analysis of underground structures. [5]  
b) Explain the kinematic analysis of rock slopes. [5]



Total No. of Questions : 8]

SEAT No. :

P4738

[Total No. of Pages : 2

[5355]-524

**M.E. (Civil - Geotechnical Engg.)**  
**GEO-ENVIRONMENTAL ENGINEERING**  
**(2017 Pattern) (Credit)**

*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) Enlist different sources of solid waste. [4]  
b) Enlist tools and equipment for collection of solid waste. [5]

OR

- Q2)** a) Define solid waste and write its classification. [5]  
b) Define transfer station and state the necessity of it. [4]

- Q3)** a) Explain the Indore and Bangalore method of composting with sketch.[4]  
b) State any four advantages and disadvantages of landfill method. [5]

OR

- Q4)** a) Explain principles of composting of solid waste. [5]  
b) State factors affecting selection of site for land filling of solid waste.[4]

- Q5)** a) Explain in detail the reclaimed waste. [8]  
b) Explain the engineering properties of "Reuse of waste". [8]

OR

**P.T.O.**

- Q6)** a) What are the uses of waste in geotechnical engineering? Explain them. [8]  
b) Explain in detail landfill reclamation process. [8]

- Q7)** a) Write the application of Geosynthetics in waste disposal design. [8]  
b) What are the advantages and disadvantages of landfill? [8]

OR

- Q8)** a) Explain in detail single and double lined landfill. [8]  
b) Explain in detail which waste materials are used for landfill liner. [8]





Total No. of Questions : 8]

SEAT No. :

P4739

[Total No. of Pages : 2

**[5355]-526**  
**M.E. (Civil - Geotechnical)**  
**CONSTRUCTION METHODS IN GEOTECHNICAL**  
**ENGINEERING**  
**(2017 Pattern) (Credit)**

*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) Write short note on concrete bored pile. [4]  
b) Explain the bracing systems for circular and rectangular cofferdams with neat sketches. [5]

OR

- Q2)* a) Explain the necessary equipment for pile driving. [5]  
b) Explain sheet pile cofferdams. [4]
- Q3)* a) Describe bottom seal of cofferdam. [4]  
b) What are the considerations for site and foundation preparation for caissons? [5]

OR

- Q4)* a) Discuss measures to resolve problems with tremie box. [5]  
b) How is sinking of open caisson achieved? [4]
- Q5)* a) Write short notes on pre-splitting and trim blasting. [8]  
b) Write short note on loading and hauling equipment for rock excavation. [8]

OR

*P.T.O.*

- Q6)** a) Discuss all the criteria for blast design. [8]  
b) Write note on rock excavation with regards to its evaluation and planning criteria. [8]

- Q7)** a) Explain single stage and multi stage method of tunneling. [8]  
b) Explain shield tunnelling and types of TBM. [8]

OR

- Q8)** a) Explain full face tunneling with support and without support. [8]  
b) Explain tunneling by TBM and its types. [8]



Total No. of Questions : 8]

SEAT No :

**P 5285**

**[5355]-527**

[Total No. of Pages : 2

**M.E. (Civil) (Geotechnical Engineering)**  
**STABILITY OF SLOPES AND EARTH DAMS**  
**(2017 Course) (End Semester) (501129) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer all of the following questions.*
- 2) Neat diagram should be drawn wherever necessary.*
- 3) Figures to right indicate full marks.*

**Q1)** Explain Swedish circle method for stability analysis of finite slopes with suitable sketch. **[9]**

OR

**Q2)** Explain how the following parameters effect design of an earth dam **[9]**

- a) optimum moisture content
- b)  $c - \phi$  value and
- c) Permeability and
- d) Sudden draw down condition.

**Q3)** Explain the various methods to control seepage through **[9]**

- a) Embankment
- b) Foundation with neat sketches.

OR

**P.T.O.**

**Q4)** Explain the design considerations in seismic region for construction of an earth dam. Also, write the factor of safety values for different conditions of stability of an earth dam. [9]

**Q5) a)** What are the objectives of Instrumentation in a dam. Explain the various types & their functions. [8]

b) What are the parameters for selection of piezometers used in an earth dam. Explain any one piezometer used in an earth dam. [8]

OR

**Q6) a)** Explain the working of Inclinator & Joint meter in detail. [8]

b) Explain how settlement of an earth dam is measured with vibrating wire settlement cell and settlement gauge. [8]

**Q7) a)** Explain the typical technical specifications of railway ballast as per Indian railway code provision. [8]

b) Explain the various applications of geotextiles as a separator with suitable sketches. [8]

OR

**Q8) a)** Explain the various types of landslides. Also, explain causes and remedial measures. [8]

b) Write a short notes [8]

i) Drainage methods

ii) Shotcreting

x x x

Total No. of Questions : 6]

SEAT No. :

**P4740**

[Total No. of Pages : 2

**[5355]-531**

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

**FLUID MECHANICS**

**(2017 Pattern) (End Semester)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions*
- 2) *Marks to right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1)** a) The velocity components of a flow are in '3' dimensional flow are  $u = -x$ ,  $v = 2y$  and  $w = 5-z$ . Derive the equation of stream line passing through (2, 1, 1) [5]

b) Derive the most general form of continuity equation for 3 dimensional flow in cartesian coordinates. [5]

**Q2)** a) Explain graphical method for solving Laplace's equation. [5]

b) Explain source, sink and doublet. [5]

**Q3)** a) Derive Hagen poiseuille equation using NS equation. [5]

b) Two large plates are kept parallel to each other at distance of 2mm apart. If water flows with an average velocity of 0.25m/sec between plates, [5]

- Determine :
- i) Maximum velocity
  - ii) Pressure drop per unit length
  - iii) Shear stress at wall of plates

**Q4)** a) Explain Boundary layer separations. What are methods of controlling boundary layer separation. [5]

b) For laminar boundary layer on a flat plate held parallel to a stream of uniform velocity, determine the position of the section where drag force upto that section is twice the drag on the remaining portion. [5]

**P.T.O.**

- Q5)** a) Explain Isotropic and homogenous turbulence. [5]  
b) Derive Reynold's equation of motion in turbulent flow. [5]
- Q6)** a) Explain fundamental equations in compressible fluids. [5]  
b) Explain normal shock in one dimensional compressible flow. [5]



Total No. of Questions : 8]

SEAT No. :

P4741

[Total No. of Pages : 2

[5355]-532

**M.E. (Civil - Hydraulics Engineering)**  
**IRRIGATION & DRAINAGE ENGINEERING**  
**(2017 Pattern)**

*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) Differentiate between Surface and Subsurface irrigation methods, [4]  
b) Explain the terms : [5]  
i) Conjunctive use of surface and groundwater.  
ii) Multi-crop irrigation scheduling.

OR

- Q2)** a) What are the benefits and ill effects of irrigation. [5]  
b) Calculate the depth and frequency of irrigation required for a crop pattern having the following data [4]  
i) Root zone depth = 1m  
ii) Field Capacity = 22%  
iii) Wilting point = 11%  
iv) Specific Weight of Soil = 1.50gm/cc  
v) Consumptive use = 25mm per day  
vi) Irrigation Efficiency = 50%

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

- Q3)** a) Explain lift irrigation considering its distribution system. [4]  
b) Explain Sprinkler Irrigation considering following points Definition, advantages and disadvantages, types of sprinkler irrigation. [5]

**P.T.O.**

OR

- Q4)** a) What do you mean by drip irrigation system? Explain the elements of drip irrigation system considering the design aspect. [5]  
b) Describe the design of sprinkler Irrigation systems. [4]

- Q5)** a) Explain the following [8]  
i) Classification of salts affecting the soils and their characteristics  
ii) Water and wind erosion  
b) Explain the causes of soil erosion and also illustrate the various soil conservation techniques, what factors would you consider to apply specific techniques for specific cause? [8]

OR

- Q6)** a) Explain the following [8]  
i) \ Reclamation of saline and alkaline soils  
ii) Leaching and salinity control  
b) Explain the following [8]  
i) Salt accumulation in soil water  
ii) Design of various types of soil conservation measures

- Q7)** a) Write short notes on [8]  
i) Need and purpose of drainage.  
ii) Soil erosion and conservation.  
b) Write short notes on [8]  
i) Water logging causes, its preventive and remedial measures.  
ii) Construction of drainage systems.

OR

- Q8)** a) Write short notes on : [8]  
i) Steady state and transient designs of surface and sub-surface drainage systems.  
ii) Drainage by wells.  
b) Write short notes on : [8]  
i) Need and purpose of drainage.  
ii) Designs sub-surface drainage systems.





Total No. of Questions : 8]

SEAT No. :

**P4742**

[Total No. of Pages : 3

**[5355]-533**

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

**PLANNING AND MANAGEMENT OF WATER RESOURCES ENGG.**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, 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 objectives and necessity of water resources planning and management. [5]  
b) Write a short note on - planning region and horizons. [4]

OR

- Q2)** a) Write a short note on - Water quality management. [4]  
b) Explain spatial and temporal scales for planning and management of water resources. [5]
- Q3)** a) Explain - Characteristics and functions of reservoir. [4]  
b) Explain - Method of Images. [5]

OR

- Q4)** a) Write a short note on - Single purpose multi reservoir system. [5]  
b) Describe the role of conjunctive use in water resources management.[4]

**P.T.O.**

- Q5) a)** Write a short note on cost allocation in multipurpose projects. [8]
- b)** A low head turbine has an initial cost of Rs. 10 million and installation cost of Rs. 1 million. Annual OMR costs are estimated to be Rs. 2,00,000 in the first year of operation, increasing by Rs. 50,000 per year thereafter due to wear and tear. Receipts from sale of power are expected to be Rs. 2 million in the first year, but will decrease by Rs 100,000 per year thereafter due to reduced efficiency and increased down time with age. The life of the turbine is estimated to be 20 yr, at which time the salvage value is expected to be Rs. 1 million. The market value of the turbine in other years is assumed to decrease linearly with time. All receipts and disbursement are expressed in today's rupees. The real interest rate (inflation free) is 60%. [8]
- i)** Find the amount and the point in time at which the turbine realizes a maximum net profit.
- ii)** Find the range of time during which the turbine realizes net profit.

OR

- Q6) a)** Explain - i) interest. ii) discount rate, iii) depreciation. [4]
- b)** Explain how to compute water demand for: [5]
- i)** community water use
- ii)** agricultural water use
- c)** Three alternative plans for expanding a water resources project are as given in Table below. Each plan has a project life of 30 years. [7]

Plan	Initial investment (Rs.)	Annual OMR cost (Rs.)
A	12,000,000	2,800,000
B	16,000,000	2,400,000
C	20,000,000	1,000,000

Using (i) the present worth method; and (ii) the annual worth method, select the economically optimum plan for a discount rate of 8%.

- Q7) a)** Write a short note on - Benefit and cost estimation. [5]
- b)** Write a short note on - appraisal criteria [4]
- c)** Water is supplied from a project for two types of users: rural and urban. The benefits to rural community are given by  $B_r = 30 y_r - 1.5 y_r^2$  and those to the urban community are given by  $B_u = 10 y_u - y_u^2/8$ . If the total cost of the project is  $C = Y^2/2 + 2Y$ , where Y is the aggregate demand, determine the optimum level of total water supply. Also determine the corresponding components of rural and urban water supply levels. [7]

OR

- Q8)** a) Explain cost and benefit curves. [4]
- b) Write a short note on - inter-basin transfer of water. [5]
- c) A recreation area is proposed to be developed near a reservoir, which will serve the population from two towns. Town A and Town B. Town A has a population of 50,000 and Town B of 1,50,000. It is estimated from surveys that 1,50,000 visits per year will be made at a travel cost of Rs. 10 per visit from Town A, and 3,00,000 visits per year will be made at a travel cost of Rs. 20 from Town B. construct demand curve for recreation and estimate the annual benefits due to recreation. [7]



Total No. of Questions : 6]

SEAT No. :

P4743

[Total No. of Pages : 2

[5355]-534

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

**DAM ENGINEERING**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions*
- 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.*

- Q1)** a) Compare elementary profile and practical profiles. Draw sketches. [6]  
b) Compute maximum normal stress developed in elementary profile of gravity dam 70m high assuming triangular uplift with factor 0.75. Take relative density of concrete as 2.4. [4]
- Q2)** a) Explain thin cylinder theory of Arch dam design. [5]  
b) What are forces acting on Arch dam? Explain their role in stability of arch dam. [5]
- Q3)** a) Explain sketch different types of Buttress dams. [5]  
b) Explain the construction aspect of roller compacted concrete dams. Give 2 examples. [5]
- Q4)** a) Explain with a neat sketch stability analysis of earthen dam by slip circle method. State assumptions and limitations of this method. [6]  
b) What is phreatic line? Enlist the steps to draw the phreatic line. [4]

**P.T.O.**

- Q5) a)** Explain with a neat sketch different types of spillway. [4]  
b) Design the profile of ogeespillway of 125m length as effective length to carry discharge of 2000 cumecs. Assume the river bed level as 500m and maximum water level of water to be 545m. [6]

OR

- Q6) a)** What are different instruments used in Earthen dam. State their function. [4]  
b) Write instrument used in dam to determine parameter [6]  
i) surface displacement  
ii) Uplift pressure  
iii) Dynamic loads  
iv) Stress  
v) Seepage  
vi) Pore water pressure  
vii) Imparture  
viii) Strain



Total No. of Questions : 6]

SEAT No. :

P4744

[Total No. of Pages : 2

[5355]-535

M.E. (Civil) (Hydraulics)

OPEN CHANNEL HYDRAULICS

(2017 Pattern) (End Semester)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 questions*
- 2) *Figures to the right indicates full marks.*

**Q1)** a) Explain channel routing and reservoir routing. [5]

b) Describe the method of difference for flood routing. [5]

**Q2)** a) Compare positive surge with negative surge. [5]

b) Explain the concept of monoclinal rising waves. [5]

**Q3)** a) Explain with sketch 'bottom rack' as spatially varied flow. [5]

b) Stating assumption, derive SVF with decreasing discharge. [5]

**Q4)** a) Show that for GVF the water surface slopes with usual notations may

be written as  $\frac{dy}{dx} = \frac{S_o - S_f}{1 - Fr_1^2}$ . [5]

b) Explain A and H profiles and their occurrence. [5]

**Q5)** a) In a rectangular channel, a discharge of 2m<sup>3</sup>/s/m flows with a Froude's number 6. If the hydraulic jump takes place, calculate the energy lost per meter width of channel due to jump. [5]

b) What is a hydraulic jump? How are they classified? [5]

**P.T.O.**

**Q6) a) Explain with sketch [5]**

i) Specific energy curve.

ii) Specific force curve.

b) A rectangular channel 4m wide carries a discharge of  $3.2\text{m}^3/\text{s}$  with a depth of 0.8m. (Manning's  $n = 0.016$ ) [5]

Determine

i) Specific energy

ii) Critical depth

iii) Specific force



Total No. of Questions : 8]

SEAT No. :

**P5286**

**[5355]-536**

[Total No. of Pages : 2

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

**SEDIMENT TRANSPORT & RIVER MECHANICS**

**(2017 Credit Course) (Semester - II) (501048)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2 or 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 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)** Differentiate the variation of form resistance and grain resistance in different flow regimes. [6]

b) Discuss the nature of sediment problems. [6]

OR

**Q2) a)** Explain fundamental properties of individual sedimentary particles. [6]

b) Explain Shields Analysis. [6]

**Q3) a)** Briefly explain the modes of sediment transport. [6]

b) What are the significance and characteristics of ripples? [8]

OR

**Q4) a)** Explain Simmon-Albertson method of stable channel design. [6]

b) Design an irrigation channel in alluvial soil according to Lacey's method for following data [8]

i) Full supply discharge : 80 m<sup>3</sup>/sec

ii) Lacey's silt factor - 0.9.

iii) Channel side slope 0.5 H : 1V

**P.T.O.**



- Q5) a)** What do you mean by saltation mechanism and explain suspended load, total load and wash load. [6]
- b) Compare Kennedy method and Lacey method for the design of an irrigation channel giving all the steps of design by both methods. [6]

OR

- Q6) a)** Explain the concept of stable channel. [6]
- b) Using Meyer-Peter and Müller method, estimate the bed load transport of sediment in an alluvial channel, 110 m wide and 3.0 m deep carrying a discharge of 240 m<sup>3</sup>/s. The channel bed slope is 1 in 3500 and the mean size of the sediment is 0.3 mm. [6]

- Q7) a)** Explain bed load measurement and suspended load measurement. [6]
- b) Write down the objectives of river training and bank protection. [6]

OR

- Q8) a)** Write short note on plan form river bed. [6]
- b) Explain the alluvial river models. [6]



Total No. of Questions : 8]

SEAT No :

**P 5287**

**[5355]-537**

[Total No. of Pages : 2

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

**HYDROLOGY**

**(Semester - II) (2017 Course) (501049)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Hydrology has a vital role in causing instability of natural resources across the globe, explain. **[4]**
- b) What are the methods of finding unit hydrograph from a complex storm.? During a storm of duration 12h, the rainfall intensity observed in successive 4hr periods was 1.8 cm/h, 0.9 cm/h and 3.5 cm/h respectively. The ordinate of direct run off at 4hr interval are 150,280,550,625,400,230,100 and 48 m<sup>3</sup>/s respectively. Calculate the ordinates of 4hr unit hydrograph using deconvolution method. **[6]**
- Q2)** a) Under what situation an instantaneous unit hydrograph is prepared and what are its advantage. **[4]**
- b) What are Rainfall runoff models- and explain SWM, TANK model for Rainfall runoff analysis. **[6]**
- Q3)** a) Explain the importance of time series in the stochastic analysis of hydrologic events and what are the properties of time series. What are the different types of time series. **[5]**
- b) What are the different test for goodness of fit? Explain Chi square goodness of fit test and what are the steps followed in the Chi square goodness of fit, **[5]**

**P.T.O.**

- Q4)** a) What is the need for flood frequency study and different methods to find the peak flood. Explain the flood frequency analysis & its utility?[4]  
 b) Find the mean, standard deviation and skewness coefficient for the following observations  
 1300,1350,1400,620,525,500,1200,1785,1050,420  
 Assuming extreme value distribution estimate the parameters and probability for the variable to exceed 1500. [6]
- Q5)** a) Explain how groundwater zones are distributed along vertical? [5]  
 b) Derive the condition for steady radial flow into a well in an unconfined aquifer. A well of diameter 30cms penetrates fully into a 40m thick unconfined aquifer. The well is pumped at a rate of 401ps. The rawdown observed in two well at a distance of 15m and 105m are 6.5m & 0.5m respectively. Find the hydraulic conductivity of the aquifer and at what distance from the well drawdown is not significant. [5]
- Q6)** a) What is the principle of analysis of well flow near aquifer boundary? Explain the well flow near a impermeable boundary. [5]  
 b) Is it necessary to test the yield of well? Explain the pumping test and Recuperation test for finding the yield of well. [5]
- Q7)** a) What is the necessity of groundwater survey and different methods of groundwater survey. Explain the Electrical resistivity method of groundwater prospecting. [6]  
 b) Gravel packing of tube well is necessary after placing the tube well assembly. Discuss. Also the suitability of different types of gravel pack. [4]
- Q8)** a) How does the aquifers derive saline water? Explain the Ghyben-Herzberg relation between fresh water and saline water. [5]  
 b) What are the different types of model developed for study of groundwater. Explain the porous media model. [5]

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Total No. of Questions : 8]

SEAT No. :

P4745

[Total No. of Pages : 2

[5355]-541

M.E. Civil (Structure Engineering)

**THEORY OF ELASTICITY AND PLASTICITY**

(2017 Pattern)

*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) Obtain strain-displacement relations for the six independent strain components in an elastic body. [4]
- b) Define Airy's stress function  $\phi$  when the body forces are absent, prove that  $\phi$  satisfies the governing equation  $\nabla^4\phi = 0$ . [5]

OR

- Q2)** a) A plane passing through a point (x, y, z) in a stress elastic body has its normal n with direction cosines  $\cos(n, x)$ ,  $\cos(n, y)$  and  $\cos(n, z)$ . Obtain expressions for the resultant stress 'Tn' and its direction in terms of the six independent stress components at the point. [5]
- b) Obtain differential equations of equilibrium in polar co-ordinates. [4]
- Q3)** a) If inner radius a = 200 mm, outer radius b = 250 mm and pressure  $p = 40 \text{ N/mm}^2$  acting internally, find  $\sigma_r$  and  $\sigma_\theta$  at inner and outer faces of cylindrical vessel. [4]
- b) What are the different analogous methods used for solving torsion problem. Explain Prandit's theory for torsion of solid sections. [5]

OR

**P.T.O.**

- Q4)** a) Explain with examples the axisymmetric problems. Hence write down the corresponding basic equations for equilibrium, compatibility and strain displacement relation. [5]  
b) Obtain the expression for torsion of elliptical cross section bar. [4]
- Q5)** a) State and explain different yield criterion. [8]  
b) Explain in brief yield surface, flow rule and ideal plastic body with its stress-strain curve. [8]

OR

- Q6)** a) Explain in details St. Venant and Von Mises yield criterion. [8]  
b) Explain in brief Prandtl Reuss equality, Mohr' s theory of yielding and Tresca's associated flow rule. [8]
- Q7)** a) Explain in brief plastic torsion and Nadai's sand heap analogy. [8]  
b) Explain in details elastic/plastic analysis of thick walled cylindrical tubes. [8]

OR

- Q8)** Derive the equation of thick spherical shell in elastic plastic analysis due to internal pressure. [16]



[5355]-542

**M.E. (Civil - Structures)**  
**STRUCTURAL DYNAMICS**  
**(2017 Pattern) (Semester - I)**

Time : 3 Hours]

[Max. Marks :50

*Instructions to the candidates:*

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

**Q1) a)** Calculate the natural frequency of the system shown in fig. 1. [4]

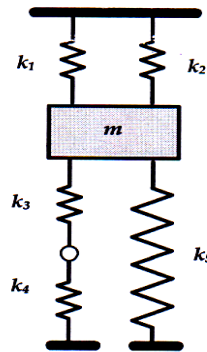


Fig. 1

- b) The free response of the damped single-degree-of-freedom system with a mass of 2 kg is recorded and is shown in **Fig.2**. A static deflection test is performed and the stiffness is determined to be  $1.5 \times 10^3$  N/m. Calculate the damping coefficient. [5]

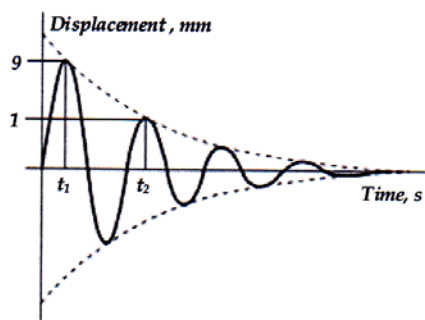


Fig. 2

P.T.O.

OR

Q2) a) Derive the expression for logarithmic decrement. [4]

b) A system shown in Fig.3 is underdamped with the damping factor  $\zeta = 0.25$ . If the initial conditions on the motion of the system are  $x = 0$  and  $\dot{x} = 4\text{ m/s}$ , determine the displacement at time  $t = 0.1\text{ s}$ .

Take  $m = 0.2\text{ kg}$ ,  $k_1 = 20\text{ N/m}$ , and  $k_2 = 30\text{ N/m}$ . [5]

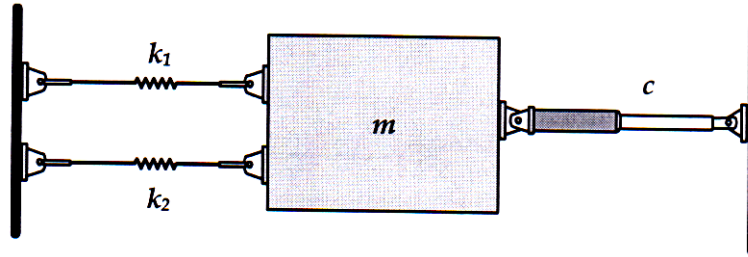


Fig.3

Q3) a) If the 30-kg block shown in Fig.4 is subjected to a periodic force of  $P = (300 \sin 5t)\text{ N}$ ,  $k = 1,500\text{ N/m}$ ,  $c = 300\text{ N.s/m}$  and, determine the equation that describes the steady-state vibration as a function of time. [4]

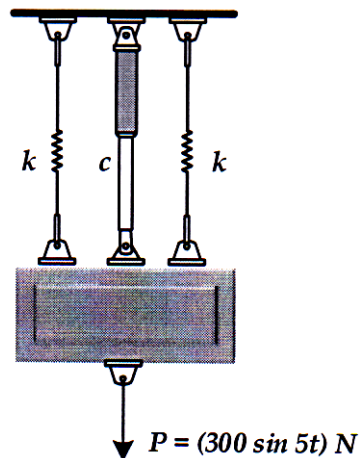


Fig.4

b) Derive the expression for dynamic magnification factor. [5]

OR

- Q4) a) Derive Duhamel's integral. [4]  
 b) A system is subjected to a step function as shown in Fig. 5. Determine the response of the system. [5]

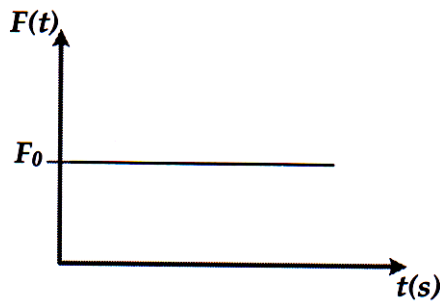


Fig. 5

- Q5) a) Calculate the natural frequencies and the mode shapes for the system shown in Fig. 6. [8]

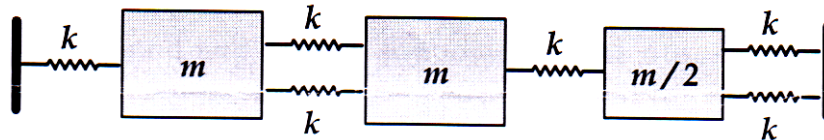


Fig. 6

- b) Derive the equation of motion for the system shown in Fig. 7 subjected to the ground acceleration  $x_g$ . Consider  $m_1 = m_2 = m$ ,  $c_1 = 3c$ ,  $c_2 = 2c$  and  $k_1 = 3k$ ,  $k_2 = 2k$ . [8]

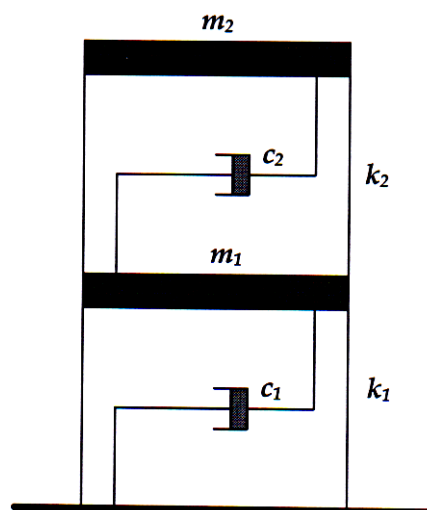
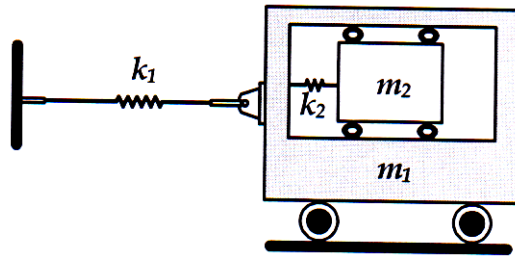


Fig. 7



OR

- Q6)** a) What are coupled equations? Explain with a suitable example. [8]  
b) Calculate the natural frequencies for the system shown in **Fig.8**.  
Consider  $m_1 = 1.92\text{kN}$ ,  $m_2 = 0.48\text{kN}$ ,  $k_1 = 98\text{kN/m}$ ,  $k_2 = 19\text{kN/m}$  [8]



**Fig.8**

- Q7)** a) A beam of uniform cross-section  $A$  and span  $l$  is fixed at one end and free at the other end. Derive the expression for longitudinal vibration of the beam. [8]  
b) Derive the expression for transverse vibration of a beam which is fixed at one end and simply supported at the other end. The beam has a uniform cross-section  $A$  and length  $l$ . [8]

OR

- Q8)** a) Explain Rayleigh-Ritz method. [8]  
b) Derive the expression for transverse vibration of a simply supported beam having a uniform cross-section  $A$  and length  $l$ . [8]



Total No. of Questions : 8]

SEAT No. :

P4747

[Total No. of Pages : 2

[5355]-543

M.E. (Civil - Structures)

**ADVANCED DESIGN OF STEEL STRUCTURES**

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

*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 and relevant IS codes are allowed.*

- Q1)** a) A hoarding of size 6m × 4m weighs 1,000N and is supported on two poles. The hoarding is 2.4m above the ground level and is located in Pune city. Analyze the hoarding structure. [6]
- b) Explain step-by-step design procedure for a microwave tower. [3]

OR

- Q2)** a) A tubular column hinged at both its ends has an outside diameter of 219.1 mm. Determine the safe load it can carry. [6]
- b) State the advantage and disadvantage of castellated beam. [3]
- Q3)** a) Two channel sections of 180mm×50mm are connected by their webs to act as a simply supported beam. The thickness of channel section is 2.0mm. The effective span of the beam is 3.8m. Determine the maximum uniformly distributed load including self-weight, which may be supported by the beam. Adopt properties of the channel section from IS: 811-1961. [6]
- b) Explain the loads acting on transmission tower. [3]

OR

- Q4)** a) What is broken wire condition? How its affect the design of transmission tower? [6]
- b) Explain stiffened, multiple stiffened and un-stiffened elements in cold formed light gauge sections. [3]

**P.T.O.**

- Q5)** a) Explain different types of steel chimneys with neat sketches. [8]  
b) What is a breech? Explain how the size and number of breech are determined. [8]

OR

- Q6)** a) A 80m tall self-supporting steel chimney is located in Mumbai. The diameter of the cylindrical portion is 2.1m. The chimney is provided with a brick lining of 100mm throughout its height. The chimney has one breech opening in its flared portion. Design the chimney. [8]  
b) Explain how the anchor bolts are designed for a steel chimney. [8]
- Q7)** a) Explain how stability check is done for steel chimneys. [8]  
b) Design base plate and anchor bolts for the chimney given in Q.6. [8]

OR

- Q8)** a) What is the function of anchor bolts? How are they designed? [8]  
b) Design step-by-step procedure to design a foundation for steel chimney. [8]



Total No. of Questions : 8]

SEAT No. :

P4748

[Total No. of Pages : 3

[5355]-544

**M.E. (Civil) (Structures Engineering) (End - Semester)**  
**NUMERICAL METHODS IN STRUCTURAL ENGINEERING**  
**(2017 Pattern)**

*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) Enumerate the properties of a typical stiffness matrix with suitable example. [4]
- b) Explain with flowchart the general procedure of Gauss elimination method. [5]

OR

- Q2)** a) Explain the importance and use of a transformation matrix. Derive the transformation matrix for a grid member. [5]
- b) What is Choleski Factorization/Decomposition Method? [4]
- Q3)** a) Derive the first-order derivative formulas of a function  $f(x)$  and list the order of their error term used in (i) forward difference method, and (ii) central difference method. (Hint: Consider the Taylor series expansion of  $f(x)$  at  $x = h$  &  $x = -h$ ) [4]
- b) Compare the different forms of Newton-Cotes methods - Trapezoidal and Simpson's Rules. Discuss with suitable sketches. [5]

OR

**P.T.O.**

- Q4) a)** Solve :  $y'' + 3y' + 2y = 0$  using Euler's method. [5]
- i) Express the 2<sup>nd</sup> Order ordinary differential equation as a 1<sup>st</sup> Order system of ordinary differential equation.
- ii) Carry out one iteration of Euler's method applied to the system of ordinary differential equation with initial conditions  $y(0) = 1$ ,  $y'(0) = 2$ , and step size  $h = 0.01$ .
- b) By applying suitable linear transformation, apply Gaussian quadrature rule to evaluate the integral; [4]

$$\int_0^2 (e^{-x^2}) dx$$

- Q5) a)** Explain with suitable examples, the Backward, Forward and Central finite difference methods. [8]
- b) Estimate the lowest buckling load of a uniform pin ended column of length " $L$ " and flexural rigidity " $EI$ " using three intervals. Assume that column has uniform flexural rigidity throughout its length. Use finite difference method. Compare the estimated approximate value with the exact Euler's Critical load. [8]

OR

- Q6) a)** A simply supported beam of uniform flexural rigidity " $EI$ " and span " $L$ " supports a triangular load of intensity " $w$ " at its center of span and zero intensity at both supports. Estimate the moments and maximum deflection at the center of span. [8]
- b) Estimate the lowest buckling load of a uniform pin ended column of length " $L$ " and flexural rigidity " $EI$ " using four intervals. Assume that column has uniform flexural rigidity throughout its length. Use finite difference method. Compare the estimated approximate value with the exact Euler's Critical load. [8]
- Q7) a)** Fit the polynomial of 2<sup>nd</sup> degree to the data points given in the Table-A below. [8]

Table-A

X	0	1	2
Y	1	6	17

- b) Explain Regression Analysis with suitable examples. Clearly state the Objectives, Use/Importance, and Procedure of a typical Regression Analysis in Structural Engineering. [8]

OR

- Q8)** a) Explain with an appropriate flowchart, example and illustrations; the use of Least Square method applied to fit a straight line. [8]
- b) Define interpolation and state its uses? Explain the logic of interpolation using Lagrange's polynomial. [8]



**[5355] - 545**  
**M.E. (Civil - Structures)**  
**FINITE ELEMENT METHOD**  
**(2017 Course)**

*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 the differential equation governing a physical phenomenon as

$$\frac{d^2y}{dx^2} + 1000x^2 = 0 \text{ for } 0 \leq x \leq 1, \text{ Boundary conditions are } y(0) = 0;$$

$y(1) = 0$  Assume trial function  $y = a(x - x^4)$ . Use point collocation method taking collocation point as midpoint domain. **[5]**

b) What is meant by static condensation of a matrix? **[4]**

OR

**Q2) a)** A continuous beam ABC is loaded and supported as shown in figure. Using standard stiffness matrix, determine the reactions at supports. **[5]**

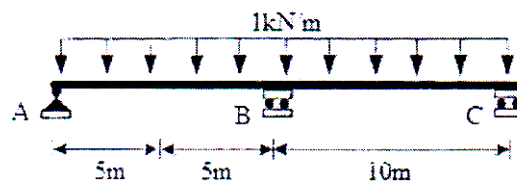


Figure 1

b) Differentiate in detail between the Rayleigh Ritz technique and weighted residual technique for solving the physical problem. **[4]**

**P.T.O.**

- Q3)** a) Derive the shape functions for one corner node, one mid - side node and internal node of a quadratic quadrilateral Lagrangian element. [5]
- b) The Cartesian coordinates of the corner nodes of an isoparametric quadrilateral element are given by (1,0), (2,0), (2.5, 1.5), and (1.5, 1). Find its Jacobian matrix. [4]

OR

- Q4)** a) A plate of size 20 cm × 20 cm × 0.8 cm plate is subjected to axial load of 10 kN. A typical element is of dimensions as shown in the figure 2. Determine the strain displacement matrix and constitutive matrix for the element . E = 200 GPa and  $\mu = 0.3$  [5]

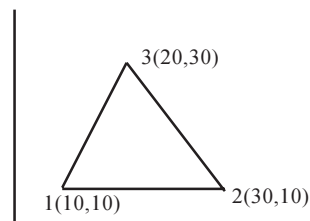


Figure - 2

- b) Explain the concept of mapping in isoparametric formulation. Differentiate between isoparametric, subparametric and super parametric elements. [4]
- Q5)** a) Explain  $C_0$ ,  $C_1$ , and  $C_2$  continuity elements with reference to plate bending problem with suitable examples. [8]
- b) Explain with suitable example, why we resort isoparametric formulation. Explain the concept of four noded isoparametric element in thin plate bending elements. [8]

OR

- Q6)** a) What is the displacement function for ACM plate bending element? Examine the conformity of the element. [8]
- b) Explain the BES plate bending element and its displacement function. [8]
- Q7)** a) For axisymmetric element, write stress strain relations and hence obtain the element stiffness matrix. [6]
- b) Explain with neat sketches the various three dimensional elements used in the analysis of shells. Explain in brief curved solid elements. [10]

OR



- Q8)** a) What are applications of axisymmetric elements? How will you differentiate the shell elements with plate element? [8]
- b) Explain the concept of degenerated solid elements. Write the displacement field for 4 noded degenerated shell element. [8]



Total No. of Questions :8]

SEAT No. :

**P5288**

**[5355]-546**

[Total No. of Pages : 2

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

**THEORY OF PLATES AND SHELLS**  
**(2017 Credit Course) (Semester-II) (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, 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.*
- 5) *Use of cell phone is prohibited in the examination hall.*
- 6) *Use of electronic pocket calculator is allowed.*

- Q1)** a) Derive the relationship between bending moment and curvature in pure bending of thin plate. [6]  
b) Differentiate Navier's and Lavy's method for the analysis of thin plate. [3]

OR

- Q2)** a) A square plate of size  $a \times a$  with all four edges simply supported, carries a uniformly distributed load of intensity  $q$ . using Lavy's method determine the maximum deflection in the plate. [6]  
b) State the assumption for small deflection theory of thin plates and Differentiate thin & thick plate. [3]

- Q3)** a) Derive expression for transverse displacement, moments and shearing forces for edge simply supported circular plate subjected to uniform lateral loading. [6]  
b) State and explain classification of shells on geometry with suitable sketches. [3]

OR

- Q4)** a) Derive the equilibrium equation for  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$  in circular cylindrical shell using membrane theory. [6]  
b) State and explain moment curvature relations for circular plate. [3]

**P.T.O.**

- Q5)** a) State the application of membrane theory to pipe and hence derive an expression for  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$ . [10]
- b) Differentiate membrane and bending theory for circular cylindrical shell. [6]

OR

- Q6)** a) Derive an equilibrium equation for circular cylindrical shell using membrane theory. [10]
- b) State and explain various boundary conditions for circular cylindrical shells. [6]

- Q7)** a) State and explain application of beam theory to cylindrical roof shells. [10]
- b) Explain in details arch analysis for cylindrical shells. [6]

OR

- Q8)** a) Explain in brief principles of Lundgren's beam theory with suitable example. [10]
- b) Explain in details beam analysis for cylindrical shells. [6]

✓ ✓ ✓

Total No. of Questions : 8]

SEAT No. :

P4749

[Total No. of Pages : 2

[5355]-547

M.E. (Civil) (Structures)

ADVANCED DESIGN OF CONCRETE STRUCTURES

(2017 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Draw neat diagrams.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.

- Q1)** a) What are the properties of yield lines? [4]  
b) Design a grid slab for a floor of hall  $10.5\text{m} \times 7.5\text{m}$  having square grid of  $1.5\text{m}$ . Use M20 and Fe 500. (Design for flexure only). [5]

OR

- Q2)** a) Draw yield lines for the following: [5]  
Rectangular slab with fixed at support on three sides with shorter edge simply supported.  
b) Design a grid slab for a floor of hall  $14.4\text{m} \times 9\text{m}$  having square grid of  $1.8\text{m}$ . Use M25 and Fe 415. (Design for flexure only). [4]
- Q3)** a) Explain different types of flat slab and its advantages. [4]  
b) An open square tank is  $5\text{m} \times 5\text{m} \times 3\text{m}$  deep and supported 6 meters above the ground level on beams and columns. Design the tank, beams, and columns. Use M20 and Fe415. [5]

OR

- Q4)** a) Design an interior panel of a flat slab for a live load of  $4\text{kN/m}^2$  and floor finish  $1\text{kN/m}^2$ . The panels are  $6\text{m} \times 6\text{m}$ . Use M20 and Fe415. (Design for flexure only). [5]  
b) Explain in detail wind load analysis of columns for a water tank supported on four identical columns with their lower ends fixed to the base and braced at intermediate levels. [4]

P.T.O.

- Q5) a)** Design a square bunker to store 350 kN coal. Unit weight of coal is  $9000\text{N/m}^2$ . Angle of repose is  $26^\circ$ . Use M25 and Fe500. Draw reinforcement details. [8]
- b)** A concrete bin is  $3.2\text{m}\times 3.2\text{m}$  and contains wheat weighing  $8.75\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.42. The coefficient of friction between grain and concrete is 0.4. If the depth of wheat is 6m, determine the lateral pressure per meter run of the bin wall. [8]

OR

- Q6) a)** Design a side wall and hopper bottom of circular bunker to store 55 tonnes of cement. Take the unit weight of cement =  $16\text{kN/m}^3$ , angle of repose =  $28^\circ$ . Use M25 and Fe415. Draw reinforcement details. [8]
- b)** A concrete bin is  $3.5\text{m}\times 3.5\text{m}$  and contains wheat weighing  $8.5\text{kN/m}^3$ . The coefficient of friction between grain and grain is 0.4. The coefficient of friction between grain and concrete is 0.41. If the depth of wheat is 2.75m determine the lateral pressure per meter run of the bin wall. [8]
- Q7) a)** A group of 24 piles is arranged with 4 rows and 6 piles each. The piles are 300mm in diameter and spaced 1m centers. Each pile can carry 200kN working load if it can act independently. Determine the carrying capacity of the pile group. [8]
- b)** Design the formwork for slab  $3\text{m}\times 3\text{m}$  having thickness 150mm. It is proposed to deposit concrete in one stage. [8]

OR

- Q8) a)** In a 25 pile group the pile diameter is 400mm and center to centre spacing of the piles is 1.5m. The piles are arranged in a square area. Ascertain whether the failure will occur with the piles acting individually or as a group. Each pile is 12m long. Take  $m=0.7$  and  $c=50\text{kN/m}^2$ . [8]
- b)** Design the raft foundation for centre to centre distance of column in both direction is 2.4m, column size  $300\text{mm}\times 300\text{mm}$ , working load on each column is 650kN. The depth of the strata is 1.8m. Use M20 and Fe500. SBC  $100\text{kN/m}^2$ . Draw reinforcement details. [8]



Total No. of Questions : 8]

SEAT No. :

**P4750**

[Total No. of Pages : 2

**[5355]-551**

**M.E. (Civil)**

**(WATER RESOURCES AND ENVIRONMENTAL ENGG.)**

**PLANNING AND MANAGEMENT OF WATER RESOURCES**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

- Q1)** a) Discuss social and environmental objectives in water resources planning and management. [4]
- b) Comment on practices in setting planning horizons. [5]

OR

- Q2)** a) Explain the system components of water resources planning and management and state various approaches of planning and management of water resources. [5]
- b) Explain constraints like non reversibility for development of water resources. [4]
- Q3)** a) Work out the life of reservoir before its capacity is reduced to 20% of the initial capacity from the following sedimentation data. Catchment area is 1000 sqkm,. Reservoir capacity is 10000 ha m, average annual flow amounts to 15 cm of runoff. Average annual sediment inflow is 0.36 million tonnes. [5]
- b) Discuss construction and maintenance of artificial wells. [4]

OR

**P.T.O.**

- Q4)** a) Explain any one water doctrine to avoid conflict amongst users. [5]  
b) Discuss Dupit's and Theims theories regarding ground water hydraulics. [4]

- Q5)** a) Explain in detail planning for flood control & flood plain management. [8]  
b) Discuss allocation of water priority wise while planning and managing water resources as per central water policy. [8]

OR

- Q6)** a) Explain allocation of cost & repayment of cost for multipurpose project. [8]  
b) Discuss essential data required for water power studies of a storage project. [8]

- Q7)** a) What are the principles & procedures for basin planning. [8]  
b) How financial performance analysis is done for assessment of the economic viability and long term sustainability of the projects. [8]

OR

- Q8)** a) What is 'Inter Basin Water Transfer', enumerate it with suitable example. [8]  
b) Discuss discounting technique for financial analysis of large dams. [8]



Total No. of Questions : 5]

SEAT No. :

P4751

[Total No. of Pages : 2

**[5355] - 552**  
**M.E. (Civil) (WREE)**  
**ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt all questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if required.*

**Q1)** Explain any four out of the following terms.

**[16]**

- a) Bio - kinetic co - efficiencies.
- b) Zoning of atmosphere.
- c) Working of flame photometer.
- d) Toxicity test on hazardous waste
- e) Various types of chemical reactions.
- f) Automobile pollution sampling technique.

**Q2)** Attempt any one of (A) & (B)

**[8]**

- A) Explain working of Activated sludge process.
- B) Design an oxidation pond based on the following data :  
Location : 26° latitude  
Elevation : 1000 m above sea level  
Mean monthly temp : 25°C max. & 10°C min.  
Population served : 10,000  
Sewage flow : 150 lpcd  
BOD<sub>5</sub> : 300 mg/l  
Desired effluent BOD<sub>5</sub> : 30 mg/l  
Sky clearance factor : 0.60  
Per capita BOD flow : 0.045 kg/day  
Pond removal constant at 20°C : 0.1 / day

**P.T.O.**



**Q3)** Attempt any one of (A) & (B) **[8]**

- A) Design a sludge digestion tank with following data :
- Average flow of sewage :  $60 \times 10^6$  lit/day
  - Total suspended solids in the raw sewage : 350 mg/lit.
  - Volatile suspended solids : 250 mg/lit.
  - Moisture content of digested sludge : 87%
  - Sludge removal in PST : 65%
  - Water content of fresh sludge : 95%
  - Volume of digested sludge : 87%
  - Digestion period : 30 days
- B) Explain leachate control in solid waste management.

**Q4)** Attempt any one out of (A) & (B) **[8]**

- A) Explain working of UASB.
- B) Write a short note on Anoxic treatment.

**Q5)** Attempt any one out of (A) & (B) **[10]**

- A) i) Derive an expression of Moond's.
- ii) Write a short note on Bioassay test.
- B) i) Differentiate between prokaryotic and eukaryotic cells.
- ii) What is substrate utilization in biological waste treatment.



Total No. of Questions : 6]

SEAT No. :

P4752

[Total No. of Pages : 2

**[5355] - 553**  
**M.E. (Civil) (WREE)**  
**Fluid Mechanics**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1)** a) Describe the density and temperature in terms of Mach number in compressible fluids. **[5]**

b) Explain the expression normal shock in one dimensional compressible fluid. **[5]**

**Q2)** a) Explain the statistical theory of turbulence. **[5]**

b) Derive the energy and momentum equation in turbulent flow. **[5]**

**Q3)** a) For the velocity profile  $\frac{u}{U} = \left(\frac{y}{\delta}\right)^n$ , Calculate the shape factor  $H = \frac{\delta^*}{\theta}$  and  $\delta^{**}$  **[5]**

b) Explain terms - **[5]**

i) Laminar sub layer

ii) boundary layer thickness

**Q4)** a) Starting from first principles show that for laminar flow between fixed parallel plates the mean velocity is two - third of maximum velocity. **[5]**

**P.T.O.**

b) A laminar flow of oil of viscosity  $0.20 \text{ N} \cdot \text{S}/\text{m}^2$  and density  $900 \text{ kg}/\text{m}^3$  flow through a pipe of a diameter  $0.35 \text{ m}$ . If the head loss of  $25 \text{ m}$  is observed in a length of  $2,500 \text{ m}$ , determine : **[5]**

i) The velocity of flow

ii) Reynold's number

iii) Friction factor

**Q5)** a) Explain method of solving Laplaces equation by graphical method in Kinematics. **[4]**

b) Describe with a neat sketch source, sink and doublet & their combination. **[6]**

**Q6)** a) Derive the one - dimensional continuity equation along stream line. **[5]**

b) If  $u = -2x$ ,  $v = 2y$  for flow field find circulation about a square formed by  $x = \pm 2$ ,  $y = \pm 2$  **[5]**



Total No. of Questions : 8]

SEAT No. :

P4753

[Total No. of Pages : 2

**[5355] - 554**  
**M.E. (Civil - WREE)**  
**ADVANCED WATER TREATMENT**  
**(2017 Pattern)**

*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 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 are the various types of plain sedimentation basins? Explain any one type of basin with a neat sketch. **[4]**

b) Write in detail about Hydraulics of Filtration and Backwashing Cycles of a rapid sand gravity filter. **[5]**

OR

**Q2) a)** Design a clariflocculator for treating 5 M/D water with the help of following data : **[5]**

i) Surface loading of 1000 lit/hr/m<sup>2</sup>.

ii) Detention period of 3 hours.

iii) Tank is circular with flocculator in the centre and clarifier surrounding it.

iv) Detention time for flocculation = 20 minutes

b) Write design steps of rapid sand filter. **[4]**

**Q3) a)** Explain Lime Soda process for removal of Hardness of water. **[4]**

b) Write design steps of rising main. **[5]**

**P.T.O.**

OR

- Q4)** a) What are the factors influencing adsorption? [5]  
b) Write short note on water hammer analysis. [4]

- Q5)** a) Comment on role of groundwater in hydrological cycle and draw a neat sketch of hydrological cycle. [8]  
b) Differentiate between shallow dug wells and deep dug wells. How are dug wells constructed? [8]

OR

- Q6)** a) What are the steady and unsteady state solutions for confined and unconfined aquifers? [8]  
b) Write a short note on [8]  
i) Pumping test analysis.  
ii) Flow and storage characteristics of aquifers

- Q7)** a) Write Theory of Membrane separation and Membrane Filtration. [8]  
b) Write principles and applications of Nano filtration. [8]

OR

- Q8)** a) Explain procedure of ion exchange and reverse osmosis. [8]  
b) Write principles and applications of Ultra filtration. [8]



Total No. of Questions : 8]

SEAT No. :

**P5253**

[Total No. of Pages : 2

**[5355] - 555**

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

**HYDROLOGY**

**(2017 Pattern)**

*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 flow chart for mathematical methods in hydrology and explain stochastic hydrology applications. **[6]**

b) Explain log- normal distribution (statistical) **[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]**

**P.T.O.**

OR

- 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 : 6]

SEAT No. :

P4754

[Total No. of Pages : 2

**[5355] - 556**  
**M.E. (Civil) (WREE)**  
**OPEN CHANNEL HYDRAULICS**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw a neat sketch wherever necessary.*

- Q1)** a) Show that the most economical triangular section is a half square with diagonal horizontal. **[5]**
- b) Design an efficient trapezoidal channel of side slopes 2 H : 1 V, bed slope 1 in 4900 to carry discharge of 8 m<sup>3</sup>/sec. ( $\eta = 0.025$ ) **[5]**
- Q2)** a) Energy loss and froude number after jump is 6 m and 0.15 respectively. Calculate discharge intial depth of jump and power lost per unit width of channel. **[5]**
- b) Explain hydraulic jump in expanding channel about drop and sloping rectangular channel. **[5]**
- Q3)** a) Explain V. Chow's method of GVF computation. **[4]**
- b) A rectangular channel has a bed width of 5 m, slope  $S_0 = 0.0004$ , mannings coefficient,  $n = 0.02$  and normal depth = 3 m. If the channel empties into pool at D/S end and pool elevation is 1.2 m higher than the canal bed elevation of D/S. Compute GVF ('2' steps) **[6]**
- Q4)** a) Derive the expression for spatially varied flow with increasing discharge. **[6]**
- b) Describe the 'side weir' as SVF. **[4]**

**P.T.O.**



**Q5)** a) Describe the dynamic equation for uniformly progressive flow with stating assumptions. [5]

b) What is meant by positive surge and Negative surge? What are the occurances? What remedies? [5]

**Q6)** a) Differentiate between [6]

i) Hydraulic and Hydrologic flood routing

ii) Reservain and channel routing.

b) Explain 'Muskinghum' method of flood routing. [4]



Total No. of Questions : 6]

SEAT No. :

P4755

[Total No. of Pages : 3

**[5355] - 557**  
**M.E. (Civil) (WREE)**  
**ADVANCED WASTE WATER TREATMENT**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *All the questions are compulsory.*
- 2) *Solve Q.1 or Q.2 , Q.3 or Q.4, Q.5 or Q.6.*

- Q1)** a) Give the importance of sewage analysis. Also explain main characteristics of sewage. [4]
- b) What are the various applications of microfiltration and ultra - filtration.[4]
- c) Draw the schematic diagram of typical wastewater treatment process. [4]
- d) Differentiate aerobic & anaerobic decomposition [4]

OR

- Q2)** a) A dual - media filter bed composed of sand & anthracite is to be used for the filtration of settled secondary effluent. If the effective size of the sand in this filter is to be 0.55 mm, sp. gravity of sand & anthracite is 2.65 & 1.7 respectively, then determine the effective size of anthracite to avoid significant mixing. [4]
- b) Enlist advantages & disadvantages of Reverse Osmosis. [4]
- c) Differentiate between Dialysis & Electro - dialysis. [4]
- d) A treated w/w with a flowrate of 1000 L/min is to be treated with PAC to reduce the conc. of residual organics measured as TOC from 5 to 1 mg/l. The Freundlich adsorption isotherm parameters were developed. Assuming the following data applied, determine PAC requirement to treat w/w flow. If PAC costs 30 Rs/Kg, estimate the annual cost for treatment, assuming the PAC will not be regenerated [4]

**P.T.O.**

Given

- i) Compound = mixed organics.
- ii) Initial conc.  $C_o = 5 \text{ mg/l}$
- iii) Final conc,  $C_e = 1 \text{ mg/l}$
- iv) GAC density =  $450 \text{ g/l}$
- v) Freundlich capacity factor =  $kg = 150 \text{ (mg/g) (L/mg)}^{1/n}$
- vi) Freundlich intensity parameter =  $1/n = 0.5$

**Q3) a)** Design a gravity thickener for a w/w treatment plant having primary & waste - activated sludge with the following characteristics. **[10]**

Type of sludge	sp. Gravity	solids (%)	flowrate (m <sup>3</sup> /d)
Primary	1.03	3.4	420
Waste Activated	1.005	0.23	2500

Assume sp. gravity of combined sludge = 1.02

- b) Write a short note on **[8]**
- i) Single stage high rate digester
  - ii) Double stage high rate digester

OR

**Q4) a)** Write a short note on paved drying bed. Design a paved drying bed for a wastewater treatment plant that produces 180,000 kg/yr for dry solids. Assume following conditions. **[9]**

- i) % of dry solids in biosolids after decanting = 8%
- ii) % dry solids required for final disposal = 35%
- iii)  $K_e = 0.6$
- iv) Evaporation rate  $Re = 720 \text{ kg/m}^2 \text{ yr.}$
- v) Annual precipitation =  $0.6 \text{ m/yr}$

- b) Explain the following terms related to ASP : [9]
- i) Loading rate
  - ii) Mixing regime
  - iii) Return sludge
  - iv) Sludge Index
  - v) Flow scheme
  - vi) Primary treatment

Also calculate the SVI for a mixed liquor with 2700 mg/lit suspended solids having settled sludge volume of 200 ml with 1 lit. sample Indicate whether this volume index is good or poor?

- Q5)** Write a short note on following ways of refuse disposal. [16]
- a) dumping into sea
  - b) Sanitary landfilling
  - c) Incineration
  - d) composting

OR

- Q6)** a) Write a short note on up - flow Anaerobic sludge blanket reactor (Principle, Advantages & Disadvantages, sketch). [8]
- b) Design a sludge drying bed for digested sludge from an activated sludge plant serving 1,50,000 persons with following data : [8]
- i) solids in digested sludge from mixed 57 g/c/d.
  - ii) dry solid loading rate = 100 kg/m<sup>2</sup>/yr
  - iii) Bed size  $\Rightarrow$  8 m  $\times$  30 m with bedslope = 0.5%
  - iv) % of solids = 7%
  - v) sp. gravity = 1.025
  - vi) No. of cycles per year = 10



Total No. of Questions : 8]

SEAT No. :

P4756

[Total No. of Pages : 3

[5355]-561

ME (Mechanical) (Design Engineering/CAD - CAM, Automobile)

ADVANCED MATHEMATICS

(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 electronic pocket calculator is allowed.
- 5) Assume suitable data, if necessary.

**Q1)** a) Find an orthonormal basis for the Euclidean space  $\mathbb{R}^3$ , by applying Gram - Schmidts method to the following vectors (1, 0, 3), (2, 2, 0) and (3, 1, 2) [5]

b) Prove that  $u = x^2 - y^2 - 2xy - 2x + 3y - 9$  is harmonic. Find a function  $v$  such that  $f(z) = u + iv$  is analytic. [5]

**Q2)** a) Evaluate  $\oint_C \frac{z^2 - 4}{(z-1)^2(z+2)} dz$ , where  $C$  is  $|z| = 3$ . [5]

b) Find the Laplace transform of the periodic function. [5]

$$f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$$

**Q3)** a) Solve the following differential equation by series method : [5]

$$\frac{d^2y}{dx^2} + x^2y = 0$$

P.T.O.

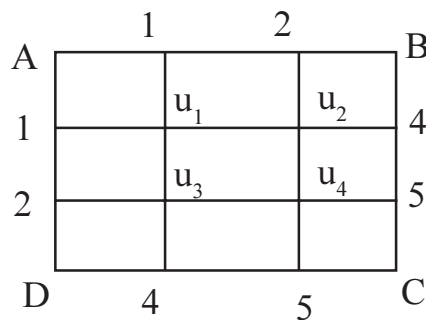
- b) Using Laplace transform, solve the initial value problem in mechanical system given by  $2\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 2y = e^{-2t}$ ,  $y(0) = 1$ ,  $y'(0) = 1$ . [5]

- Q4) a)** Using power method find the numerically largest eigen value of

$$A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$$

and corresponding eigen vector. [5]

- b) Solve the boundary value problem  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  for the given square shown below : [5]



- Q5) a)** Use Bendre - Schmidt method to solve the heat equation

$$\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$$

with boundary conditions  $u(0,t) = 0$ ,  $u(8,t) = 0$ ,  $u(x,0) = 4x - \frac{x^2}{2}$  taking  $h = 1$ . Tabulate  $u(x, t)$  up to 2 levels of time. [5]

- b) Using Galerkin's method, obtain solution of the boundary value problem of a mass spring system given by  $y'' + y = x^2$ ,  $0 < x < 1$ ,  $y(0) = y(1) = 0$ . [5]

**Q6) a)** Solve the Euler's equation for the functional  $\int_{x_0}^{x_1} (1 + x^2 y') y' dx$  [5]

b) Solve the system of equations by least square method  $x - 2y = 1$ ,  
 $2x + 4y = -1$ ,  $4x - 3y = 2$ . [5]

**Q7) a)** Find the image of the circle  $|z - i| = 1$  under the transformation  $w = \frac{1}{z}$  in  
to w - plane. [5]

b) Solve the integral equation [5]

$$\int_0^{\infty} f(x) \cos \lambda x d\lambda = e^{-\lambda}, \lambda > 0$$

**Q8) a)** For the system shown in the figure assuming there is no friction. Find  
the natural frequencies of the system and cooresponding normal mode  
of the vibration using matrix method. [5]



b) Solve the Boundary value problem  $16 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$  with conditions

$u(0,t) = u(5,t) = 0$ ,  $u(x,0) = x^2(5 - x) \left( \frac{\partial u}{\partial t} \right)_{t=0} = 0$  by taking  $h = 1$  up  
to 5 levels of time  $t$ . [5]



Total No. of Questions : 7]

SEAT No. :

P4757

[Total No. of Pages : 2

[5355] - 562

M.E. (Mechanical) (Design Engineering)

**MATERIAL SCIENCE AND MECHANICAL BEHAVIOR OF  
MATERIALS**

**(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) *Figures to the right indicate full marks.*
- 4) *Use of programmable calculators not permitted.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** A continuous and a aligned fiber - reinforced composite is to be produced consisting of 30 vol% Aramid fibers and 70 vol% of a polycarbonate matrix; mechanical characteristics of the these two materials are as follows: Modulus of Elasticity of Aramid fiber 131 GPa, Tensile strength of Aramid fiber 3600 MPa. Modulus of Elasticity of Polycarbonate fiber 2.4 GPa, Tensile strength of Aramid fiber 65 MPa. The composite has a cross - sectional area of 320 mm<sup>2</sup> and is subjected to a longitudinal load of 44500 N. Also the stress on the polycarbonate matrix when the Aramid fibers fail is 45 MPa. For this composite **[5]**

- i) Compute longitudinal tensile strength.
  - ii) Compute the longitudinal modulus of elasticity.
  - iii) Calculate the fiber matrix load ratio.
  - iv) Calculate the actual loads carried by both fiber and matrix phases.
  - v) Compute the magnitude of stress on each of the fiber and matrix phases.
- b) Explain the applications of nano material by considering Functional attributes. **[5]**

**P.T.O.**



- Q2)** a) What are smart materials? Discuss the applications of smart materials. [5]  
 b) Discuss the Strengthening mechanism in case of lightweight nonferrous alloy. [5].

**Q3)** Stress at point in certain component of machine tool is as follows  $\sigma_x = 55 \text{ MPa}$ ,  $\sigma_y = 55 \text{ MPa}$ ,  $\tau_{xy} = -5 \text{ MPa}$ ,  $\sigma_z = 20 \text{ MPa}$  and  $\tau_{yz} = \tau_{zx} = 30 \text{ MPa}$ , Sketch the Mohr's circle diagram for this stress State; Find the three principal stresses, the largest shear stress in the component and octahedral stresses. [10]

- Q4)** a) A wide sheet (1 mm thick) of steel is bent elastically to a constant radius of curvature,  $\rho = 500 \text{ mm}$  measured from the axis of bending to the center of the sheet as shown in figure 1. Find the stress in the surface. Assume that there is no net force in the plane of the sheet. Knowing that  $E = 208 \text{ GPa}$ , and  $\nu = 0.3$  for steel. [5]

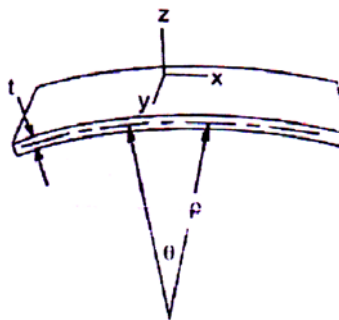


Figure 1

- b) Explain three point bend test. [5]
- Q5)** a) Explain isotropic strain hardening model in plasticity. [5]  
 b) Explain thermo plasticity in plastic yielding. [5]
- Q6)** Explain Residual stresses and residual strain in cylinder in torsion. [10]
- Q7)** a) Explain Maxwell model in viscoelasticity. [5]  
 b) Explain Thermo - elastic effect in metals. [5]



[5355] - 563

**M.E. (Mechanical) (Design Engineering)**  
**ADVANCED STRESS ANALYSIS**  
**(2017 Credit Pattern)**

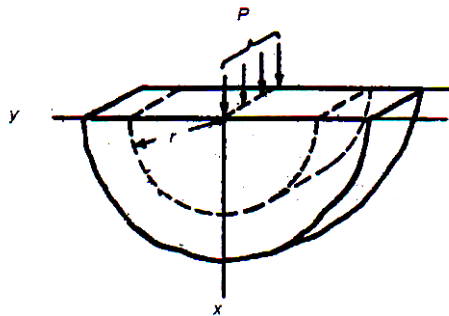
*Time : 3 Hours]**[Max. Marks :50**Instructions to the candidates:*

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

**Q1) a)** The Airy's stress function for the stress distribution under knife edge on the boundary of infinite solid is given in polar coordinates by

$$\phi = \frac{P.r}{\pi} \theta . \sin \theta$$

where P is the uniformly distributed load per unit length of edge, refer fig. 1. Determine values of  $\sigma_r$ ,  $\sigma_\theta$  and  $\tau_{r\theta}$ . Hence prove that the resultant of forces integrated any semi circular path around the edge is equal to P. [6]



Q1) fig. 1

- b) Reduce the Polar form compatibility equation for symmetrical stress distribution about an axis. Give suitable examples of applicability of this case. [4]

*P.T.O.*

- Q2) a)** Determine whether the following stress distribution is a valid solution for a two dimensional problem : **[5]**

$$\sigma_x = -Ax^2y \quad \sigma_y = -\frac{1}{3}Ay^3 \quad \tau_{xy} = -Axy^2$$

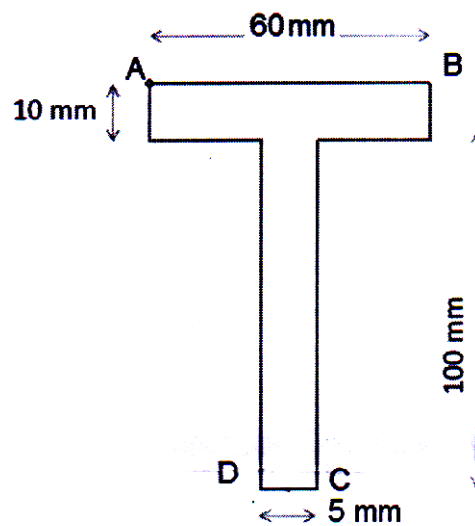
Where 'A' is a constant and Body forces are neglected.

- b) For Beam carrying moving point loads, Obtain condition for maximum bending moment relating position of load, resultant of point loads and beam length. **[5]**

- Q3)** A beam of T - section (flange : 60 mm × 10 mm, web 100 mm × 5 mm) shown in fig. 2 is of 3 m length and simply supported at the ends. It carries a load of 4 kN at centre of span, inclined at 20° to the vertical and passing through centroid of section. If Young's Modulus  $E = 200 \text{ GPa}$ . **[10]**

Determine :

- i) Maximum tensile stress,
- ii) Maximum compressive stress
- iii) Maximum bending stress
- iv) Deflection due to the load,
- v) Position of neutral axis



Q3) fig. 2

- Q4)** For an equilateral triangular bar subjected to pure torsion, Obtain the stress function and relations between shear stress and torque. If the boundaries of an equilateral triangle are defined as : **[10]**

$$x = a; \quad x + 2a = \sqrt{3}y; \quad x + 2a + \sqrt{3}y = 0$$

Hence show that Warping function  $\Psi = A(y^3 - 3x^2y)$  is valid for the problem.

- Q5)** A hard steel ball ( $E = 200$  GPa,  $\nu = 0.29$ ) of diameter 50 mm is pressed against a thick aluminum plate ( $E = 72$  GPa,  $\nu = 0.33$ , Yield stress = 450 MPa), **[10]**

- a) Determine the magnitude of load required  $P_y$  to initiate yield in the aluminum plate according to the maximum octahedral shear stress criteria of failure.
- b) If the factor of safety is considered as 1.75 recalculate the load required to initiate yield in the aluminum plate also determine the displacement of the ball relative to plate.

- Q6)** a) A delta rosette strain gauge is mounted on a steel specimen. For a particular state of loading of the structure the strain gauge readings are –

$$\epsilon_A = 200 \mu\text{m/m (at } 30^\circ \text{ angle), } \epsilon_B = 900 \mu\text{m/m (at } 60^\circ \text{ angle),}$$

$$\epsilon_C = 1000 \mu\text{m/m (at } 120^\circ \text{ angle)}$$

Determine orientation of the maximum principal strain.

Young's modulus  $E = 200$  GPa and Poisson's ratio  $\nu = 0.285$ . **[6]**

- b) Explain Kelvin's fluid flow analogy, with suitable example. **[4]**

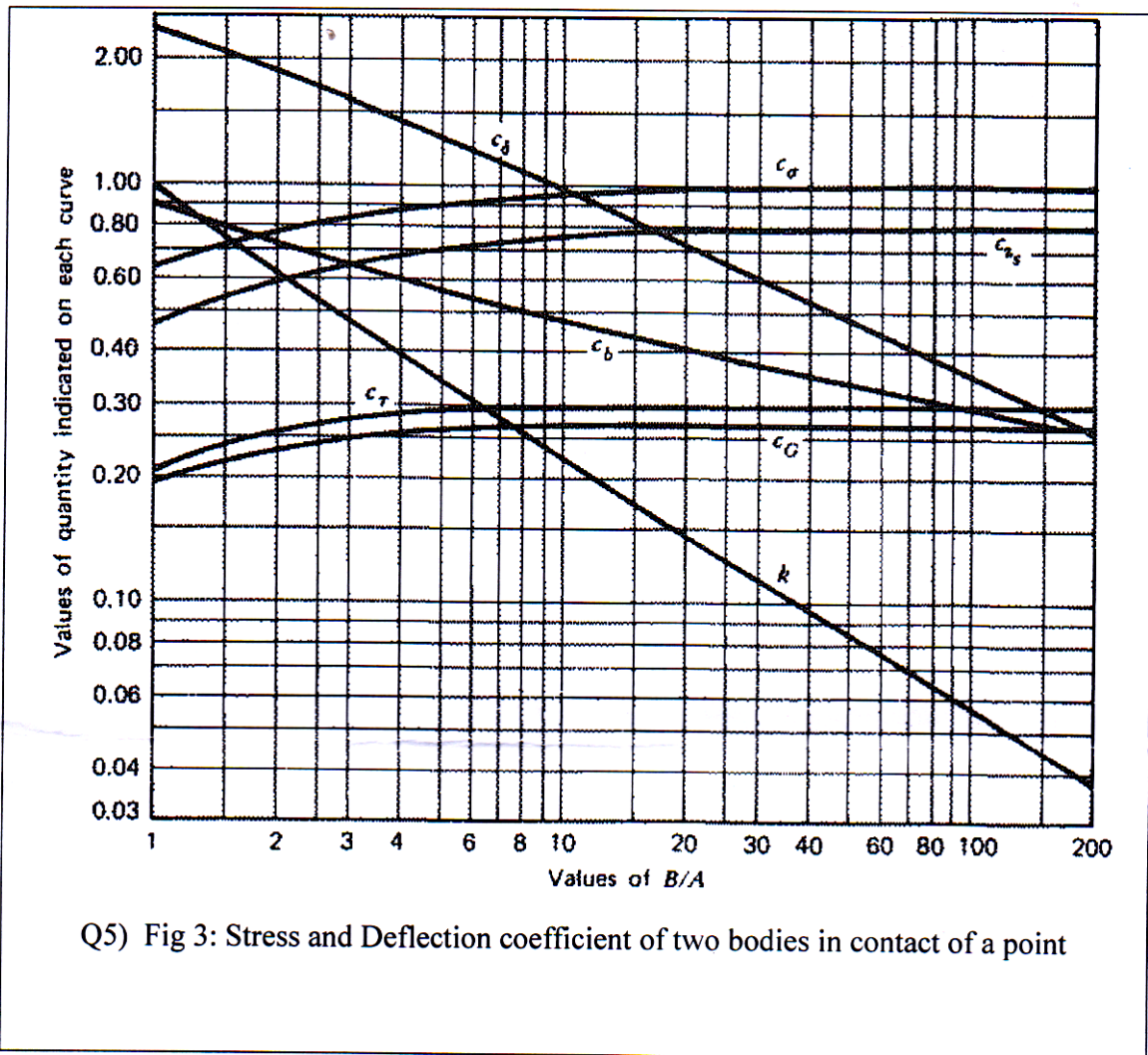
- Q7)** a) A simply supported steel beam 3 m long of a rectangular cross section 150 mm deep and 75 mm wide is to carry a uniform load of 6 kN/m along a span with  $E = 200$  GPa.

A photo - elastic scale model 500 mm long is to be constructed of a material with a modulus of elasticity of  $E = 20$  GPa.

The prototype is to be loaded with a uniformly distributed force at a particular location. To assure that the stresses in the model do not exceed the linear range of material, it was decided to apply a uniform load of 240 N/m on the model. The model test revealed a maximum bending stress of 1.4 MPa.

Determine the maximum bending stress for prototype. **[6]**

- b) Explain working of Plain Polariscope and explain how Iso - clinics and Iso - chromatics are obtained when a stressed model is viewed through polariscope. [4]



Total No. of Questions : 8]

SEAT No. :

P4759

[Total No. of Pages : 2

**[5355] - 564**  
**M.E. (Mechanical Engineering)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** a) Explain different steps in “Research Methodology” with examples. [5]

b) Discuss different types of research? Give examples for each. [5]

**Q2)** a) Explain inductive method and deductive method in research? Explain with flow chart. [5]

b) Explain the importance of review of literature, different sources of literature? [5]

**Q3)** a) How to collect data and represent it in different forms? Which is best suited for engineering research. [5]

b) How do you estimate mean deviation? Sum of squares between samples and sum of squares within sample? [5]

**Q4)** a) Explain how to carry out linear regression using computer program. What is the significance of R square value. [5]

b) Explain the term covariance. Give examples with diagram for variants which are strongly covariant, negative covariant and not covariant. [5]

**P.T.O.**

- Q5)** a) Define ANOVA and one way and two way methods. Where do you use two way ANOVA. [5]  
b) Explain MANOVA and MANCOVA. [5]
- Q6)** a) Explain the different sections / formats in a project proposal. [5]  
b) How do you estimate the budget for the proposed project? List steps for one case study. [5]
- Q7)** a) Write a note on different forms of reporting the research results. [5]  
b) Explain the difference in journal publications, conference paper and short communication. [5]
- Q8)** a) Explain the term IPR. Which are different categories of IPR. [5]  
b) Explain the different steps involved in obtaining patent. [5]



[5355]-565

**M.E. (Mechanical Design Engineering)**  
**ANALYSIS AND SYNTHESIS OF MECHANISMS**  
**(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 whenever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume suitable data whenever necessary.

- Q1) a)** State whether the linkages shown in Fig. 1 is mechanisms with one degree of freedom, if not suggest suitable. Changes using Gruebler's criterion. [4]

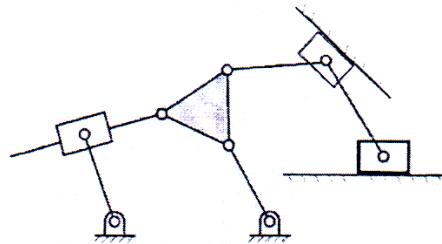


Fig. 1

- b)** The mechanism shown in Fig.2 has,  $OA=150\text{mm}$ ,  $AB=500\text{mm}$ ,  $AC=250\text{mm}$ ,  $BD=600\text{mm}$  (vertical),  $CE=500\text{mm}$ . When crank  $OA$  rotates at  $10\text{ rad/s}$  clockwise Determine : [6]

velocity of slider  $E$ , angular velocity of link  $BD$  and  $CE$  using velocity polygon method.

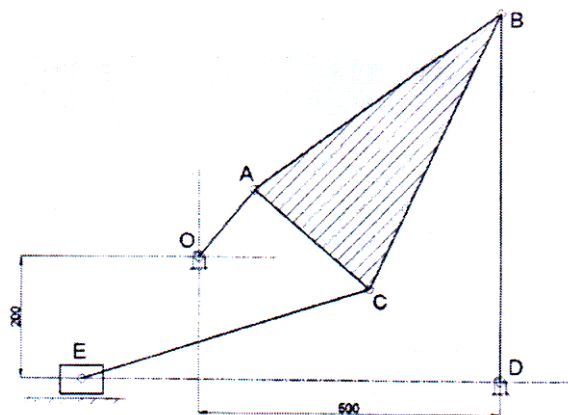


Fig. 2

**P.T.O.**



**Q2)** Synthesize a four-bar mechanism in position 1, where points A and D are fixed pivot positions. B and C are two points on the coupler, whose three positions are shown in Fig.3. BC is 80mm long and position  $B_1C_1, B_3C_3$  are horizontal. [10]

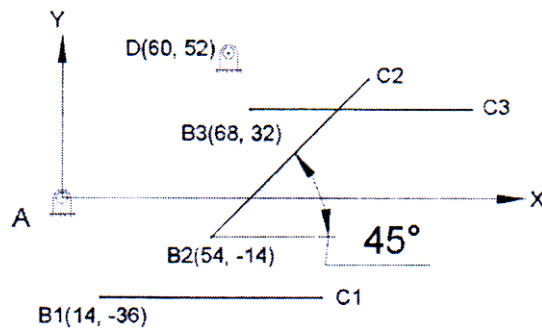


Fig. 3

**Q3)** Determine velocity and acceleration of slider 'E' in Fig.4 using auxiliary point method if the crank  $O_1A$  rotates with speed 1 rad/sec in clockwise direction. Dimensions are links are  $O_1A=40\text{mm}$ ,  $AC=80\text{mm}$ ,  $DC=75\text{mm}$ ,  $ED=52.5\text{mm}$  and  $O_2D=70\text{mm}$ . [10]

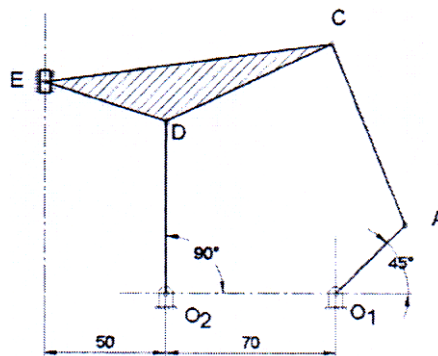


Fig. 4

**Q4) a)** A moving link with endpoints A and B, and their center of curvature  $A'$  and  $B'$  are known. Explain the procedure to determine inflection circle for moving link AB, using Bobillier construction. Show that construction satisfies the Euler - Savary equation. [6]

b) Explain Branch and Order Defect with suitable example. [4]

**Q5) a)** State and prove Robert - Chebyshev Theorem. [5]

b) Explain procedure to obtain cubic of stationary curvature for the moving link of a four-bar mechanism, this obtain Ball's point for the same. [5]

**Q6)** Synthesize a function generating mechanism using Freudenstein's equation, to solve the equation  $y = 1/x$  over the range  $1 \leq x \leq 2$  using three precision point. For the input link starting position is  $30^\circ$  and total swing is  $90^\circ$ . The output link starting position is  $240^\circ$  and total swing is  $90^\circ$ . **[10]**

**Q7) a)** Explain matrix method of analysis of Spatial Mechanisms. **[5]**

b) Frame {B} is rotated relative to frame {A} about  $\hat{Z}$  by  $30^\circ$  and translated 4 units in  $\hat{X}_A$  direction and 3 units in  $\hat{Y}_A$  direction. Determine transformation matrix, thus find coordinates of a point in frame {A} when it is identified with coordinates (5, 5) in frame {B}. **[5]**



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

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

**Q1)** The arrangement of the compressor, turbine and generator in the power plant is shown in fig.1, where  $J_i$  denote the mass moment of inertia of the three components compressor, Turbine and generator,  $M_{ti}$  indicates the external moments acting on the components and  $k_{ti}$  represents the torsional spring constants of the shaft between the components as in fig 1. Identify the type of vibrations setup in the system, [10]

Derive the equation of motion of the system using Lagrange's equation.

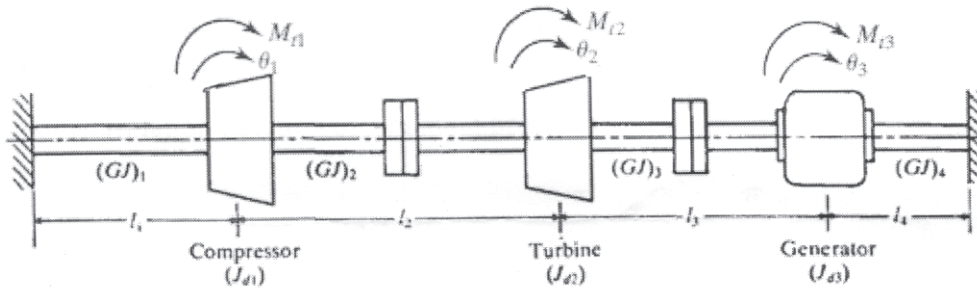


Fig 1. Q1

**Q2)** Derive frequency equation for transverse vibrations of string from first principles. Determine the tension required for a musical instrument cord fixed at both ends to have a fundamental frequency of a) 1 Hz b) 5 Hz, and has a length 2 m, diameter 0.5 mm and density  $7800 \text{ kg/m}^2$ . [10]

- Q3)** Find the response of un-damped spring mass system to half sinusoidal pulse force shown in Fig.2. **[10]**

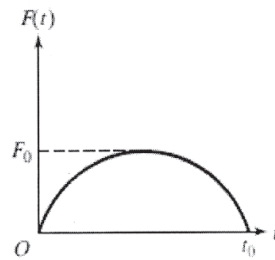


Fig 2. Q3

- Q4) a)** An electronic instrument is to be isolated from a panel that vibrates at frequencies ranging from 25 Hz to 35 Hz. It is estimated that at least 80 percent vibration isolation must be achieved to prevent damage to the instrument. If the instrument weights 85 N, find the necessary static deflection of the isolator. **[6]**
- b) Explain balancing of masses in single plane by vibration measurement technique. **[4]**
- Q5) a)** A machine of mass 150 kg with a rotating unbalance of 0.5 kg -m is paced at the midspan of a 2-m-long simply supported beam. The machine operates at a speed of 1200 rpm. The beam has an elastic modulus of 210 Gpa and a cross-sectional moment of inertia of  $2.1 \times 10^{-6} \text{ m}^4$ . **[6]**
- i) What is the steady-state amplitude of the primary system without an absorber?
- ii) Design the dynamic vibration absorber of minimum mass such that, when attached to the midspan of the beam, the vibrations of the beam will cease and the steady-state amplitude of the absorber will be less than 2 mm.
- iii) What are the system's natural frequencies when the absorber is in place?
- b) Explain how time domain analysis techniques are used for condition monitoring and fault diagnosis. **[4]**

**Q6) a)** The autocorrelation function of a random process is given by [5]

$$R_x(\tau) = A \cos \omega \tau ; -\frac{\tau}{2\omega} \leq \tau \leq \frac{\pi}{2\omega}$$

Where, A and  $\omega$  are constants. Find the power spectral density of the random process.

**b)** The spectral density of a random signal is given by [5]

$$S(f) = 0.0001 \text{ m}^2 / \text{cycle}/\text{sec}, \quad 10\text{Hz} \leq f \leq 1000\text{Hz}$$
$$= 0 \quad \text{elsewhere}$$

Find the standard deviation and the root mean square value of the signal by assuming its mean value to be 0.05 m.

**Q7) a)** Write a short note on [6]

i) Narrow band analysis

ii) Rayleigh's method

**b)** Explain Experimental modal analysis performed for dynamic response of a structural member. [4]

Table of Laplace Transforms

$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$	$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$
1. 1	$\frac{1}{s}$	2. $e^{at}$	$\frac{1}{s-a}$
3. $t^n, n=1,2,3,\dots$	$\frac{n!}{s^{n+1}}$	4. $t^p, p > -1$	$\frac{\Gamma(p+1)}{s^{p+1}}$
5. $\sqrt{t}$	$\frac{\sqrt{\pi}}{2s^{3/2}}$	6. $t^{n+1/2}, n=1,2,3,\dots$	$\frac{1 \cdot 3 \cdot 5 \cdots (2n-1)\sqrt{\pi}}{2^n s^{n+3/2}}$
7. $\sin(at)$	$\frac{a}{s^2+a^2}$	8. $\cos(at)$	$\frac{s}{s^2+a^2}$
9. $t \sin(at)$	$\frac{2as}{(s^2+a^2)^2}$	10. $t \cos(at)$	$\frac{s^2-a^2}{(s^2+a^2)^2}$
11. $\sin(at) - at \cos(at)$	$\frac{2a^3}{(s^2+a^2)^2}$	12. $\sin(at) + at \cos(at)$	$\frac{2as^2}{(s^2+a^2)^2}$
13. $\cos(at) - at \sin(at)$	$\frac{s(s^2-a^2)}{(s^2+a^2)^2}$	14. $\cos(at) + at \sin(at)$	$\frac{s(s^2+3a^2)}{(s^2+a^2)^2}$
15. $\sin(at+b)$	$\frac{s \sin(b) + a \cos(b)}{s^2+a^2}$	16. $\cos(at+b)$	$\frac{s \cos(b) - a \sin(b)}{s^2+a^2}$
17. $\sinh(at)$	$\frac{a}{s^2-a^2}$	18. $\cosh(at)$	$\frac{s}{s^2-a^2}$
19. $e^{-at} \sin(bt)$	$\frac{b}{(s-a)^2+b^2}$	20. $e^{-at} \cos(bt)$	$\frac{s-a}{(s-a)^2+b^2}$
21. $e^{-at} \sinh(bt)$	$\frac{b}{(s-a)^2-b^2}$	22. $e^{-at} \cosh(bt)$	$\frac{s-a}{(s-a)^2-b^2}$

✓ ✓ ✓

Total No. of Questions : 8]

SEAT No. :

P4760

[Total No. of Pages : 2

**[5355] - 567**  
**M.E. Mech (Design Engg.)**  
**FINITE ELEMENT METHOD**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Assume suitable data if necessary.*

**Q1)** a) Using generalised coordinate approach, find shape functions for two noded bar element. **[5]**

b) Write short note on variational principles. **[5]**

**Q2)** a) Explain the terms **[6]**

i) Constant strain triangle. (CST)

ii) Linear Strain triangle (LST)

iii) Quadratic strain triangle (QST)

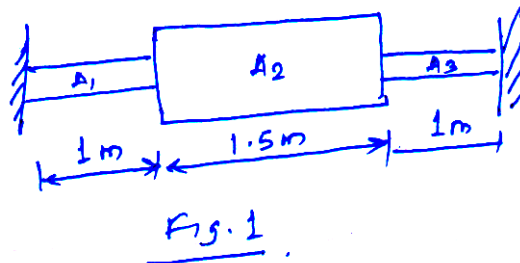
b) Determine the shape functions for a CST element in terms of natural cood system. **[4]**

**Q3)** a) Explain the term 'Axi - symmetric problems' **[4]**

b) The triangular element has nodal coordinates (10, 10), (40, 20) and (30, 50) for nodes 1, 2 and 3 respectively for a point P inside triangle. Determine the 'X' and 'Y' coordinates it shape functions  $N_1$  and  $N_2$  are 0.15 and 0.25 respectively. **[6]**

**P.T.O.**

- Q4)** a) Define Aspect ratio for a element? What is effect of element aspect ratio on accuracy? [6]  
 b) Explain hexahedral and tetrahedral elements used in 3D problems in stress analysis. [4]
- Q5)** a) Derive basic relations in thin plate theory. [4]  
 b) Write short note on shell elements. [6]  
 i) Facet elements  
 ii) curved elements
- Q6)** a) Explain various non - linear problems in finite element analysis. [5]  
 b) Explain 'Iterative procedure' to handle material non - linear problems. [5]
- Q7)** For the stepped bar as shown in fig. 1 determine the first two natural frequencies in terms of rad/s for undamped free vibration. Let  $A_1 = A_3 = 5 \text{ cm}^2$   $A_2 = 10 \text{ cm}^2$ ,  $E = 210 \text{ Gpa}$  and  $\rho = 7860 \text{ kg/m}^3$ . Use consistent mass matrices for each element. [10]



- Q8)** a) Explain pre - processing and post processing in Analysis. [5]  
 b) Explain different types of symmetries that occurs in meshing. [5]





[5355]-571

ME (Mech. Energy Engg. &amp; Heat Power Engg.)

ADVANCED MATHEMATICS AND NUMERICAL METHODS

(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 electronic pocket calculator is allowed.
- 5) Assume suitable data, if necessary.

**Q1) a)** Using Bisection method, find an approximate root of the equation

$$\sin x = \frac{1}{x} \text{ which lies between } x = 1 \text{ and } x = 1.5 \text{ (carry out 5 iterations)} [5]$$

b) The pressure and volume of a gas are related by the equation  $PV^a = K$ , Where 'a' and 'k' are constants. Fit this equation for the data : [5]

P(kg/cm <sup>2</sup> )	:	0.5	1.0	1.5	2.0	2.5	3.0
V(litres)	:	1.62	1.00	0.75	0.62	0.52	0.46

**Q2) a)** Solve the system of linear equations : [5]

$$x + y + z = 9$$

$$2x - 3y + 4z = 13$$

$$3x + 4y + 5z = 40$$

by LU decomposition method.

b) Find Lagrange's interpolating polynomial for the data :

x	0	1	3	6
y :	18	10	-18	90

Also find  $\frac{dy}{dx}$  at  $x = 2$ . [5]

P.T.O.

**Q3) a)** Obtain the cubic spline for the following data :

$x$	1	2	3	4
$y$	1	2	5	11

Find the values of  $y(1.5)$  and  $y'(3)$  [5]

b) Use Romberg's method to compute  $\int_0^1 \frac{dx}{1+x^2}$  correct up to 4 decimal places. [5]

**Q4) a)** Evaluate  $\int_{-1}^1 \frac{dx}{1+x^2}$  using Gauss Legendre's two point formula. [5]

b) Determine the largest eigen value and corresponding Eigen vector of the following matrix using power method. [5]

$$A = \begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix} \text{ by taking } X_0 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

**Q5) a)** Use the Given's method to reduce the symmetric matrix  $A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$  to tridiagonal form. [5]

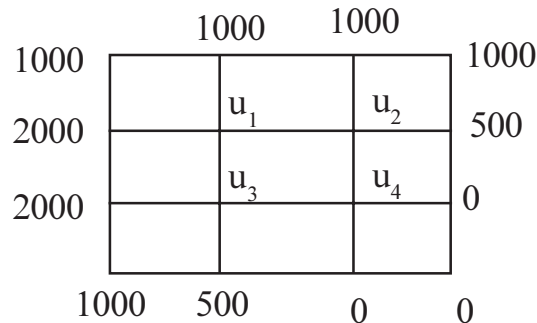
b) Use Runge - Kutta method of 4<sup>th</sup> order to solve  $\frac{dy}{dx} = \frac{1}{x+y}$ ,  $x_0 = 0$ ,  $y_0 = y(0) = 1$  which represents mechanical system, find  $y$  at  $x = 0.4$  taking  $h = 0.2$  [5]

**Q6) a)** Use Adams - Bashforth method to find  $y$  at  $x = 1.4$  given that

$$\frac{dy}{dx} = x^2(1+y) \text{ and } \span style="float: right;">[5]$$

$x :$	1	1.1	1.2	1.3
$y :$	1	1.233	1.548	1.979

- b) Solve the partial differential equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  represented by a mechanical system, Use Jacobi's method carry out 5 iterations to find  $u_1, u_2, u_3, u_4$  given that [5]



- Q7)** a) Solve  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  for the following condition using Crank - Nicholson method At  $x = 0$  &  $x = 3$   $u = 0$  for all values of  $t$ . At  $t = 0$ ,  $u = x^2$  for  $0 < x < 3$  Take increment in  $x$  as 1 and that of  $t$  as 0.1. Find all values of  $u$  for  $t = 0$  to  $t = 0.2$ . [5]

- b) Using Gauss. Siedel method, Solve the following set of simultaneous equations upto three decimal place accuracy [5]

$$x + 3y + z = 10$$

$$x + 2y + 5z = 12$$

$$4x + y + 2z = 16$$

- Q8)** a) Use Heun's method to solve  $\frac{dx}{dt} = t - x$  with the initial condition at  $t = 0$ ,  $x = 0.2$ . Assuming an increment  $\delta t = 1$ , find  $x$  at  $t = 3$ . [5]

- b) Solve  $\frac{\partial^2 u}{\partial t^2} = 4 \frac{\partial^2 u}{\partial x^2}$  for the following condition  $u = 0$  at  $x = 0$ ,  $t > 0$  &  $u = 0$  at  $x = 4$ ,  $t > 0$  & initial condition  $u = x(4 - x)$  at  $t = 0$ ,  $0 \leq x \leq 4$   
 $\frac{\partial u}{\partial x} = 0$  at  $t = 0$ ,  $0 \leq x \leq 4$  Solve the equation for  $0 \leq t \leq 3$  taking  $\Delta x = 1$ . [5]



Total No. of Questions : 8]

SEAT No. :

P4762

[Total No. of Pages : 3

[5355] - 572

**M.E. (Mechanical) (Heat Power Engineering)**  
**ADVANCED THERMODYNAMICS & COMBUSTION TECHNOLOGY**  
**(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) *Figures to the right indicate full marks.*
- 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)** Define the compressibility factor and describe the generalized compressibility chart. **[4]**

b) Steam initially at 0.3 MPa, 250°C is cooled at constant volume. **[6]**

i) At what temperature will the steam becomes saturated vapour?

ii) What is the quality at 80°C?

iii) What is the heat transferred per kg of steam in cooling from 250°C to 80°C.

**Q2) a)** A cylinder volume 0.1 m<sup>3</sup> contains 7 kg ethane at a pressure of 70 bar using compressibility chart, find the temperature of ethane in the cylinder. **[6]**

For ethane :- T<sub>c</sub> = 305.4 k; P<sub>c</sub> = 4.884 MPa, R = 0.2765 KJ/kgK.

b) Draw the phase equilibrium diagram for pure substance on T - s and h - s plots with relevant constant property lines. **[4]**

**Q3) a)** Setup the expression for availability of a closed system. **[6]**

b) Define entropy and show that for an irreversible process  $\int ds > \int \frac{\delta Q}{T}$  **[4]**

**P.T.O.**

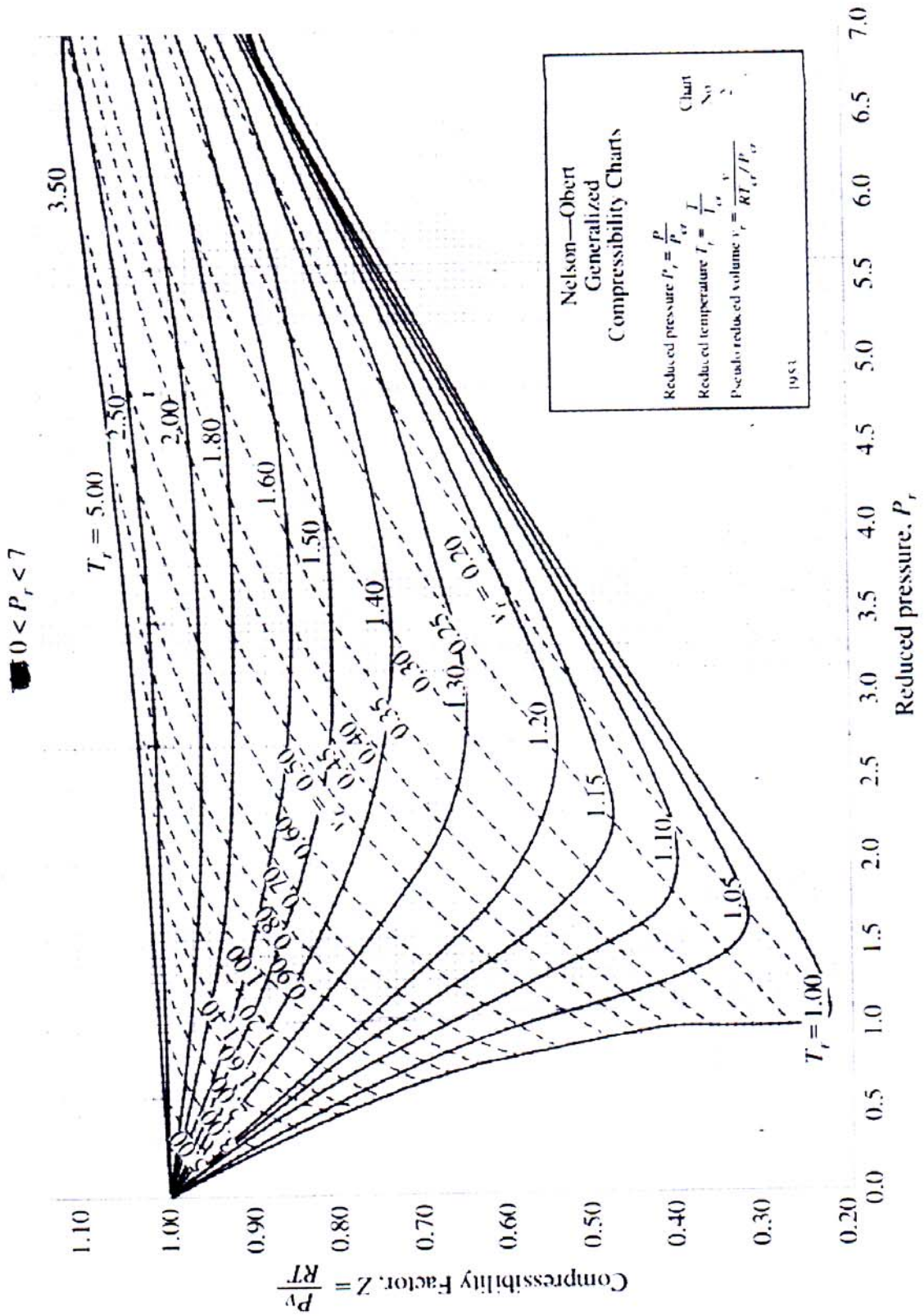
- Q4)** a) Steam at 7 MPa and 450°C is throttled in a valve to a pressure of 3MPa during a steady flow process. Determine the entropy generated during this process and check if the increase of entropy principle is satisfied. [6]
- b) What is meant by exergy? Define dead state. [4]

- Q5)** a) Using the Clapeyron equation, estimate the enthalpy, of vaporization of refrigerant - 134a at 40°C and compare it to the tabulated value. Take @ 40°C,  $v_f = 0.0008720 \text{ m}^3/\text{kg}$  and  $V_g = 0.019952 \text{ m}^3/\text{kg}$ . [6]

Tsat	Psat
38°C	1072.8 kPa
42°C	963.68 kPa

- b) Define the term volume expansivity and isothermal compressibility. [4]
- Q6)** a) Write a short note on Joule Thomson Coefficient. Why is it zero for an ideal gas? [4]
- b) What is adiabatic flame temperature? List the factors influencing the same. [6]
- Q7)** a) Propane (C<sub>3</sub>H<sub>8</sub>) is burned with 75 percent excess air during a combustion process. Assuming complete combustion, determine the air - fuel ratio. [4]
- b) Explain Fugacity and activity and discuss Amagat's Law. [6]

- Q8)** Write note on : [10]
- a) Energy conversion efficiency of biological system.
- b) Thermodynamics of Nutrition and exercise.



[5355] - 573

M.E. (Mechanical - Heat Power Engineering)

Advanced Fluid Mechanics

(2017 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

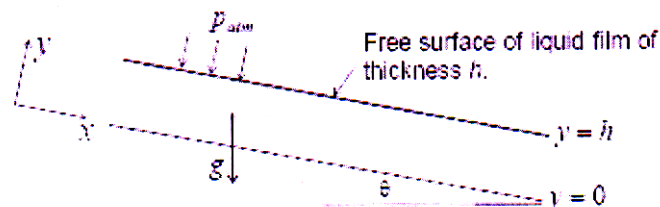
- 1) Answer any five questions from following.
- 2) Draw diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data wherever necessary.

**Q1)** a) Derive an expression for conservation of mass and momentum using differential analysis. [7]

- b) Water flows in a circular pipe. At one section, the diameter is 0.3 m, the static pressure is 260 kPa gauge, the velocity is 3 m/s and the elevation is 10 m above ground level. The elevation at a section downstream is 0 m, and the pipe diameter is 0.15 m. Find the gauge pressure at the downstream section. Frictional effects may be neglected. Assume density of water to be 999 kg/m<sup>3</sup>. [3]

**Q2)** Derive generalized expression of Navier Stokes equations. [10]

**Q3)** a) 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  $\theta = 30^\circ$ ,  $h = 10$  mm, dynamic viscosity of liquid = 0.4 kg/m.s,  $\rho = 920$  kg/m<sup>3</sup> [5]



- b) Obtain exact solution of Couette flow. [5]

P.T.O.



**Q4)** a) Obtain an expression for stream function and velocity function for following flows. Also determine pressure distribution in sink flow. [5]

i) Source & Sink flow

ii) Vortex flow

b) Determine the radial pressure gradient at radius  $r = 1.5$  m for a two - dimensional fluid motion defined by the stream function. [5]

$$\Psi = \log_e r$$

**Q5)** a) Obtain momentum - integral equation for the boundary layer. [5]

b) A general sinusoidal velocity profile for laminar boundary - layer flow on a flat plate can be taken as [5]

$$u = A \sin(By) + C$$

State the three boundary conditions applicable to the velocity profile, and thus evaluate the constants A,B,C.

**Q6)** a) Explain different types of free turbulent flows. What is a need of turbulence modeling? [5]

b) Water is flowing through a rough pipe, 400 mm in dia., at the rate of  $2.5 \text{ m}^3/\text{s}$

Calculate the power loss in overcoming friction per km length of pipe, if the roughness element height ( $\epsilon$ ) = 0.25 mm. Also calculate the maximum velocity for laminar flow for turbulent flow + 1.74,

$$= 8.5 + 2.5 \log_e \quad [5]$$

**Q7)** a) Develop area - velocity relationship in terms of Mach number and discuss effect of variation of area of subsonic, sonic and supersonic flows. [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. :

P4764

[Total No. of Pages : 4

[5355] - 575

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

ADVANCED HEAT TRANSFER

(2017 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

**Q1)** a) What are an initial and a boundary condition? How many initial and boundary conditions do we need to specify for a two - dimensional heat transfer problem? [5]

- b) An ice box whose outer dimensions are 30 cm × 40 cm × 40 cm is made of 3 - cm - thick Styrofoam ( $k = 0.033 \text{ W/m} \cdot ^\circ\text{C}$ ). Initially, the box is filled with 40 kg of ice at  $0^\circ\text{C}$ , and the inner surface temperature of the ice box can be taken to be  $0^\circ\text{C}$  at all time. The heat of fusion of ice at  $0^\circ\text{C}$  is 333.7 kJ/kg, and the surrounding ambient air is at  $30^\circ\text{C}$ . Disregarding any heat transfer from the 40 - cm × 40 - cm base of the ice box, determine how long it will take for the ice in the chest to melt completely if the outer surfaces of the ice box are at  $8^\circ\text{C}$ . [5]

**Q2)** a) Consider a hot baked potato on a plate. The temperature of the potato is observed to drop by  $4^\circ\text{C}$  during the first minute. Will the temperature drop during the second minute be less than, equal to, or more than  $4^\circ\text{C}$ ? Why? [5]

- b) Stainless steel ball bearings ( $\rho = 8085 \text{ kg/m}^3$ ,  $k = 15.1 \text{ W/m} \cdot ^\circ\text{C}$ ,  $C_p = 0.480 \text{ kJ/kg} \cdot ^\circ\text{C}$ , and  $\alpha = 3.91 \times 10^{-6} \text{ m}^2/\text{s}$ ) having a diameter of 1.2 cm are to be quenched in water. The balls leave the oven at a uniform temperature of  $900^\circ\text{C}$  and are exposed to air at  $30^\circ\text{C}$  for a while before they are dropped into the water. If the temperature of the balls is not to fall below  $850^\circ\text{C}$  prior to quenching and the heat transfer coefficient in the air is  $125 \text{ W/m}^2 \cdot ^\circ\text{C}$ , determine how long they can stand in the air before being dropped into the water. [5]

P.T.O.

**Q3) a)** Explain the velocity and thermal boundary layer. State and explain the dimensionless number relating these boundary layers. [5]

b) Explain the concept of relation between momentum and heat transfer with the help of Reynolds analogy and extended Reynolds analogy. [5]

**Q4) a)** 15 - cm X 15 - cm circuit board dissipating 15 W of power uniformly is cooled by air, which approaches the circuit board at 20°C with a velocity of 5 m/s. Disregarding any heat transfer from the back surface of the board, determine the surface temperature of the electronic components at the end of the board. Assume the flow to be turbulent since the electronic components are expected to act as tabulators. [5]

Use the following air properties and empirical correlation.

$$k = 0.265 \text{ W/m} \cdot ^\circ\text{C}$$

$$\nu = 1.655 \times 10^{-5} \text{ m}^2/\text{s}$$

$$Pr = 0.7268$$

$$Nu_x = 0.0308 Re_x^{0.8} Pr^{1/3}$$

b) Cold air at 5°C enters a 12 - cm - diameter 20 - m - long isothermal pipe at a velocity of 2.5 m/s and leaves at 19°C. Estimate the surface temperature of the pipe. [5]

Use following air properties :

$$\rho = 1.238 \text{ kg/m}^3$$

$$k = 0.02454 \text{ W/m} \cdot ^\circ\text{C}$$

$$\nu = 1.444 \times 10^{-5} \text{ m}^2/\text{s}$$

$$C_p = 1007 \text{ J/kg} \cdot ^\circ\text{C}$$

$$Pr = 0.7331$$

**Q5) a)** Physically, what does the Grashof number represent? How does the Grashof number differ from the Reynolds number? [5]

b) Write short note on : [5]

i) Combined natural convection and Forced Convection

ii) Importance of natural convection in electronics cooling.

**Q6) a)** What is difference between film and drop wise condensation? Which is a more effective mechanism of heat transfer? [5]

b) Explain the different boiling regimes in the order they occur in a vertical tube during flow boiling. [5]

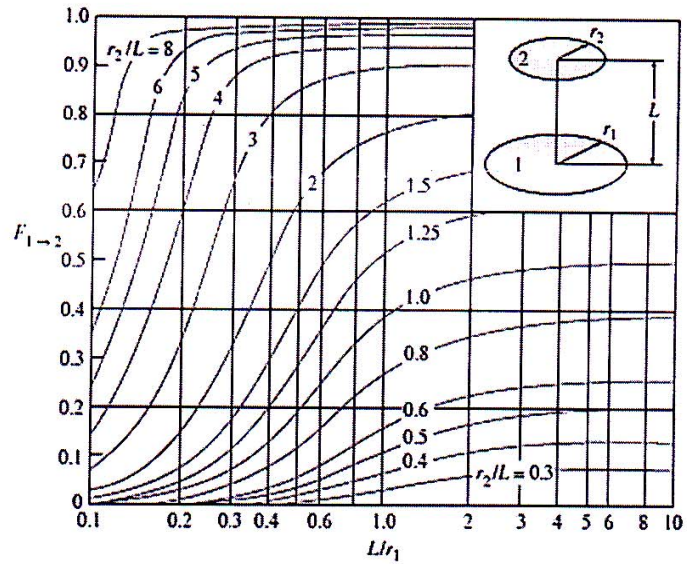
- Q7)** a) It is desired that the radiation energy emitted by a light source reach a maximum in the blue range ( $\lambda = 0.47 \text{ m}$ ). Determine the temperature of this light source and the fraction of radiation it emits in the visible range ( $\lambda = 0.40 - 0.76 \text{ m}$ ). (Refer Table - 1) [5]
- b) Explain the following terms : [5]
- i) Radiation Intensity
  - ii) Shape Factor
- Q8)** a) How does radiation transfer through a participating medium differ from that through a nonparticipating medium? [5]
- b) A furnace is of cylindrical shape with  $R = H = 2 \text{ m}$ . the base, top, and side surfaces of the furnace are all black and are maintained at uniform temperatures of 500, 700, and 1200 K, respectively. Determine the net rate of radiation heat transfer to or from the top surface during steady operation. (Refer Fig. 1) [5]

Table -1: Blackbody Radiation Function

Blackbody radiation functions  $f_\lambda$

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

Fig. 1: View factor between two coaxial parallel disks.



Total No. of Questions : 7]

SEAT No. :

P4765

[Total No. of Pages : 2

[5355] - 576

**M.E. (Mechanical - Heat Power Engg.)  
AIR CONDITIONING TECHNOLOGY  
(2017 Pattern) (Semester - II)**

*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) *Use of steam tables, p - h chart, Psychrometric chart and scientific calculator is allowed.*
- 4) *Assume suitable data wherever necessary.*
- 5) *Figures to the right indicate full marks.*

**Q1) a)** What is Air refrigeration system? With neat sketch explain Vapor Compression Cycle. **[6]**

b) Explain in detail local and central air conditioning system. **[4]**

**Q2) a)** A retail shop has following loads, **[6]**  
RSH = 58.15 kW, RLH = 14.54 kW, OA = 40 deg. C DBT, 27 deg. C WBT, RA = 25 deg. C, 50% RH, Ventilation air = 70 cmm, BF = 0.15  
Determine Ventilation Load, Grand Total Heat and ESHF.

b) Explain the term Air Washer? List down the practical applications of Air Washer system. **[4]**

**Q3) Write short note on, (Any 2) **[10]****

- a) Indoor air quality
- b) Metabolic heat generation
- c) Infiltration and Ventilation

**P.T.O.**

**Q4)** Discuss various sources of the internal and external heat gains (any five) related to Heating and Cooling Load Calculations. Also explain the procedure to calculate them. **[10]**

**Q5)** a) A circular duct of 40 cm diameter is used to carry air in an air conditioning system at a velocity of 440 m/min. If this duct is to be replaced by a rectangular duct of aspect ratio of 1.5, find out the size of rectangular duct by equal friction method, when : **[6]**

- i) Velocity of air in two ducts is same.
- ii) The discharge rate of air in two ducts is same.

If  $f = 0.015$ , find out the pressure loss per 100 m length of the duct. Take the density of air =  $1.15 \text{ Kg/m}^3$

b) Discuss any one method for duct design. **[4]**

**Q6)** Explain in detail. **[10]**

- a) Desiccant Dehumidification.
- b) Compare Air Cooled VRV and Water Cooled VRV system.
- c) Types of Ventilation System.

**Q7)** For cold Storage plant, vegetable storage capacity is 450 tonnes. Inside design condition are 19 deg. C DBT, 60% RH. Outdoor conditions are 36 deg. DBT, 28 deg. C WBT, Infiltration - 180 m<sup>3</sup>/hr., Fresh air supply - 4500 m<sup>3</sup>/hr. Number of operators working 20. **[10]**

Heat gain through glass = 5.5 kW

Sensible heat gain through wall, ceiling = 10.8 kW

Water content in vegetables = 74%

Loss of water content per hour = 0.01%

Heat from equipment = 3.1 KW

System consist of cooling & dehumidifying and then re - heating (if required) such that air entry temperature should not exceed 16 deg.C.

Determine :

- a) Amount of air recirculated, if it is mixed with fresh air before entering the cooling coil.
- b) Capacity of heating coil. Use psychrometric chart. Show processes on schematic.



Total No. of Questions : 8]

SEAT No. :

**P5291**

**[5355]-577**

[Total No. of Pages : 2

**M.E. (Mechanical) (Heat Power Engg.)  
MEASUREMENTS AND CONTROL  
(2017 Pattern) (502109) (Semester - II)**

*Time : 3Hours]*

*[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)** Explain difference between systematic and random errors. What are the typical sources of these two types of errors? **[5]**

**b)** Define terms: **[5]**

- i) Repeatability
- ii) Accuracy
- iii) Static sensitivity
- iv) Resolution
- v) Linearity

**Q2) a)** Explain following terms: **[4]**

- i) Dynamic error
- ii) Static error
- iii) Probable error
- iv) Mean standard deviation

**b)** What are various stages of measurement? **[6]**

**Q3) a)** Explain with neat sketch the working of hot wire anemometer. **[5]**

**b)** Explain method of measurement of pressure of 0.001mm of Hg. **[5]**

**P.T.O.**



- Q4)** a) Calculate correlation co-efficient from:  
 $N=10$ ,  $\Sigma X = 350$ ,  $\Sigma Y = 310$ ,  $\Sigma(X-35)^2 = 162$ ,  $\Sigma(Y-31)^2 = 222$ ,  
 $\Sigma(X-35)(Y-31) = 92$ . Also find regression line Y on X. [4]
- b) What are the various types of correlations? [6]
- Q5)** a) A Mcleod gauge has volume of bulb, capillary and tube down to its opening equal to  $90 \text{ cm}^3$  and a capillary diameter of 1 mm. Calculate the pressure indicated by a reading of 3cm on capillary tube. [6]
- b) Discuss the importance of Transient response specifications w.r.t. performance of control system. [4]
- Q6)** a) What are mechanical tachometers? Explain with examples. Describe advantages of mechanical tachometers. [4]
- b) The output voltage of a LVDT is 1.5 V at maximum displacement. At a load of  $0.5 \text{ M}\Omega$ , the deviation from linearity is maximum and it is  $\pm 0.003 \text{ V}$  from a straight line through origin. Find linearity at given load. [6]
- Q7)** a) While measuring speed of a steam turbine with stroboscope single line images were observed for stroboscope setting of 3000, 4000 and 5230 rpm. Calculate speed of turbine. [6]
- b) Discuss application of closed loop control system in automotive. [4]
- Q8)** a) Discuss the advantages of PID controller. [5]
- b) Explain construction and working of any one torque measurement device. [5]





Total No. of Questions : 7]

SEAT No. :

P4766

[Total No. of Pages : 2

[5355] - 582

M.E. (Mechanical) (Automotive Engineering)

Automotive Engine Design

(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 scientific calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** a) An engine operating on ideal Otto cycle for which maximum temperature in cycle is  $1277^{\circ}\text{C}$ , temperature after expansion  $447^{\circ}\text{C}$ , initial pressure and temperature is 1 bar and  $37^{\circ}\text{C}$ . Air consumption is 2 Kg/min. Find [6]

- i) Compression ratio
- ii) Air standard efficiency
- iii) Power output.

b) Explain the operating variables that affect the performance of CI engine. [4]

**Q2)** a) The output of an I.C engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 75 cm and rope diameter is 5cm. The dead load on the tight side is 41 kg, and the spring balance reading is 5 kg. The engine consumes 4 kg/hr. of fuel at rated speed of 1000 rpm. The calorific value of fuel is 44000 KJ/kg. Calculate the brake specific fuel consumption and the brake thermal efficiency. [5]

b) Explain exhaust gas recirculation system. [5]

**P.T.O.**

- Q3)** a) Explain the general engine design procedure using flowchart. [5]  
b) Which materials are most commonly used for piston? Explain the merits and limitations. [5]
- Q4)** Explain with neat sketch and mathematical expressions how dynamic analysis of reciprocating and rotating masses of IC engine is carried out. [10]
- Q5)** Design cylinder head for 4 stroke water cooled diesel engine developing 4 KW at 1500 rpm. Indicated mean effective pressure is 700KN/m<sup>2</sup>. Assume mechanical efficiency as 80%. [10]
- Q6)** a) Explain in detail the design procedure for connecting rod. [7]  
b) What is the function of counter in crankshafts? [3]
- Q7)** Write short notes on (Any two) [10]  
a) Alternate fuels  
b) Engine performance characteristics.  
c) Fatigue life estimation of crankshaft



Total No. of Questions : 7]

SEAT No. :

P4767

[Total No. of Pages : 2

[5355] - 583

**M.E. Mechanical (Automotive Engineering)**  
**AUTOMOTIVE SAFETY AND REGULATIONS**  
**(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) *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) Describe various steps involved in crash testing of vehicle. What parameters are studied in crash test? Discuss in detail. [5]
- b) Describe what do you understand by active safety? What are various components of it? [5]
- Q2)** a) Explain “injury measurement and criteria” for human body undergone with impact during accidents. What is injury rating? Explain. [5]
- b) Explain various features for Hybrid III dummy used in frontal crash test.[5]
- Q3)** a) What are the functions of car bumper? Explain various requirements of crash worthiness of it. [5]
- b) Describe role of side door intrusion beam in providing passive safety in cases of side impacts. [5]
- Q4)** a) Name the different types of environments test defined in India standards for evaluation of lighting and signaling devices, explain them. [5]
- b) Explain asymmetrical beam used in head lamp. What is merits and demerits of plastic lens head lamps? [5]

**P.T.O.**

- Q5)** a) Sketch any three road signs specifying dimensions and color code as per CMVR rule. [5]
- b) Explain briefly what procedure to be followed for passing a permit of commercial vehicles by regulatory authority RTO. [5]
- Q6)** a) What instrument is needed to study various parameters in a crash test? Give details. [5]
- b) What is LED? State merits and demerits of led's used in automobile lighting system. [5]
- Q7)** Write short notes on the following (Any two) [10]
- a) Seat belt system with pre - tensioner in load limiter.
- b) Crash energy management.
- c) Reflex reflector.



Total No. of Questions : 7]

SEAT No. :

P 4768

[Total No. of Pages : 2

[5355]-585

**M.E. Mechanical (Automotive Engineering)**

**ENGINE COMBUSTION TECHNOLOGY**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to 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) Petrol consists of 86% Carbon and 14% hydrogen by mass. If fuel is burnt with 20 % excess air and combustion is complete, estimate volumetric composition of products of combustion including water vapours formed. **[6]**
- b) Explain first law analysis of reacting system. **[4]**
- Q2)** a) Iso octane is burned with 80 % theoretical air in a small three cylinder turbocharged engine Calculate
- i) Air-fuel ratio.
  - ii) Fuel air ratio
  - iii) Equivalence ratio. **[5]**
- b) Explain turbulent flame propagation in engine. **[5]**
- Q3)** a) Explain the dissociation effect during combustion. **[5]**
- b) Explain the concept of lean burn engine. **[5]**

**P.T.O**

- Q4)** a) What is ignition lag? Discuss the effect of engine variables on ignition lag. [5]
- b) Explain the phenomenon of diesel knock. Compare it with the phenomenon of detonation in SI engine [5]
- Q5)** a) What are the various methods to control the emissions from engine. [5]
- b) Explain Flame ionisation detector method for HC measurement. [5]
- Q6)** a) What are the main types of gas turbine combustion chambers? Discuss their relative merits and demerits. [5]
- b) What are the different pressure losses in the combustion system of a gas turbine? Suggest the methods to reduce them. [5]
- Q7)** Write short notes on (Any two) [10]
- a) Adiabatic flame temperature
- b) Stratified charge Engine.
- c) Catalytic Converter.



Total No. of Questions : 5]

SEAT No. :

P 4769

[Total No. of Pages : 2

[5355]-586

**M.E. (Mechanical Automotive Engg.)**  
**NOISE VIBRATION AND HARSHNESS**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any Two from each question.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1)** Solve any Two questions

- a) What are the Interior sources of noise in vehicle? **[5]**
- b) Explain the Octave Band analysis and their significance in NVH? **[5]**
- c) The sound pressure level measured at 10 m from an automobile horn is 110 dB. Determine the sound pressure level at distance of
  - i) 20 m
  - ii) 80 m. Assume that the inverse square law holds good between intensity and distance **[5]**

**Q2)** Solve any Two questions

- a) Explain why noise source identification is required and what the different methods are available? **[5]**
- b) Why signal Conditioning is require and explain in detail Digital Signal Processing? **[5]**
- c) Explain effect of noise on human beings **[5]**

**P.T.O**

**Q3) Solve any Two questions**

- a) Explain the single source structure-borne noise transmission path analysis [5]
- b) Explain following types of windowing with their time window and application [5]
  - i) Uniform
  - ii) Hanning
- c) The lower and upper frequencies an octave band are 11,312 and 22,614 Hz. Determine
  - i) The central frequency of the 1/1 octave band
  - ii) The intermediate frequency of the 1/2 octave band, and
  - iii) The intermediate frequencies of the 1/3 octave band [5]

**Q4) Solve any Two questions**

- a) Explain Impedance tube ( Kundt's tube) method (ASTM E1050) with Figure [5]
- b) Explain in details of Experimental Modal Analysis. [5]
- c) Explain the characteristic of absorptive material:
  - i) Porosity
  - ii) Flow Resistant
  - iii) Tortuosity [5]

**Q5) Write a Short Note (Any two)**

- a) Broad band noise, Pink noise, White noise. [5]
- b) Pass by Noise measurement method for Vehicle. [5]
- c) Acoustic holography technique [5]





Total No. of Questions : 7]

SEAT No. :

P 4770

[Total No. of Pages : 2

[5355]-587

**M.E. Mechanical (Automotive Engineering)**

**AUTOMOTIVE CHASSIS DESIGN**

**(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) *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) Justify the need of variable rate spring for heavy duty commercial vehicle. Explain the salient features of variable rate leaf spring. **[5]**
- b) A rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers. **[5]**
- Q2)** a) Explain With the help of neat sketches steering characteristics i.e. under steer and over steer. **[5]**
- b) Explain the function and working of steering gear box mechanism with neat sketch.Name its components. **[5]**
- Q3)** a) Explain with the help of neat sketch servo - power assisted braking systems. **[5]**
- b) With the help of neat diagram explain the working and construction of disc brake. **[5]**

**P.T.O**

- Q4)** a) Explain the parameters on which the tread wear fatigue life and road grip depend. [5]
- b) Draw cross section of a tyre explaining the role of various components in that. What are the factors improving road grip? [5]
- Q5)** a) Write short notes on the Types of tracks used for vehicle evaluation. [5]
- b) With the help of neat sketch explain working of six wheeled vehicle. Discuss its application and the method of calculating wheel torque on different wheels. [5]
- Q6)** a) Explain with the help of neat sketch Brake limiting device. [5]
- b) What are the advantages and disadvantages of Tubeless Tire with respect to conventional tires? [5]
- Q7)** Write short notes on the following (Any two) [10]
- a) Mc pherson strut system.
- b) Electrical Power Steering system.
- c) Load Conscious Valve.
- d) Retrading and manufacturing of tyres.



Total No. of Questions : 5]

SEAT No. :

P 4771

[Total No. of Pages : 2

[5355]-592

**M.E. (Mechanical) (CADME)**  
**ADVANCED MACHINE DESIGN**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any two questions from Q1, Q2 & Q3*
- 2) *Q4 and Q5 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1) a)** The creep data at a certain temperature is obtained as **[8]**

$S_1 = 15 \text{ MPa}$   $\epsilon_1 = 0.022$  percent per 1000 hrs

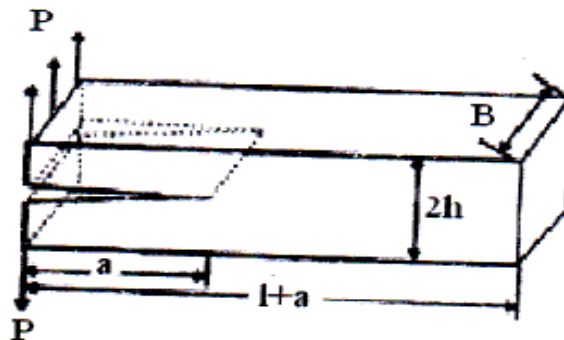
$S_2 = 17 \text{ MPa}$   $\epsilon_2 = 0.035$  percent per 1000 hrs

Determine the constants of hyperbolic sine law and calculate the creep rates of stress 45 MPa and 48 MPa

b) Derive the expression for Airy's stress function in Cartesian coordinate **[7]**

**Q2) a)** Describe Rheological models and its application **[7]**

b) Determine strain energy release rate for a double cantilever beam with  $a \gg 3h$  and  $l \gg 3h$  as shown in figure. The P is a applied load and B is the width of beam **[8]**



*P.T.O*

- Q3)** a) Explain the concept of energy balance during crack growth. [7]  
b) Describe the elasto-plastic analysis for torsion of bars [8]

**Q4)** Solve any two

- a) Derive the expression for octahedral shearing stress theory [6]  
b) Explain stress concentration around cut outs in composite laminates [4]  
c) Write short notes on relations between elastic constants. [4]

**Q5)** Solve any two

- a) A continuous and aligned glass fiber reinforced composites consist & of 40% volume of glass fiber having modulus of elasticity 69 GPa and 60% volume of fiber polyester resin having modulus of elasticity of 3.4 GPa. [6]  
i) Calculate modulus of elasticity of composite in longitudinal direction  
ii) If c/s area is 250 mm<sup>2</sup> and stress of 50 MPa is applied in longitudinal direction, determine the magnitude of load carried by each of fiber and matrix phase
- b) Explain of Castigliano's theorems with its application [4]  
c) Describe the Influence of super imposed static stresses in fatigue [4]



Total No. of Questions : 7]

SEAT No. :

P 4772

[Total No. of Pages : 1

[5355]-593

**M.E. (Mechanical) (CADM&E)  
COMPUTER AIDED DESIGN  
(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

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

**Q1)** Explain with neat sketch, B-Splines curves and State its advantages. [10]

**Q2)** How will you evaluate points on curves and Discussed “Blending”? [10]

**Q3)** What do you understand by C-rep & B-rep approaches? Compare them.[10]

**Q4)** Explain in detail the concept of Sweep Representation in solid? [10]

**Q5)** Derive the parametric representation of Coons surface? [10]

**Q6)** Explain the following features:

- |            |             |
|------------|-------------|
| i) Extrude | ii) Revolve |
| iii) Loft  | iv) Shaft   |
| v) Boss    |             |

[10]

**Q7)** What is meant by hidden line removal feature in modeling? Explain briefly with example. [10]





Total No. of Questions : 7]

SEAT No. :

P 4774

[Total No. of Pages : 1

[5355]-596

**M.E. (Mechanical Engineering) (CADME)**

**Industrial Product Design & Product Lifecycle Management**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) Answer any FIVE questions from the following.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicates full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** 'Development of new component technology is related with S - Curve technology'. Explain with merits & demerits. **[10]**

**Q2)** What are the latest approaches to product design? Explain Rapid prototyping with example. **[10]**

**Q3)** Explain different factors to be considered while generating new product design concept **[10]**

**Q4)** Explain Tear - down method with example. **[10]**

**Q5)** Discuss main issues in product data & product work flow in PLM with an example. **[10]**

**Q6)** Compare PLM with Enterprise resource planning with justified example. **[10]**

**Q7)** Explain with example, the collaborative engineering concept. **[10]**



Total No. of Questions : 7]

SEAT No. :

P 4775

[Total No. of Pages : 1

[5355]-597

M.E. (Mechanical) (CADM & E)

**AUTOMATED MANUFACTURING SYSTEM MODELING**

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

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions from the following.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

**Q1)** Give reason for automation and Explain Automation in production system?[10]

**Q2)** a) Explain five levels of Automation with chart? [5]

b) List the components of Automated Manufacturing System & explain it. [5]

**Q3)** Write the objectives of the Cellular Manufacturing and their several Aspects? [10]

**Q4)** a) Draw Pneumatic circuit for automatic die casting machine. [5]

b) Explain Fuzzy decision and control in an Automation system [5]

**Q5)** a) Explain the Principles of Inspection? [5]

b) Explain Contact and Non-contact Inspection technique? [5]

**Q6)** Explain with sketch two Queuing models in manufacturing system? Also Explain steady state analysis of M/M/1 Queue? [10]

**Q7)** What are the petri Nets and list 4 applications in manufacturing system? Explain stochastic petri nets with suitable example? [10]





Total No. of Questions : 8]

SEAT No. :

P 4776

[Total No. of Pages : 2

[5355]-602

M.E. (Mechanical Energy Engineering)

ADVANCED THERMODYNAMICS

(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 side indicate full marks.
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables are allowed.
- 5) Assume Suitable data if necessary

- Q1)** a) Write short note on virial equation of State? [5]  
b) Consider a gas mixture that consists of 3 kg of O<sub>2</sub>, 5 kg of N<sub>2</sub>, and 12 kg of CH<sub>4</sub>. Determine (i) the mass fraction of each component, (ii) the mole fraction of each component, and (iii) the average molar mass and gas constant of the mixture. [5]
- Q2)** a) Write short note on the steam table and its uses [4]  
b) A vessel of volume 0.04 m<sup>3</sup> contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy, and the internal energy. [6]
- Q3)** a) What do you understand by entropy transfer? Why is entropy transfer associated with heat transfer and not with work transfer? [5]  
b) At S.T.P. 8.4 litres of oxygen and 14 litres of hydrogen mix with each other completely in an insulated chamber. Calculate the entropy change for the process assuming both gases behave as ideal gases. [5]

P.T.O.

- Q4)** a) Write note on Exergy Destruction. [4]  
 b) Two kg of air at 500 kPa, 80°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surrounding which is at 100 kPa, 5°C. For this process, determine  
 i) The maximum work  
 ii) The change in availability  
 iii) The irreversibility  
 For air, take  $c_v = 0.718$  kJ/kg K,  $u = c_v T$  where  $c_v$  is constant, and  $pV = mRT$  where  $p$  is pressure in kPa,  $V$  volume in  $m^3$ ,  $m$  mass in kg,  $R$  a constant equal to 0.287 kJ/kg K, and  $T$  temperature in K. [6]

- Q5)** a) Write short note on Joule Thomson coefficient [4]  
 b) With usual notations derive the following thermodynamic relation [6]

$$C_p - C_v = \frac{TV\beta^2}{k_T}$$

- Q6)** a) What is fugacity and activity? [5]  
 b) The products of combustion of an unknown hydrocarbon  $C_xH_y$  have the following measured composition : 8%  $CO_2$ , 0.9%  $CO$ , 8.8%  $O_2$ , and 82.3%  $N_2$ . Determine the composition of the fuel, air fuel ratio and percentage excess air used. [5]

- Q7)** a) Describe the anomalous behavior of water compared to other liquids. [5]  
 b) A certain gas has  $C_p = 1.968$  and  $C_v = 1.507$  kJ/kg K. Find its molecular weight and the gas constant.  
 A constant volume chamber of  $0.3m^3$  capacity contains 2 kg of this gas at 5°C. Heat is transferred to gas until the temperature is 100°C. Find the work done, the heat transferred, and the changes in internal energy, enthalpy and entropy. [5]

- Q8)** a) Write a note on T-dS relations [5]  
 b) Explain Inversion Curve and Joule-Thompson Coefficient. [5]



Total No. of Questions : 8]

SEAT No. :

P 4777

[Total No. of Pages : 2

[5355]-603

**M.E. (Mechanical-Energy Engineering)**

**Non-Conventional Energy Sources**

**(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) *Figures to the right side indicate full marks.*
- 4) *Use of non programmable calculator is allowed.*
- 5) *Assume Suitable data if necessary*

- Q1)** a) What are the conventional and un-conventional energy sources? Describe briefly [5]  
b) What are the prospects of non-conventional energy sources in India? [5]
- Q2)** a) What is the principle of solar photovoltaic power generation? What are the main elements of a PV system? [5]  
b) Write a note on: [5]  
i) Solar pumping  
ii) Solar cell arrays
- Q3)** a) Describe a central receiver system for a central solar thermal power station? [5]  
b) Describe the main considerations in selecting a site for wind generators? [3]  
c) What is the basic principle of wind energy conversion? [2]
- Q4)** a) Describe in detail different components in microhydel power plants? [4]  
b) How biomass conversion takes place? [3]  
c) What is meant by anaerobic digestion? Explain briefly factors affecting it? [3]

- Q5)** a) What are the advantages and disadvantages of Geothermal energy forms? [4]  
b) What are the main types of OTEC power plants? Describe their working in brief? [6]
- Q6)** a) Write a short note on wave energy conversion machines? [5]  
b) Explain with sketches the various methods of tidal power generations. What are the limitations of each method? [5]
- Q7)** a) Describe in detail Fuel cell energy storage system [4]  
b) How are Gasifiers classified? What is Pyrolysis? [3]  
c) What are the main applications of Biogas? [3]
- Q8)** Write a short note on : [10]  
a) Diesel PV system  
b) Wind PV system  
c) Microhydel-PV system



Total No. of Questions : 8]

SEAT No. :

P 4778

[Total No. of Pages : 2

[5355]-605

**M.E. (Mechanical-Energy Engineering)**

**ADVANCED HEAT TRANSFER**

**(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) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data if necessary*

**Q1) a) Explain** **[10]**

- i) Reynolds analogy
- ii) Chilton-Colburn analogy

**Q2) a)** A horizontal steam pipe of diameter 20cm runs through a large room and is exposed to air at a temperature of 20°C. The pipe surface temperature is 180°C. Find the flow of heat per meter length of the pipe by convection and radiation. Take emissivity of pipe surface as 0.8, Use correlation.  
$$Nu = 0.53 (Gr.Pr)^{1/4}$$
 **[7]**

b) Write the physical significance of Grashof's Number. **[3]**

**Q3) a) Explain Forced convection Boiling in detail.** **[7]**

b) Write Dropwise condensation correlations. **[3]**

**Q4) a) Write a note on**

- i) Atmospheric and Solar radiation
- ii) Pool Boiling Curve

**[10]**

**P.T.O.**

- Q5)** a) Using dimensional analysis establish a relation between Nusselt, Prandtl and Grashof numbers. [4]  
 b) Explain filmwise and dropwise condensation [6]
- Q6)** a) An enclosure measures  $1.5\text{m} \times 1.7\text{m}$  with a height of  $2\text{m}$ . The walls and ceiling are maintained at  $250^\circ\text{C}$  and the  $130^\circ\text{C}$ . The wall and ceiling have an emissivity of  $0.82$  and the floor  $0.7$ . Determine the net radiation to the floor. [7]  
 b) Define : i) Absorptivity ii) Reflectivity iii) Transmissivity [3]
- Q7)** a) Find the shape factor of cylindrical cavity of diameter  $d$  and depth  $H$  with respect to itself If  $d = 200\text{mm}$ ,  $H = 500\text{mm}$ ,  $T_1 = 600\text{K}$  and  $\epsilon_1 = 0.8$ , find the rate at which energy streams out from the cavity. [6]  
 b) How forced convection boiling different from pool boiling? [4]

**Q8)** A metal plate  $0.609\text{m}$  in height forms the vertical wall of an oven and is at a temperature of  $171^\circ\text{C}$ . Within the oven is air at a temperature of  $93.4^\circ\text{C}$  and atmospheric pressure. Assuming that natural convection conditions hold near the plate and that this case

$$\text{Nu} = 0.548(\text{Gr.Pr})^{1/4}$$

Find the mean heat transfer coefficient and the heat taken up by air per second per meter width. For air at  $132.2^\circ\text{C}$ , take  $k = 33.2 \times 10^{-6} \text{KW/mK}$ ,  $\mu = 0.232 \times 10^{-4} \text{kg/ms}$ .  $C_p = 1.005 \text{KJ/KgK}$ . Assume air as an ideal gas and  $R = 0.287 \text{KJ/KgK}$ .

[10]

Table : Properties of Air

Temperature (0C)	$u \text{ (m}^2\text{/s)}$	$k \text{ (W/mk)}$	Pr	$p \text{ (Kg/m}^3\text{)}$	$C_p \text{ (KJ/Kgk)}$
100	$23.13 \times 10^{-6}$	$3.208 \times 10^{-2}$	0.688	0.946	1.009



Total No. of Questions : 8]

SEAT No. :

P 4779

[Total No. of Pages : 2

[5355]-606

M.E. (Mechanical-Energy Engineering)

ENERGY CONVERSION AND ENVIRONMENT

(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) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data if necessary*

- Q1)** a) Describe procedures for measurement of moisture, volatile matter and ash content in the Indian coal [6]  
b) Explain chemical conversion of fuel into heat. [4]

- Q2)** The following particulars refer to a single stage of a Parson's steam turbine; Mean diameter of blade ring = 80 cm, R.P.M. = 3200, Steam velocity at exit of the blades 150 m/s, Blade outlet angle = 20°, Steam flow through blades = 7.5 kg/s. Draw 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. [10]

- Q3)** a) Explain lean burn engine. [4]  
b) What is the need of high temperature combined cycle, Explain? [6]

- Q4)** a) Explain the operating principle of a waste heat recovery boiler with examples. [6]  
b) Explain the operating principle of a heat pump with examples. [4]

- Q5)** a) Explain environmental aspects of nuclear power generation. [5]  
b) Define various nuclear reactions. [5]

*P.T.O.*

- Q6)** a) Describe advantages of adopting Diesel power plants [4]  
b) Explain Energy Saving Opportunities in Cooling Towers [6]
- Q7)** Explain global energy policy. [10]
- Q8)** a) Explain environmental impact of industrial operations. [5]  
b) Explain in detail the factors affecting performance of compressors. [5]





**M.E. (Mechanical) (Energy Engineering)**  
**ADVANCED FLUID MECHANICS**  
**(2017 Course) (Semester -II)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

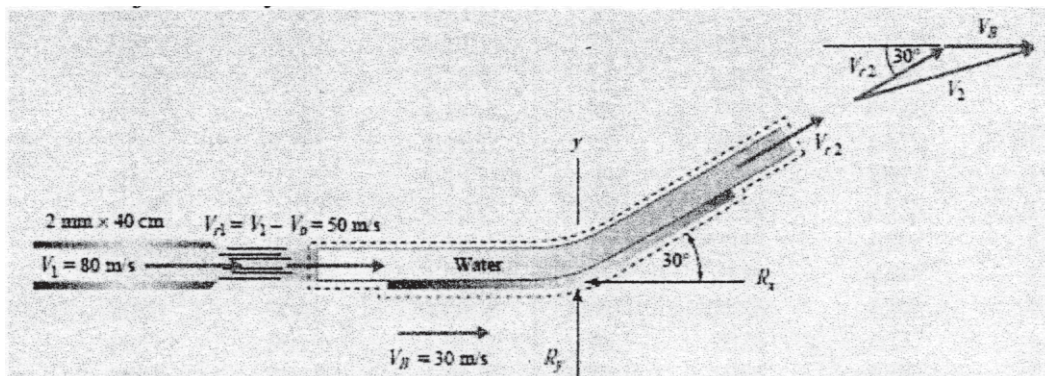
- 1) Answer five questions from following.
- 2) Draw Diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data where ever necessary.

**Q1) a)** Derive an expression for conservation of mass and momentum using differential analysis. [7]

- b) Water flows in a circular pipe. At one section, the diameter is 0.3 m, the static pressure is 260 kPa gauge, the velocity is 3 m/s and the elevation is 10 m above ground level. The elevation at a section downstream is 0 m, and the pipe diameter is 0.15 m. Find the gauge pressure at the downstream section. Frictional effects may be neglected. Assume density of water to be 999 kg/m<sup>3</sup>. [3]

**Q2)** Derive generalized expression of Navier stokes equations. [10]

- Q3) a)** The deflector shown in Fig. moves to the right at 30 m/s while the nozzle remains stationary. Determine (i) the force components needed to support the deflector, (ii)  $V_2$  as observed from a fixed observer, and (iii) the power generated by the vane. The jet velocity is 80 m/s. [5]



- b) Obtain exact solution of Couette flow. [5]

P.T.O.

- Q4)** a) Obtain an expression for stream function and velocity function for following flows. Also determine pressure distribution in sink flow [5]  
 i) Source & sink flow  
 ii) Vortex flow.
- b) Determine the radial pressure gradient at radius  $r=1.5$  m for a two - dimensional fluid motion defined by the stream function. [5]

$$\psi = \log_e r$$

- Q5)** a) Estimate the boundary - layer thickness at the end of a 4 - m- long flat surface if the free stream velocity is  $U = 5$  m/s. Use atmospheric air at  $30^\circ\text{C}$ . Also, predict the drag force if the surface is 5 m wide. (i) Neglect the laminar portion of the flow and (ii) account for the laminar portion using  $Re_{cr} = 5 \times 10^5$  [5]
- b) A general sinusoidal velocity profile for laminar boundary - layer flow on a flat plate can be taken as  
 $u = A \sin (By) + C$   
 State the three boundary conditions applicable to the velocity profile, and thus evaluate the constants A, B, C. [5]

- Q6)** a) Explain different types of free turbulent flows. What is a need of turbulence modeling? [5]
- b) Water at  $20^\circ\text{C}$  flows in a 10-cm-diameter pipe at an average velocity of 1.6 m/s. If the roughness elements are 0.046 mm high, would the wall be rough or smooth? take  $n = 7.5$  [5]

- Q7)** a) Develop area - velocity relationship in terms of Mach number and discuss effect of variation of area for subsonic, sonic and supersonic flows. [5]
- b) A converging - diverging nozzle has a throat diameter of 5 cm and an exit diameter of 10cm. The reservoir is the laboratory, maintained at atmospheric conditions of  $20^\circ\text{C}$  and 90 kPa absolute. Air is constantly pumped from a receiver so that a normal shock wave stands across the exit plane of the nozzle. Determine the receiver pressure and the mass flux. [5]

TABLE D.1 Isentropic Flow

M	$p/p_0$	$T/T_0$	$A/A^*$	M	$p/p_0$	$T/T_0$	$A/A^*$
0	1.0000	1.0000	$\infty$	.96	.5532	.8444	1.0014
.02	.9997	.9999	28.9421	.98	.5407	.8389	1.0003
.04	.9989	.9997	14.4815	1.00	.5283	.8333	1.0000
.06	.9975	.9993	9.6659	1.02	.5160	.8278	1.0000
.08	.9955	.9987	7.2616	1.04	.5039	.8222	1.0001
.10	.9930	.9980	5.8218	1.06	.4919	.8165	1.0003
.12	.9900	.9971	4.8643	1.08	.4800	.8108	1.0005
.14	.9864	.9961	4.1824	1.10	.4684	.8052	1.0008
.16	.9823	.9949	3.6727	1.12	.4568	.7994	1.0111
.18	.9776	.9936	3.2779	1.14	.4455	.7937	1.015
.20	.9725	.9921	2.9635	1.16	.4343	.7879	1.020
.22	.9668	.9904	2.7076	1.18	.4232	.7822	1.025
.24	.9607	.9886	2.4956	1.20	.4124	.7764	1.030
.26	.9541	.9867	2.3173	1.22	.4017	.7706	1.037
.28	.9470	.9846	2.1656	1.24	.3912	.7648	1.043
.30	.9395	.9823	2.0351	1.26	.3809	.7590	1.050
.32	.9315	.9799	1.9219	1.28	.3708	.7532	1.058
.34	.9231	.9774	1.8229	1.30	.3609	.7474	1.066
.36	.9143	.9747	1.7358	1.32	.3512	.7416	1.075
.38	.9052	.9719	1.6587	1.34	.3417	.7358	1.084
.40	.8956	.9690	1.5901	1.36	.3323	.7300	1.094
.42	.8857	.9659	1.5289	1.38	.3232	.7242	1.104
.44	.8755	.9627	1.4740	1.40	.3142	.7184	1.115
.46	.8650	.9594	1.4246	1.42	.3055	.7126	1.126
.48	.8541	.9560	1.3801	1.44	.2969	.7069	1.138
.50	.8430	.9524	1.3398	1.46	.2886	.7011	1.150
.52	.8317	.9487	1.3034	1.48	.2804	.6954	1.163
.54	.8201	.9449	1.2703	1.50	.2724	.6897	1.176
.56	.8082	.9410	1.2403	1.52	.2646	.6840	1.190
.58	.7962	.9370	1.2130	1.54	.2570	.6783	1.204
.60	.7840	.9328	1.1882	1.56	.2496	.6726	1.219
.62	.7716	.9286	1.1657	1.58	.2423	.6670	1.234
.64	.7591	.9243	1.1452	1.60	.2353	.6614	1.250
.66	.7465	.9199	1.1265	1.62	.2284	.6558	1.267
.68	.7338	.9153	1.1097	1.64	.2217	.6502	1.284
.70	.7209	.9107	1.0944	1.66	.2151	.6447	1.301
.72	.7080	.9061	1.0806	1.68	.2088	.6392	1.319
.74	.6951	.9013	1.0681	1.70	.2026	.6337	1.338
.76	.6821	.8964	1.0570	1.72	.1966	.6283	1.357
.78	.6691	.8915	1.0471	1.74	.1907	.6229	1.376
.80	.6560	.8865	1.0382	1.76	.1850	.6175	1.397
.82	.6430	.8815	1.0305	1.78	.1794	.6121	1.418
.84	.6300	.8763	1.0237	1.80	.1740	.6068	1.439
.86	.6170	.8711	1.0179	1.82	.1688	.6015	1.461
.88	.6041	.8659	1.0129	1.84	.1637	.5963	1.484
.90	.5913	.8606	1.0089	1.86	.1587	.5910	1.507
.92	.5785	.8552	1.0056	1.88	.1539	.5859	1.531
.94	.5658	.8498	1.0031	1.90	.1492	.5807	1.555

TABLE D.1 Isentropic Flow (continued)

M	$p/p_0$	$T/T_0$	$A/A^*$	M	$p/p_0$	$T/T_0$	$A/A^*$
1.92	.1447	.5756	1.580	2.92	.3071 <sup>-1</sup>	.3696	3.924
1.94	.1403	.5705	1.606	2.94	.2980 <sup>-1</sup>	.3665	3.999
1.96	.1360	.5655	1.633	2.96	.2891 <sup>-1</sup>	.3633	4.076
1.98	.1318	.5605	1.660	2.98	.2805 <sup>-1</sup>	.3602	4.155
2.00	.1278	.5556	1.688	3.00	.2722 <sup>-1</sup>	.3571	4.235
2.02	.1239	.5506	1.716	3.02	.2642 <sup>-1</sup>	.3541	4.316
2.04	.1201	.5458	1.745	3.04	.2564 <sup>-1</sup>	.3511	4.399
2.06	.1164	.5409	1.775	3.06	.2489 <sup>-1</sup>	.3481	4.483
2.08	.1128	.5361	1.806	3.08	.2416 <sup>-1</sup>	.3452	4.570
2.10	.1094	.5313	1.837	3.10	.2345 <sup>-1</sup>	.3422	4.657
2.12	.1060	.5266	1.869	3.12	.2276 <sup>-1</sup>	.3393	4.747
2.14	.1027	.5219	1.902	3.14	.2210 <sup>-1</sup>	.3365	4.838
2.16	.9956 <sup>-1</sup>	.5173	1.935	3.16	.2146 <sup>-1</sup>	.3337	4.930
2.18	.9649 <sup>-1</sup>	.5127	1.970	3.18	.2083 <sup>-1</sup>	.3309	5.025
2.20	.9352 <sup>-1</sup>	.5081	2.005	3.20	.2023 <sup>-1</sup>	.3281	5.121
2.22	.9064 <sup>-1</sup>	.5036	2.041	3.22	.1964 <sup>-1</sup>	.3253	5.219
2.24	.8785 <sup>-1</sup>	.4991	2.078	3.24	.1908 <sup>-1</sup>	.3226	5.319
2.26	.8514 <sup>-1</sup>	.4947	2.115	3.26	.1853 <sup>-1</sup>	.3199	5.420
2.28	.8251 <sup>-1</sup>	.4903	2.154	3.28	.1799 <sup>-1</sup>	.3173	5.523
2.30	.7997 <sup>-1</sup>	.4859	2.193	3.30	.1748 <sup>-1</sup>	.3147	5.629
2.32	.7751 <sup>-1</sup>	.4816	2.233	3.32	.1698 <sup>-1</sup>	.3121	5.736
2.34	.7512 <sup>-1</sup>	.4773	2.274	3.34	.1649 <sup>-1</sup>	.3095	5.845
2.36	.7281 <sup>-1</sup>	.4731	2.316	3.36	.1602 <sup>-1</sup>	.3069	5.956
2.38	.7057 <sup>-1</sup>	.4688	2.359	3.38	.1557 <sup>-1</sup>	.3044	6.069
2.40	.6840 <sup>-1</sup>	.4647	2.403	3.40	.1512 <sup>-1</sup>	.3019	6.184
2.42	.6630 <sup>-1</sup>	.4606	2.448	3.42	.1470 <sup>-1</sup>	.2995	6.301
2.44	.6426 <sup>-1</sup>	.4565	2.494	3.44	.1428 <sup>-1</sup>	.2970	6.420
2.46	.6229 <sup>-1</sup>	.4524	2.540	3.46	.1388 <sup>-1</sup>	.2946	6.541
2.48	.6038 <sup>-1</sup>	.4484	2.588	3.48	.1349 <sup>-1</sup>	.2922	6.664
2.50	.5853 <sup>-1</sup>	.4444	2.637	3.50	.1311 <sup>-1</sup>	.2899	6.790
2.52	.5674 <sup>-1</sup>	.4405	2.686	3.52	.1274 <sup>-1</sup>	.2875	6.917
2.54	.5500 <sup>-1</sup>	.4366	2.737	3.54	.1239 <sup>-1</sup>	.2852	7.047
2.56	.5332 <sup>-1</sup>	.4328	2.789	3.56	.1204 <sup>-1</sup>	.2829	7.179
2.58	.5169 <sup>-1</sup>	.4289	2.842	3.58	.1171 <sup>-1</sup>	.2806	7.313
2.60	.5012 <sup>-1</sup>	.4252	2.896	3.60	.1138 <sup>-1</sup>	.2784	7.450
2.62	.4859 <sup>-1</sup>	.4214	2.951	3.62	.1107 <sup>-1</sup>	.2762	7.589
2.64	.4711 <sup>-1</sup>	.4177	3.007	3.64	.1076 <sup>-1</sup>	.2740	7.730
2.66	.4568 <sup>-1</sup>	.4141	3.065	3.66	.1047 <sup>-1</sup>	.2718	7.874
2.68	.4429 <sup>-1</sup>	.4104	3.123	3.68	.1018 <sup>-1</sup>	.2697	8.020
2.70	.4295 <sup>-1</sup>	.4068	3.183	3.70	.9903 <sup>-2</sup>	.2675	8.169
2.72	.4165 <sup>-1</sup>	.4033	3.244	3.72	.9633 <sup>-2</sup>	.2654	8.320
2.74	.4039 <sup>-1</sup>	.3998	3.306	3.74	.9370 <sup>-2</sup>	.2633	8.474
2.76	.3917 <sup>-1</sup>	.3963	3.370	3.76	.9116 <sup>-2</sup>	.2613	8.630
2.78	.3799 <sup>-1</sup>	.3928	3.434	3.78	.8869 <sup>-2</sup>	.2592	8.789
2.80	.3685 <sup>-1</sup>	.3894	3.500	3.80	.8629 <sup>-2</sup>	.2572	8.951
2.82	.3574 <sup>-1</sup>	.3860	3.567	3.82	.8396 <sup>-2</sup>	.2552	9.115
2.84	.3467 <sup>-1</sup>	.3827	3.636	3.84	.8171 <sup>-2</sup>	.2532	9.282
2.86	.3363 <sup>-1</sup>	.3794	3.706	3.86	.7951 <sup>-2</sup>	.2513	9.451
2.88	.3263 <sup>-1</sup>	.3761	3.777	3.88	.7739 <sup>-2</sup>	.2493	9.624
2.90	.3165 <sup>-1</sup>	.3729	3.850	3.90	.7532 <sup>-2</sup>	.2474	9.799

**TABLE D.2** Normal-Shock Flow (*continued*)

$M_1$	$M_2$	$p_2/p_1$	$T_2/T_1$	$p_{02}/p_{01}$
2.30	.5344	6.005	1.947	.5833
2.32	.5321	6.113	1.965	.5745
2.34	.5297	6.222	1.984	.5658
2.36	.5275	6.331	2.002	.5572
2.38	.5253	6.442	2.021	.5486
2.40	.5231	6.553	2.040	.5401
2.42	.5210	6.666	2.059	.5317
<b>2.44</b>	<b>.5189</b>	<b>6.779</b>	<b>2.079</b>	<b>.5234</b>
2.46	.5169	6.894	2.098	.5152
2.48	.5149	7.009	2.118	.5071
2.50	.5130	7.125	2.138	.4990
2.52	.5111	7.242	2.157	.4991
2.54	.5092	7.360	2.177	.4832
2.56	.5074	7.479	2.198	.4754
2.58	.5056	7.599	2.218	.4677
2.60	.5039	7.720	2.238	.4601
2.62	.5022	7.842	2.259	.4526
2.64	.5005	7.965	2.280	.4452
2.66	.4988	8.088	2.301	.4379
2.68	.4972	8.213	2.322	.4307
2.70	.4956	8.338	2.343	.4236
2.72	.4941	8.465	2.364	.4166
<b>2.74</b>	<b>.4926</b>	<b>8.592</b>	<b>2.386</b>	<b>.4097</b>
2.76	.4911	8.721	2.407	.4028
2.78	.4896	8.850	2.429	.3961
2.80	.4882	8.980	2.451	.3895
2.82	.4868	9.111	2.473	.3829
2.84	.4854	9.243	2.496	.3765
2.86	.4840	9.376	2.518	.3701
2.88	.4827	9.510	2.540	.3639
2.90	.4814	9.645	2.563	.3577
2.92	.4801	9.781	2.586	.3517
2.94	.4788	9.918	2.609	.3457
2.96	.4776	10.06	2.632	.3398
2.98	.4764	10.19	2.656	.3340





[5355]-611

M.E. (Mechanical-Mechatronics)

SYSTEM MODELLING, IDENTIFICATION &amp; SIMULATION

(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) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume Suitable data if necessary

**Q1)** Draw a suitable flow chart and explain the process of parameter estimation using unscented Kalman filter. [10]

**Q2)** For the system represented by Eq. 1, draw the signal flow diagram. [10]

$$\frac{y(s)}{x(s)} = \frac{(s+3)}{(s^2+10s+24)} \quad (\text{Eq.1})$$

**Q3)** Derive the state space model of the rotational mechanical system in Figure 1. [10]

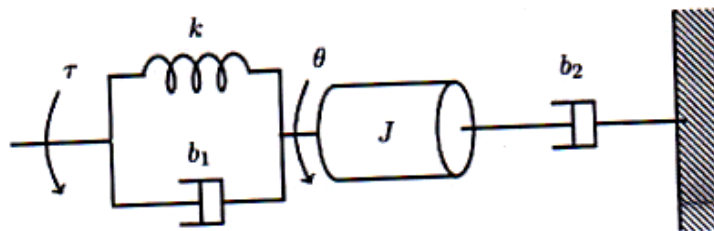


Figure 1: Rotational mechanical system

**Q4)** Discuss the modelling of a cantilever beam as a multi degree of freedom system using the state space approach. [10]

**Q5)** Draw the flow chart and explain the identification of ARX model using Least Square method. **[10]**

**Q6)** List 3 types of fuzzy logic membership functions and explain their selection process. **[10]**

**Q7)** Explain time domain analysis and frequency domain analysis. Also, using suitable illustration, discuss how the type of analysis, between time and frequency, would be selected. **[10]**



Total No. of Questions : 7]

SEAT No. :

P 4781

[Total No. of Pages : 2

[5355]-612

M.E. (Mechanical-Mechatronics)

CONTROL SYSTEMS - I

(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) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume Suitable data if necessary

**Q1)** With respect to full state feedback control, discuss the significance of assessment of controllability and observability. [10]

$$\frac{y(s)}{u(s)} = \frac{10}{(s+1)(s+2)} \quad \text{Eq....Q1-1}$$

**Q2)** The open loop transfer function .of a second order system is given by Eq Q1-1. Convert this model into an equivalent state space model. From this state space model, determine the location of the poles, the zeros and comment on the stability of the system. [10]

**Q3)** Draw the signal flow diagram of the second order system given by Eq Q1 -1 and comment on the controllability of the said system. [10]

**Q4)** Considering the state space model derived in Q2, determine a full state feedback gain, k, such that the desired closed loop system has maximum percentage overshoot of 15% and a 2% settling time of 0.5 seconds. Use Ackerman's technique for determination of the full state feedback gain. Also, determine the state space model of the closed loop system using the full state feedback gain. [10]

P.T.O.



- Q5)** a) Using the pole placement method, build a full state observer such that the observer poles are located at 10 times the closed loop poles. Consider the closed loop poles to be of the closed system from Q4. [5]
- b) Determine the A matrix for the compensator using the full state feedback gain  $k$ , and the observer gain  $L$  from Q-4 and Q-5 respectively. [5]
- Q6)** Draw a suitable block diagram and discuss, in detail, a control system for precise tracking operation. [10]
- Q7)** Draw a suitable block diagram and describe the process for designing of an observer based full state feedback controller. [10]



Total No. of Questions : 7]

SEAT No. :

P 4782

[Total No. of Pages : 2

[5355]-613

M.E. (Mechanical-Mechatronics)

Sensors, Transducers and Interfacing Techniques

(2017 Pattern)

Time : 3 Hours]

[Max. Marks :50

*Instructions to the candidates:*

- 1) *Attempt any FIVE questions*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat figures, diagrams wherever necessary.*
- 4) *Use of Scientific Calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Explain Chi Square test for goodness of fit using neat example. [5]

b) Discuss in detail following terms [5]

i) Correlation coefficients

ii) Probability distributions.

**Q2)** Explain the terms sensor and transducer. [10]

With the help of neat schematic explain the operation, advantages, disadvantages and applications of following-

a) Piezoelectric transducers

b) Capacitive transducers.

**Q3) a)** Discuss dynamic response characteristics with respect to pressure measurements. [5]

b) Explain the construction and working of Pirani gauge. State its advantages / limitations and applications. [5]

**Q4) a)** Explain the operation of hot wire and hot film anemometers. [5]

*P.T.O.*

- b) Explain the significance of following terms - [5]
- i) Specific humidity,
  - ii) Dry-bulb temperature
  - iii) Wet-bulb temperature
  - iv) Dew point.
- Q5)** a) Explain the working of thermocouple. Explain transient response of thermal systems. [5]
- b) Explain the thermal conductivity measurement technique in detail. [5]
- Q6)** a) Explain how weight is measured using strain gauge. [5]
- b) Discuss the technique of temperature compensation of strain gauges. [5]
- Q7)** a) Draw the generalized block diagram of data acquisition system and explain each block in detail. [5]
- b) Explain the terms data transmission and data storage with respect to DAS. [5]



[5355]-615

**M.E. (Mechanical) (Mechatronics) (Semester - II)**  
**PLC PROGRAMMING**

Time : 3 Hours]

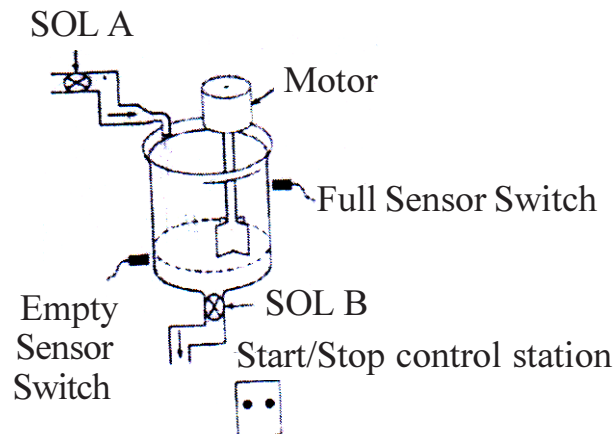
[Max. Marks : 50

*Instructions to the candidates:*

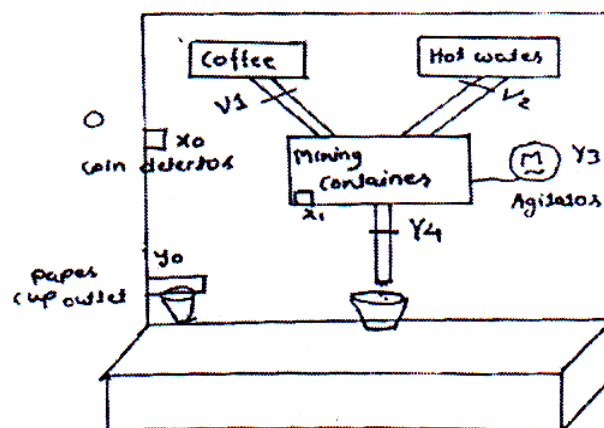
- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data, if necessary.

**Q1)** Write a program to implement the process illustrated in Fig. The sequence of operation is to be as follows: [10]

- Normally open start and normally closed stop pushbuttons are used to start and stop the process.
- When the start button is pressed, solenoid A energizes to start filling the tank.
- As the tank fills, the empty level sensor switch closes.
- When the tank is full, the full level sensor switch closes.
- Solenoid A is de-energized.
- The agitate motor starts automatically and runs for 3 min to mix the liquid.
- When the agitate motor stops, solenoid B is energized to empty the tank.
- When the tank is completely empty, the empty sensor switch opens to de-energize solenoid B.
- The start button is pressed to repeat the sequence.

**P.T.O.**

- Q2)** a) State one application for each of the following special i/o module [5]
- Encoder counter module
  - Stepper motor module
- b) How to the temporary end instruction used to troubleshoot a program.[5]  
(Refer to Q 2 a)
- Q3)** a) What two addresses are contained in some five-digit PLC addressing formats? [5]
- b) How to the temporary end instruction used to troubleshoot a program.[5]  
(Refer to Q 3 a)
- Q4)** Draw a ladder diagram for making the paper cup come out of the outlet when a coin is inserted. At the same time, the coffee pours in the mixing container . After 2 sec, the hot water pours in. 60 sec later, the ready-made coffee will be pouring out from the coffee outlet. [10]



- Q5)** a) Assume that a thermocouple is connected to an analog input module. Explain how the temperature of the thermocouple is communicated to the processor. [5]
- b) Briefly describe each of the following modes of operation of PICs: [5]
- PROGRAM
  - TEIT
  - RUN

**Q6)** In PLC based automatic ball sorting system, there three types of ball viz. metal, plastic and glass are to be sorted. If metallic ball is sensed, actuator A1 will be actuated and will retract touching the limit switch LS1. If plastic ball is sensed, actuator A2 will be actuated and will be retract touching the limit switch LS2. If ball is of glass, no actuators would be actuated. When balls in the hopper are reduced below low level, a RED light should glow along with buzzer so operator would fill it to get a continuous sorting operation. [10]

**Q7) a)** Compare the method of operation of each of the following types of switches: [5]

- i) Manually operated switch
- ii) Mechanically operated switch
- iii) Proximity switch

**b)** Explain what each of the following quantities associated with a PIC timer instruction represents: [5]

- i) Preset time
- ii) Accumulated time
- iii) Time base

**Q8)** A temperature control system consists of four thermostats controlling three heating units. The thermostat contacts are set to close at 50°, 60°, 70°, and 80°F, respectively. The PLC ladder logic program is to be designed so that at a temperature below 50°F, three heaters are to be ON. Between 50°, to 60°F, two heaters are to be ON. For 60° to 70°F, one heater is to be ON. Above 80°F, there is a safety shutoff for all three heaters in case one stays on because of a malfunction. A master switch is to be used to turn the system ON and OFF. Prepare a typical PLC program for this control process. [10]



Total No. of Questions : 7]

SEAT No. :

**P5293**

**[5355]-616**

[Total No. of Pages : 3

**M.E. (Mechanical-Mechatronics)**  
**CONTROL SYSTEMS - II**  
**(2017 Pattern) (Semester - II) (502808)**

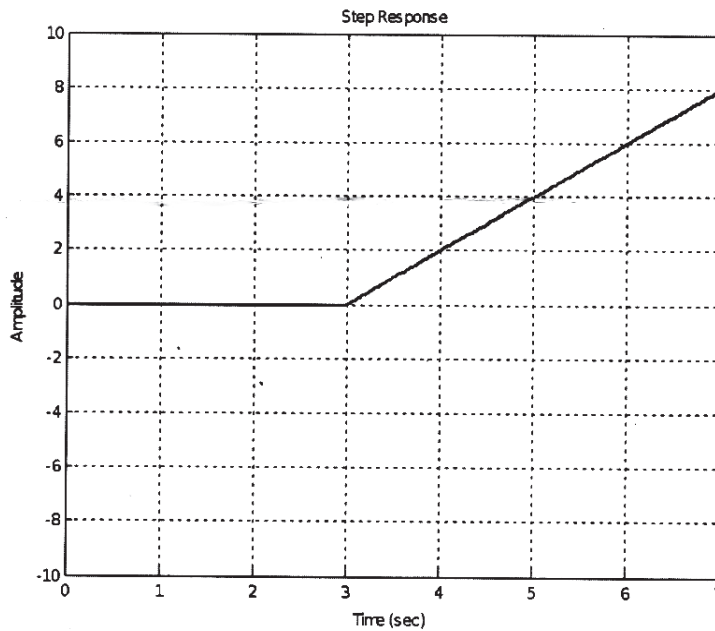
*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn 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)** The step response of a model is shown below. Using suitable technique identify the model. **[5]**

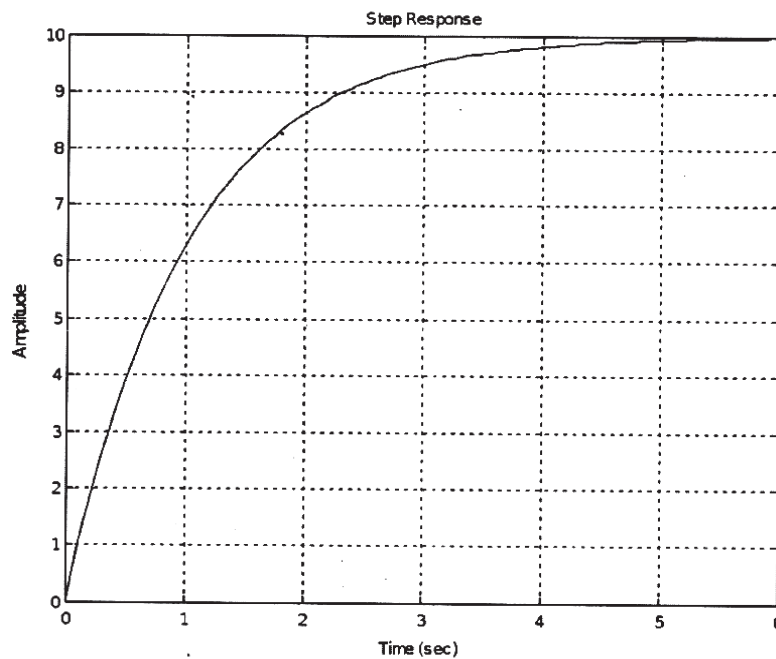


b) Write a short note on Nyquist Stability Criterion.

**[5]**

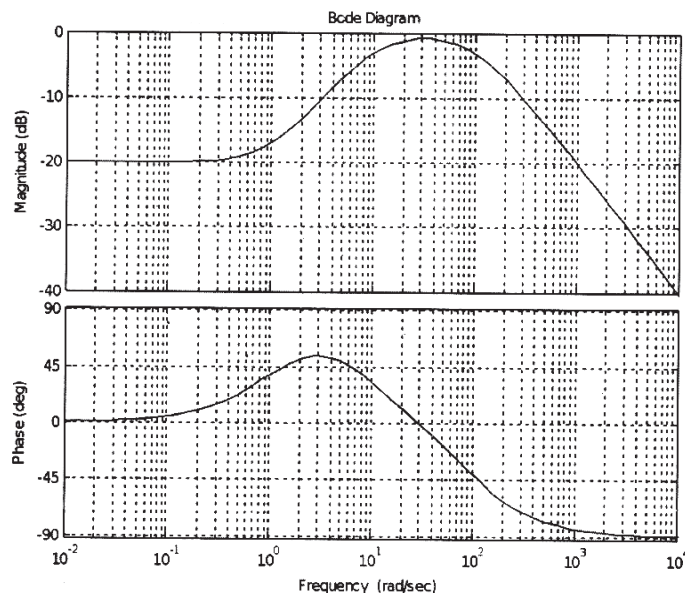
*P.T.O.*

**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]**

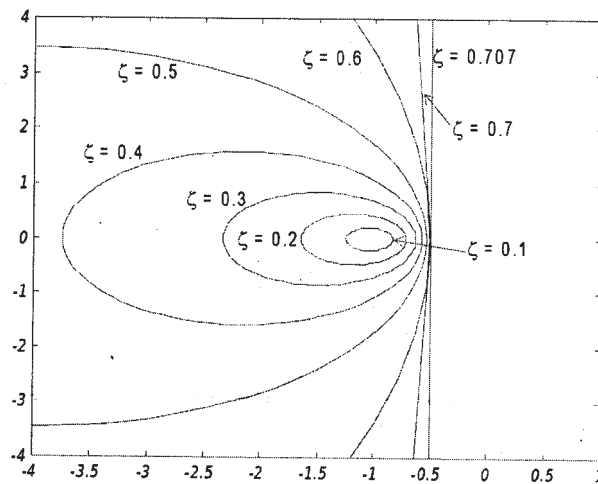
**Q3) a)** Determine the approximate value of Gain and the Phase Margin from below plot. **[5]**



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. :

**P5294**

[5355]-617

[Total No. of Pages : 2

**M.E. (Mechanical - Mechatronics)**  
**INDUSTRIAL DRIVES AND ACTUATORS**  
**(2017 Course) (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)** Explain concept of group, individual and multi - motor electric drive in detail. **[10]**

**Q3) a)** Explain the factors on which decides whether hydraulic system is to be used or pneumatic system is to be used. **[5]**

b) Enlist any four significant factors to be considered while choosing hydraulic fluid medium. **[5]**

**Q4)** Explain armature controlled and field controlled DC servo motor drive. **[10]**

**Q5) a)** Explain classification of pneumatic cylinders w.r.t. construction with industrial application of each type. **[5]**

b) Explain the effect of incorrect alignment of hydraulic cylinder during installation. **[5]**

**P.T.O.**

- Q6)** a) Explain hydraulic power steering as a hydraulic servo system. [5]  
b) Explain the application of sequence valve and pressure relief valve in industrial hydraulic circuits. [5]
- Q7)** a) Explain constant torque constant power speed control characteristics of synchronous motor drive. [5]  
b) Explain working principle synchronous motor. [5]
- Q8)** Answer any two: [10]  
a) Air motor and electric motor comparison  
b) Closed loop block diagram of modern electric drive  
c) Encoders w.r.t. actuators.  
d) Various types of load torque.



Total No. of Questions : 8]

SEAT No. :

P 4783

[Total No. of Pages : 2

[5355]-621

**M.E. (Electronics - Digital Systems)**

**Analog & Digital CMOS Design**

**(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) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculators is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) What is MOSFET scaling? Describe its types. [4]  
b) Describe accumulation, depletion and inversion mode of operation in EMOSFET. [4]  
c) Explain in brief Micron design rules with respect to physical limits of CMOS design. [2]
- Q2)** a) Draw and explain fabrication steps of CMOS inverter using twin tub process. [4]  
b) What are different capacitances in MOSFET? Describe gate capacitor. [4]  
c) What do you mean by channel length modulation? [2]
- Q3)** a) What are the components considered for the power dissipation in a CMOS VLSI circuit? Calculate approximate dynamic power dissipation in a chip operating with  $V_{DD} = 4.5$  V at 100MHz with an internal switched capacitance of 500pF. [4]  
b) Explain Fan in and Fan out of CMOS logic, Give the expression and explain dependencies. [4]  
c) What are the different causes of power dissipation in CMOS? Explain in brief. [2]

**P.T.O.**

- Q4)** a) With the help of suitable schematic, explain RC delay model. [4]  
 b) What is need of logical effort? Explain with suitable example [4]  
 c) Write note on Interconnect. [2]
- Q5)** a) With the help of suitable schematic, explain Cascode amplifier. What are its merits? Give the expressions for voltage gain and output resistance. [4]  
 b) Draw and explain CMOS operational amplifier. Give the expressions for voltage gain and output resistance. [4]  
 c) Describe nonlinear resistance of MOS Diode. [2]
- Q6)** a) Draw and describe general two stage OPAMP. Describe frequency response curve [4]  
 b) Explain current mirror in detail. Why is it needed? [4]  
 c) Explain how CMOS inverter can be used as amplifier. [2]
- Q7)** a) Design a Full Adder using: i) Static CMOS logic. ii) Pass transistor logic. [4]  
 b) Why NAND gate is preferred in CMOS design? How does mobility of electrons and holes affect size of gates in CMOS logic? [4]  
 c) What is advantage of transmission gate based design over convention CMOS design [2]
- Q8)** a) Design static CMOS logic circuit for the following expressions and compute the chip area for implementation of Boolean function :  
 $f = \sim(x1 + x2. x3)$  [4]  
 b) What is rationed logic circuit? Why it is needed? [4]  
 c) Design 2: 1 multiplexer using transmission gates and explain its operation. [2]



Total No. of Questions : 8]

SEAT No. :

P 4784

[Total No. of Pages : 2

[5355]-622

**M.E. (Digital Systems) (Electronics)**

**Multirate Signal Processing**

**(2017 Pattern)**

*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 indicate marks.*

- Q1)** a) Design a 2-stage decimator which is used to reduce sampling rate from 240 KHz to 8 KHz **[5]**  
PB ripple : 0.06  
SB ripple : 0.01  
Freq. band of interest: 0-3.4 KHz  
Also calculate storage required  
and multiplication per seconds
- b) Derive the coefficient vector update expression (in terms of error and step size) of steepest descent algorithm for adaptive filter. What are limitations of this algorithm. **[5]**
- Q2)** a) Find the pade approximation of second order to a signal  $x(n)$  that is given by  $x(n) = \{1,0,2,-1, 2, 0,1,2\}^T$  with two pole and two zero. **[5]**
- b) What do mean by synthesis and analysis of filter ? explain with wavelet.**[5]**
- Q3)** a) How to design a DFT filter banks., explain. **[4]**
- b) What is characteristics of QMF's frequency response? How to design these filters. **[4]**
- c) Calculate 4 point DCT of a  $x(n) = \{1, 2, 6, 4\}$ . **[2]**

- Q4)** a) Explain how to use wavelet transform for image compression [4]  
 b) Design a 2-stage interpolator which is used to increase sampling rate from 128 KHz to 1024KHz [4]  
 PB ripple : 0.02  
 SB ripple : 0.01  
 Freq. band of interest: 0-60 KHz  
 c) Determine the output  $y(n)$  in terms of input  $x(n)$  for the multirate system [2]



Shown in figure

- Q5)** a) Explain use of adaptive filter for noise cancellation. [4]  
 b) Explain the design steps for phase shifter in multirate system. [4]  
 c) Compare Prony's and Pade approximation method with respect to signal modeling [2]
- Q6)** a) Transfer function is  $H(z) = (1 + 0.85 Z^{-1}) / (1 - 0.65 Z^{-1})$ . perform polyphaser decomposition of  $H(Z)$  into 4 section. [4]  
 b) What is mother wavelet ? explain wavelet function and scaling function. [4]  
 c) Calculate order of operation for wavelet transform. Compare with DFT. [2]
- Q7)** a) Explain the concept of decimation for image resizing. [4]  
 b) Derive the expression for output spectrum of decimator in terms of input spectrum. Draw the spectrum. [4]  
 c) What do mean by multiresolution analysis. ? Where it is applicable? [2]
- Q8)** a) Write a note on sampling rate conversion by a rational factor. Also comment on sequence of multirate sampling [4]  
 b) What is role of sigma delta modulator in oversampling DAC. [3]  
 c) Write a note on Haar wavelet. [3]



Total No. of Questions : 8]

SEAT No. :

P 4785

[Total No. of Pages : 2

[5355]-623

M.E. (Electronics Digital Systems)

EMBEDDED SYSTEM DESIGN

(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) Assume suitable data if necessary.

- Q1)** a) Compare the different types of development Platform Trends in terms of IDE, board details and applications. [4]  
b) Draw and describe Cortex Microcontroller Software Interface Standard [4]  
c) What are the characteristics of embedded systems [2]
- Q2)** a) List the different types of life cycle models in embedded system Design and explain any one in detail. [4]  
b) Compare classical series of ARM architectures and ARM CORTEX [4]  
c) What are design metric of embedded system? [2]
- Q3)** a) What are important requirements that an OS must meet to be considered an RTOS? [4]  
b) Explain the Task Scheduling and Task synchronization in RTOS. [4]  
c) Compare VXWorks and Micro-C/OS-II. [2]
- Q4)** a) Explain the different kernel services of RTOS [4]  
b) Describe the process of Android application development [4]  
c) Explain the role of Watchdog used in RTOS. [2]

P.T.O.



- Q5)** a) What is Linux-Kernel configuration? Give steps for Linux Kernel configuration. [4]  
b) What are the steps to implement device driver for Keyboard. [4]  
c) Explain the procedure for porting Linux on ARM [2]
- Q6)** a) What are the steps to implement device driver for LCD. [4]  
b) Explain how kernel initialization and space initialization is carried out in Embedded Linux. [4]  
c) What are the advantages of Embedded Linux. [2]
- Q7)** a) Discuss Digital camera as Embedded system case study with respect to following points: [4]  
i) Blockdiagram  
ii) Algorithm/flowchart  
b) Explain reliability and failure analysis of embedded system [4]  
c) What are issues related with mechanical packaging of embedded products? [2]
- Q8)** a) Explain the design details of Automated meter reading system [6]  
b) Explain the importance of EMI/RFI certification in embedded product.[4]



Total No. of Questions : 8]

SEAT No. :

P 4786

[Total No. of Pages : 2

[5355]-624

**M.E. (Electronics Digital Systems)**  
**(Electronics and Telecommunication - VLSI and Embedded**  
**System, Microwave, Signal Processing, Communication Network)**  
**Research Methodology (2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Support your answer with neat diagram if necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) How do you define a research problem? Give example to illustrate your answer. [5]  
b) Explain the meaning of research hypothesis in contest of research design. [5]
- Q2)** a) Compare and contrast the different methods of collecting the data. [5]  
b) Describe process of data coding and classification with example [5]
- Q3)** a) Explain the meaning of significance of the concept of standard error in sampling analysis in Research. [5]  
b) Explain regression analysis with suitable example? [5]
- Q4)** a) Explain the meaning of Analysis of variance (ANOVA) and explain eight steps of 'ONE WAY ANOVA' [5]  
b) Explain important characteristics of multivariate techniques, list multivariate techniques? [5]
- Q5)** a) What do you mean by principle component analysis explain in details. [5]  
b) Describe in brief Layout of Research report covering all relevant points [5]

*P.T.O.*

**Q6)** Write short note on -

- a) Process of evaluating the Research [5]
- b) Data collection and interpretation of data. [5]

**Q7)** a) Describe How to prepare research proposal to setup innovation centre in your department? [5]

- b) Describe in brief Bibliography & its importance in context of research report. [5]

**Q8)** a) How to write literature review to develop conceptual framework for research? [5]

- b) Explain in brief 'Interpretation' in the contest of research methodology. [5]



Total No. of Questions : 8]

SEAT No. :

P 4787

[Total No. of Pages : 2

[5355]-625

**M.E. (Electronics) Digital Systems**

**Advanced DSP Processors**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Explain the features of a program sequencer unit of a programmable DSP with a neat block diagram. [5]  
b) Explain implementation of 8- tap FIR filter, [5]  
i) pipelined using MAC units and  
ii) parallel using two MAC units. Draw block diagrams.
- Q2)** a) Explain guard bits in a MAC unit of DSP. Consider a MAC unit whose inputs are 24-bit numbers. How many guard bits should be provided if 512 products have to be added in the accumulator to prevent overflow condition? What is the overall size of the accumulator required? [5]  
b) How to create and build a project in Code Composer Studio. [5]
- Q3)** a) Describe any five data addressing modes of TMS320c54xx processor [5]  
b) Why circular buffers are required in DSP processor? How they are implemented? [5]
- Q4)** a) Describe the multiplier/adder unit of TMS320c54xx processor with a neat block diagram. [5]  
b) Explain the functioning of barrel shifter in TMS320C54XX processor. [5]

**P.T.O.**

- Q5)** a) Explain the following assembler directives of TMS320C54XX processors [5]
- i) .mmregs                      ii) .global
  - iii) .include 'xx'              iv) .data
  - v) .end                              vi) .bss
- b) Explain the different types of interrupts in TMS320C54xx Processors. [5]
- Q6)** a) Compare TMS320C54XX and TMS320C6713 [5]
- b) Explain architecture of the Blackfin BF533 processor. [5]
- Q7)** a) Describe the pipelining operation of TMS320C54XX processors. [5]
- b) State the selection criterion for DSP processors. [5]
- Q8)** a) What is the role of compiler, Assembler, linker, simulator, emulator. [5]
- b) Explain memory map of black fin BF533 Processor. [5]



Total No. of Questions : 8]

SEAT No. :

P 4788

[Total No. of Pages : 2

[5355]-626

M.E. (Electronics) (Digital Systems)

PLDs and ASIC Design

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Figures to the right indicate full meark.*

- Q1)** a) Explain one hot encoding method and it's usefulness for FPGAs. [4]  
b) Describe any two design issues of finite state machines. [4]  
c) What is postponed process? [2]
- Q2)** a) Explain the top down approach to design PLDs. [4]  
b) What is system on chip? What are advantages and disadvantages of SOC? [4]  
c) What is operator inference in VHDL? [2]
- Q3)** a) Explain the data flow and structural modelling techniques in VHDL [4]  
b) Explain the architecture and functional block of cool runner CPLD. [4]  
c) What is test bench? Explain it's use. [2]
- Q4)** a) Explain different delay models in VHDL. [4]  
b) Explain the significance of std - Logic - 1164. all package and numeric - std. all package available in library IEEE. [4]  
c) Explain concurrent statement in VHDL with example. [2]
- Q5)** a) Draw and explain basic logic block of Actel fusion architecture. [4]  
b) Describe bus function models. [4]  
c) Explain chipscope pro. [2]

*P.T.O.*

- Q6)** a) Draw boundary scan architecture and describe functions of its elements. [4]  
b) Draw and explain the architecture of xilinx spartan - II [4]  
c) What are advantages of static timing analysis? [2]
- Q7)** a) Explain different programming technologies used for ASICs. [4]  
b) Design serial / parallel converter. [4]  
c) What is IP core? [2]
- Q8)** a) Write short note on ASIC cell libraries. [4]  
b) What are different ASIC design tools? Explain any one. [4]  
c) Explain RTL to GDS - II flow. [2]



Total No. of Questions : 8]

SEAT No :

**P 5295**

**[5355]-627**

[Total No. of Pages : 2

**M.E. (Electronics Engineering) (Digital Systems)  
IMAGE PROCESSING AND COMPUTER VISION  
(Semester - II) (2017 Course) (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) *Assume suitable data, if necessary.*

- Q1)** a) Explain in detail morphological operations opening and closing. [4]  
b) What is Erosion? Explain in detail. [3]  
c) Write short note on Hear transform. [3]
- Q2)** a) What is histogram? Explain with the help of some example. Draw a histogram for a low contrast image. [5]  
b) Write short notes on Sobel operator and Prewitt operator. [5]
- Q3)** a) Explain RGB color model with the help of neat diagram. [4]  
b) Write short note on color image sharpening. [3]  
c) What is color edge detection? How it is achieved. [3]
- Q4)** a) Explain in detail tone and color corrections used in photo enhancement and color reproduction. [4]  
b) Write short note on segmentation in HSI color space. [3]  
c) What is color slicing? Explain in detail. [3]

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



- Q5)** a) Write short note on point-based image registration methods. [4]  
b) What is Iterative closest point algorithm? [3]  
c) Which are the Intensity-based image registration methods? Explain any one in detail. [3]
- Q6)** a) Enlist different nonrigid transformation techniques used in image registration. Explain curved transformations in detail. [4]  
b) Write short note on image registration methods. [3]  
c) What is image rectification? How it is done. [3]
- Q7)** a) Write short note on plane sweep algorithm. [4]  
b) What is Active rangefinding? Explain its application in digital heritage. [3]  
c) Write short note on surface representations. [3]
- Q8)** a) Explain Epipolar geometry for stereo correspondance. [5]  
b) Write short note on shape from shading and photometric stereo techniques of 3D reconstruction. [5]

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Total No. of Questions : 8]

SEAT No. :

P 4789

[Total No. of Pages : 2

[5355]-631

M.E. (E&TC) (Communication Networks)

MODELLING AND SIMULATION OF COMMUNICATION NETWORKS

(2017 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Answer any FIVE questions.
- 2) Draw neat diagram whenever necessary.
- 3) Figures to right indicate full marks.
- 4) Use of electronic pocket calculator is allowed.

- Q1)** a) Explain how simulation helps in performance studies of the Analytically intractable communication systems. [4]
- b) Explain how simulation helps in performance studies of the Analytically tedious communication systems. [4]
- c) Explain how simulation helps in performance studies of the Analytically intractable communication systems. [2]
- Q2)** a) What is effect of fixed point and floating point arithmetic on quantization error? [4]
- b) What is up sampling and down sampling? Illustrate these concepts with reference to simulation of a communication system. [4]
- c) What is direct component and quadrature component of a signal? [2]
- Q3)** a) What are different techniques to generate uniformly distributed random numbers. Explain multiplication algorithm with prime modulus. [4]
- b) Compare and contrast the following techniques to test random number generators? [4]
- i) Scatter plots
  - ii) Durbin-Watson Test

P.T.O.

- c) Elaborate various methodologies used in mapping a problem into a simulation model. [2]
- Q4)** a) What are PN sequence generators? What are the properties of PN sequence generators? Why do we need them in simulating communication systems? [4]
- b) What are correlated Gaussian numbers? Why do we need them? Explain any one technique to generate correlated Gaussian numbers in detail. [4]
- c) Describe the situations when one will choose the following estimation routines based on the data generated by simulation process. [2]
- i) Histogram
- ii) PSD
- Q5)** a) Explain Saleh's quadrature model for nonlinearity with memory. [4]
- b) Write an algorithm for simple Monte Carlo simulation for BER estimation of BPSK modulation. Assuming AWGN channel, Data symbols at source output are independent and equally probable and No pulse shaping is performed at transmitter. [4]
- c) Enlist factors to be considered while simulating nonlinearities. [2]
- Q6)** a) What is tapped delay line model for LTV system? How various tap gains are generated? [4]
- b) Explain random process model with reference to time varying system. [4]
- c) Why is semi analytic simulation technique used? [2]
- Q7)** a) What are categories of a communication channel? Explain multipath fading in wireless communication channel. [4]
- b) What are the various parameters that must be considered while simulating a radio channel? [4]
- c) What is discrete memory less channel model? [2]
- Q8)** a) Write an algorithm to demonstrate two state Markov model for discrete channel with memory. [4]
- b) What are different techniques used to reduce run-time of the Monte Carlo method? Hence explain importance of sampling. [4]
- c) Explain valid and invalid use of tail extrapolation. [2]



Total No. of Questions : 6]

SEAT No. :

P 4790

[Total No. of Pages : 1

[5355]-632

**M.E. (E&TC) (Communication Networks)**  
**HIGH SPEED COMMUNICATION NETWORKS**  
**(2017 Pattern) (Semester - I) (Credit System)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary*

- Q1)** a) What is the significance of Quality of Service in a network? Discuss the various parameters which define the Quality of Services in a network. **[5]**  
b) With detailed diagram explain the Frame Relay Architecture. **[5]**

OR

- Q2)** a) How does ATM connection happen in ATM cell? How does AAL play a role? **[5]**  
b) Explain the structure, types and working of Fast and Gigabit Ethernet. **[5]**

- Q3)** a) Explain the Poisson's model for queueing analysis. **[5]**  
b) Explain various Congestion Control Techniques. **[5]**

- Q4)** a) Explain Karn's Algorithm. **[5]**  
b) Discuss ABR Capacity Allocation. **[5]**

- Q5)** a) Explain Random Detection Algorithm. **[5]**  
b) Describe architecture for media streaming. **[5]**

- Q6)** a) Explain types of Video signals. **[5]**  
b) Explain various Color models in images. **[5]**





Total No. of Questions : 6]

SEAT No. :

P4791

[Total No. of Pages : 2

[5355] - 633

**M.E. (E & TC) (Communication Networks)**

**NETWORK SECURITY**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Question Nos. 5 and 6 are compulsory. Out of the remaining attempt 3 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 Public key and Private key algorithm with example. [5]

b) What is the need of cyber security for wired and wireless networks? [5]

**Q2)** a) Explain International Data Encryption (IDEA) symmetric key algorithm briefly and list the applications. [5]

b) Explain Secure Hash Function. [5]

**Q3)** a) Describe security Architecture Models with neat sketch. [5]

b) Explain Secure Electronic Transaction in detail. [5]

**Q4)** a) What are the requirements of security protocol. [5]

b) Explain Web Security requirements with justification. [5]

**P.T.O.**

**Q5)** Explain the requirements of Mobile IP and also define Mobile Node, Foreign Agent ,Care of Address, and Home Agent for mobile IP system. **[5]**

OR

Explain Data Encryption Standard (DES) algorithm in detail and compare with Advance Encryption Standard (AES) algorithm.

**Q6)** Write short notes on any three: **[15]**

- a) Cryptography model.
- b) SSL/TSL.
- c) Cyber-attacks.
- d) Hash Message Authentication Code (HMAC).
- e) Properties of digital signature.



Total No. of Questions : 8]

SEAT No. :

**P4792**

[Total No. of Pages : 2

**[5355] - 635**

**M.E. (Electronics & Telecommunication)**

**COMMUNICATION NETWORKS**

**Traffic Analysis and QoS**

**(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) *Use of Calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

- Q1)** a) Explain QoS in detail? [4]  
b) Explain high speed network in terms of performance modeling & estimation? [4]  
c) What are the system utilities for management? [2]
- Q2)** a) What is the TMN Service architecture? [4]  
b) Explain control Traffic & congestion control in ATM networks. [4]  
c) Define ATM. [2]
- Q3)** a) Explain network statistics. [4]  
b) Write a short note on ISA services. [4]  
c) Explain QoS parameters define by ATM forum? [2]
- Q4)** a) Write a short note on differential services. [4]  
b) Write short note on SNMP tools [4]  
c) Write a short note on protocol analyzer [2]
- Q5)** a) Explain Information model? [4]  
b) Explain High speed LAN performance, modeling & its estimation? [4]  
c) Explain in detail SMI in SNMP protocol. [2]

**P.T.O.**



- Q6)** a) What are the policies used for TCP implementation [4]  
b) Prepare a chart for functional roll of management tools? [4]  
c) Explain Cell Delay Variation? [2]
- Q7)** a) Write a short note on fiber channel as a high speed LAN [4]  
b) Write a short note on Integrated service Architecture. [4]  
c) Explain ISA components in detail. [2]
- Q8)** a) Explain effect of congestion. [4]  
b) With neat diagram explain network management system ? [4]  
c) What are Service categories define by ATM forum'? [2]



Total No. of Questions : 8]

SEAT No. :

**P5296**

**[5355]-636**

[Total No. of Pages : 2

**M.E. (E&TC) (Communication Network)**  
**BROADBAND WIRELESS TECHNOLOGIES**  
**(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) *Figures to the right side indicate full marks.*
- 4) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Explain working of OFDM system with a suitable block diagram. Also indicate need of cyclic prefix and guard interval. **[4]**
- b) Explain OFDMA (Orthogonal frequency-division multiple access) System with a suitable block diagram. **[4]**
- c) What are Iterative receivers? **[2]**
- Q2)** a) Compare and contrast MIMO SCCP System and MIMO-IFDMA System. **[4]**
- b) Compare ZF Receiver and MMSE Receiver on the basis of SINR performance. **[4]**
- c) What are the techniques used to implement Transmitter diversity with feedback and without feedback? **[2]**
- Q3)** a) Explain SC-FDMA (Single-carrier frequency-division multiple access) System with a suitable block diagram. **[4]**
- b) Compare and contrast the MIMO Channel Capacity for One-Channel Realization for CSI known case and CSI unknown case. **[4]**
- c) Enlist factors deciding signal-to-interference-plus-noise ratio (SINR) for a Linear Receiver. **[2]**

**P.T.O.**

- Q4)** a) Explain time hopping UWB system for Idealized Multiple-Access Channel with Single-Class Traffic with Continuous Transmission. [5]  
b) Explain Multiple-time-hopping PPM UWB system with variable bit rate transmission. [5]
- Q5)** a) Explain Time Hopping-PPM UWB with MIMO. [5]  
b) Explain channel model for multipath channel used to study TH-PPM UWB. [5]
- Q6)** a) With reference to super frame format for IEEE 802.15.4 in beacon enabled mode explain energy efficient MAC. [5]  
b) Compare and contrast DTOR (directional transmission and omni-directional reception) and DTDR (directional transmission and directional reception) schemes for directional antenna MAC. [5]
- Q7)** a) Classify routing protocols on the basis of their path selection criteria.[5]  
b) Explain the concept of outage probability for video services in a multirate DS-CDMA system. [5]
- Q8)** a) Explain QoS protection and Admission control in Ethernet Passive Optical Network. [5]  
b) Explain grant scheduling and grant sizing with reference to bandwidth management for multichannel Ethernet Passive Optical Network. [5]



Total No. of Questions : 8]

SEAT No. :

P4793

[Total No. of Pages : 2

[5355] - 637

**M.E. (Electronics & Telecommunication)**  
**(Communication Networks) (Semester - II)**  
**SDR AND COGNITIVE RADIO**  
**(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.*

**Q1)** a) Discuss the evolution of architecture of Software Defined radio (SDR) in detail? [5]

b) What is Spectrum Sensing and Spectrum mobility? [5]

**Q2)** a) Discuss in detail about the technology tradeoffs in SDR. [5]

b) Explore how optimization of radio resources is achieved. [5]

**Q3)** a) Draw the conceptual model of location and environment awareness cycle. [5]

b) Draw the Cognitive Radio Architecture and explain its functional components in detail. [5]

**Q4)** a) Explore the advanced services which would be enabled by ideal Cognitive Radio [5]

b) Categorize the design rules of cognitive radio. [5]

**P.T.O.**

- Q5)** a) Discuss the various requirements of Software Communication Architecture. [5]  
b) Explain the networking overview of Software Communication Architecture. [5]
- Q6)** a) Describe Common Object Request Broker Architecture (CORBA) in detail. [5]  
b) How the JTR Set Components are integrated through the SCA? Explain in detail. [5]
- Q7)** a) Explain, how the application of cognitive radio principle can improve the antenna design. [5]  
b) Explain the basic architecture of smart antenna in detail. [5]
- Q8)** Write a short note on (any two).  
a) Adaptive signal processing. [5]  
b) Phased array antennas [5]  
c) Beamforming [5]



Total No. of Questions : 8]

SEAT No. :

P4794

[Total No. of Pages : 2

[5355] - 641

M.E. (E & TC) (Microwave)

**ELECTROMAGNETICS AND ANTENNA THEORY**

**(Revised) (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) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** a) Write a short note on Rhombic and Spiral antennas discussing structural details, significant parameters, design equations, applications and also sketch the radiation pattern of each antenna. **[5]**

b) Determine the capacitance for the parallel plate capacitor using Laplace's equation. **[5]**

**Q2)** a) Draw the parabolic reflector with Cassagrain feeding, sketch its radiation pattern and discuss what the advantages are comparing with standard parabolic reflector. **[5]**

b) State Uniqueness theorem and explain its significance in electromagnetic problem solution with a suitable example, illustrative diagrams and relevant expressions. **[5]**

**Q3)** Determine the excitation coefficients for a 9-element linear array with uniform spacing for the side lobe levels to be less than 35dB. Explain the design procedure. **[10]**

**Q4)** a) Write the expression for the current distribution in a half wave dipole and determine its far field electric field intensity using pattern multiplication principle. **[8]**

b) Compare the radiation intensity and radiation density with relevant mathematical expressions. **[2]**

**P.T.O.**

- Q5)** a) Determine in dB the directivity of 25 turns helix, having  $\alpha=10^\circ$ , circumference equal to one wavelength. [3]
- b) Find out the length L width W, and half flare angles  $\theta_E$  and  $\theta_H$  of a pyramidal horn antenna for which the mouth height  $h=12\lambda$ . The horn is fed by a rectangular wave guide with  $TE_{10}$  mode. [4]
- c) Find out the beam width between first Nulls and power gain of a 4-m paraboloid reflector operating at 3000MHz. [3]
- Q6)** a) Two extensive homogeneous isotropic dielectrics meet on plane  $z=0$ . for  $z \geq 0$ ,  $\epsilon_r=4$  and for  $z \leq 0$ ,  $\epsilon_r = 3$ . A Uniform electric field  $\vec{E}_1=5\hat{a}_x - 2\hat{a}_y + 3\hat{a}_z$  kV/m exists for  $z \geq 0$ . Find
- i)  $\vec{E}_2$  for  $z \leq 0$
- ii) The angles  $E_1$  and  $E_2$  make with the interface. [5]
- b) Two Hertzian dipole antenna elements are placed along a line with distance of  $d$ , apart. Both the elements are fed with equal amplitude currents with a phase difference of  $\alpha$ . Find the total radiated field and explain the pattern multiplication principle. [5]
- Q7)** a) Explain the various feeding methods for Microstrip Antennas with illustrative figures and Draw the equivalent circuits for each method. [7]
- b) Explain the Cavity model for the analysis of a microstrip antenna. [3]
- Q8)** a) Draw the radiation pattern of the following antennas with reference to structure [5]
- i) Rhombic Antenna
- ii) V-Antenna
- iii) Yagi -Uda Antenna
- iv) Half Wave Dipole
- v) Microstrip Antenna
- b) Compare Horn and Parabolic Reflector antennas with reference to Gain, Directivity, Bandwidth, Beam width. [2]
- c) The radial component of the radiated power density of an antenna is given by [3]
- $\vec{W}_{rad} = A_0 \frac{\sin \theta}{r^2} \hat{a}_r$ . Find the radiation intensity and the total radiated power.



Total No. of Questions : 8]

SEAT No. :

P4795

[Total No. of Pages : 2

[5355] - 642

**M.E. (E & TC) (Microwave)**  
**RF AND MICROWAVE CIRCUITS**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

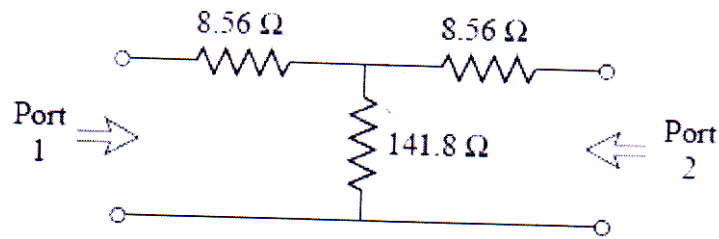
*Instructions to the candidates:*

- 1) *Solve any five questions.*
- 2) *Figures on the right indicate full marks.*
- 3) *Assume Suitable data, wherever necessary.*

- Q1)** a) The input impedance of a short circuited lossy transmission line of length 1.5 m ( $< \lambda/2$ ) and a characteristic impedance of  $100\Omega$  is  $40-j280\Omega$ . [6]
- i) Find  $\alpha$  and  $\beta$  of the line.
  - ii) Determine the input impedance if the short circuit is replaced by a load resistance  $Z_L = 50 + j50\Omega$ .
- b) For an arbitrary N port microwave device, derive the relationship between Transmission (ABCD) matrix and impedance matrix. [4]
- Q2)** a) Derive the expressions for Propagation Constant, Impedance, and Power Flow for the Lossless Coaxial Line. [5]
- b) Consider a load resistance  $R_L = 100\Omega$  to be matched to a  $50\Omega$  line with a quarter-wave transformer. Find the characteristic impedance of the matching section and plot the magnitude of the reflection coefficient versus normalized frequency,  $f/f_0$ , where  $f_0$  is the frequency at which the line is  $\lambda/4$  long. [5]
- Q3)** a) Explain with help of proper diagram, working of two hole directional coupler and derive its scattering matrix. [5]
- b) Find the scattering parameters of the 3 dB attenuator circuit shown in following figure, [5]

**P.T.O.**





- Q4)** a) Write short note on conversion gain and distortion. [5]  
 b) Explain the concept of Intersymbol Interference. How ISI affects the wireless communication? Derive expression for Roll off Factor. [5]
- Q5)** a) Explain the operating principle of Tunnel diode. [5]  
 b) Describe in detail construction and operating principle of PIN diode. [5]
- Q6)** a) How RF diode differs from conventional semiconductor diode? Explain construction and working of Schottky diode with related parametric derivation. [5]  
 b) Explain MESFET in terms of Construction, Working & frequency response. [5]
- Q7)** Explain in detail the unilateral design approach for amplifier design. [10]
- Q8)** Using signal flow graph of single stage amplifier, derive the following relationships: Incident power to the amplifier  $P_{inc}$ , available power  $P_A$ , Transducer gain  $G_T$  and Unilateral transducer gain  $G_{TU}$ . [10]



Total No. of Questions : 8]

SEAT No. :

P4796

[Total No. of Pages : 1

[5355] - 643

**M.E. (E & TC) (Microwave)**  
**MICROWAVE MEASUREMENT**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any one question from Q.1 and Q.2.*
- 2) *Attempt any two questions from Q.3, Q.4 and Q.5.*
- 3) *Attempt any two questions from Q.6, Q.7 and Q.8.*

- Q1)** a) State the basic principle of Transmission line. [5]  
b) Draw and Explain the structure of Transmission line. [5]
- Q2)** a) Find "S" parameters for microwave T. Junction. [5]  
b) What is uncertainty related to RF-match. [5]
- Q3)** Name the different types of Co-axial Connectors used in Microwave measurement. Explain any Two co-axial connectors with neat diagram and waveform. [10]
- Q4)** What is the need of attenuation measurement. State and Explain the important consideration for attenuation measurement. [10]
- Q5)** Name the different types of Noise in Electrical Circuits. What are the types of noise sources. Explain any one method to reduce the noise. [10]
- Q6)** Give the technical specification of spectrum Analyzer. Draw and Explain the basic signal on Spectrum Analyzer. [10]
- Q7)** Explain with neat diagram the MMIC measurement techniques and state merits and demerits of MMIC. [10]
- Q8)** State the technical specification of Reflectometers. Explain the working with necessary diagram of Reflectometer. [10]



Total No. of Questions : 8]

SEAT No. :

P4797

[Total No. of Pages : 2

[5355] - 645

M.E. (E & TC) (Microwave)

COMPUTATIONAL ELECTROMAGNETICS

(2017 Pattern) (Semester - II)

*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) *Assume suitable data if necessary.*

**Q1)** a) Explain various techniques to solve an EM problems. [5]

b) What do you mean by Green's function in two dimensional case. [5]

**Q2)** a) Explain the concept of FDTD analysis. [5]

b) Explain application of one dimensional FDTD analysis. [5]

**Q3)** State and explain the significance of finite difference analysis for guiding structures. [10]

**Q4)** a) Explain Ritz Variational method. [5]

b) Explain applications of Ritz Variational method. [5]

**Q5)** a) Explain the advances in FDTD technique. [5]

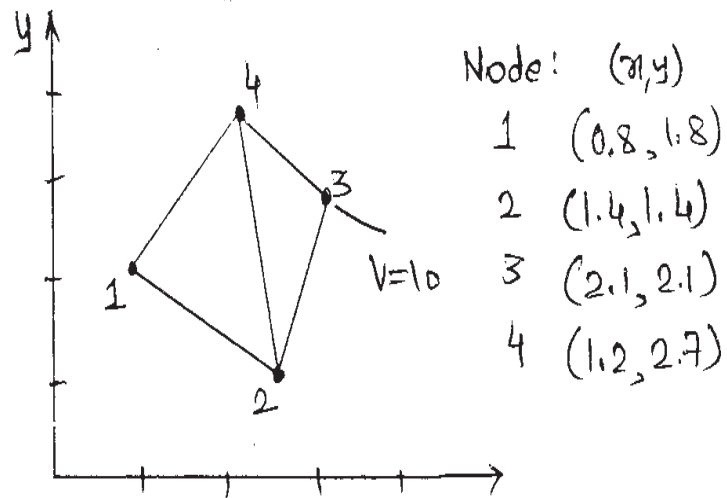
b) Explain in detail method of weighted residual. [5]

**Q6)** a) Compare FEM and MOM. [5]

b) Compare FDM and FDTD. [5]

**P.T.O.**

**Q7)** Consider two element mesh as shown in figure given below. Determine the potential within the mesh using FEM technique. **[10]**



- Q8)** a) Explain Galerkins method. **[5]**  
 b) Explain Point Matching method. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4798

[Total No. of Pages : 2

[5355] - 646

**M.E. (E & TC) (Microwave)  
RF and MMIC Technology  
(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) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** a) Compare MMIC With Hybrid MIC and discuss advantages and disadvantages. [5]

b) Explain three different design approaches used in MMIC technology. [5]

**Q2)** a) Explain the Fabrication Technology used in HEMT coplanar waveguide MMIC. [5]

b) Explain the structures of different Microstrip Couplers in detail. [5]

**Q3)** a) Explain synthesis of nonlinear MIC by Harmonic Balance Method. [5]

b) Explain how Matrix Decomposition is done in Microwave Circuit. [5]

**Q4)** a) Discuss the time domain method of synthesis of MIC. [5]

b) Explain any two system application of MMIC. [5]

**Q5)** a) What is Circuit Simulation Engine? List and discuss the various simulation engines. [5]

b) Explain the Measurement technique used in MMIC. [5]

**P.T.O.**

- Q6)** a) Discuss Integrated CAD Design Environment in detail. [5]  
b) Explain the different CAD package features. [5]
- Q7)** a) What is test fixture? Explain the main parts. [5]  
b) Explain the design and features of MMIC Switches. [5]
- Q8)** Write short notes on [10]  
i) Multilayer Techniques in MMIC  
ii) Phase Shifters



Total No. of Questions : 8]

SEAT No. :

P4799

[Total No. of Pages : 2

[5355] - 647

M.E. (E & TC) (Microwave)

WIRELESS COMMUNICATION SYSTEM

(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) Figures to the right side indicate full marks.
- 4) Use of calculator is allowed.
- 5) Assume Suitable data if necessary.

**Q1)** a) What is line of sight communication, write the expression for free space path loss model. [3]

b) Why the cell geometry is Hexagonal in cellular communication? Justify. [2]

c) What is Doppler shift and its effect on signal propagation in a wireless channel. Explain with the help of mathematical support. [2]

d) Define the term GoS, If there are 400 seizures (lines connected for service) and 20 blocked calls (lost calls) during the BH, what is the GoS? [3]

**Q2)** a) Consider an urban area in which average mobile subscriber has 600 minutes of use (MoU) per month. Eighty percent of traffic occurs during workdays (i.e., only 20% of traffic occurs on weekends). There are 20 workdays per month. Assuming that in a given day. 10% traffic occurs during busy hour, what is the traffic per subscriber in Erlangs? [4]

b) What are the various functions of Radio Link Control Protocol and describe the same. [4]

c) Explain the hand off mechanism at cell boundary with illustrative diagrams. [2]

P.T.O.

- Q3)** a) Explain the terms reflection, scattering, diffraction with reference to the propagation with illustrative diagrams. [3]
- b) Name one cellular system for each standard from 1G to 4G, also write the services and the data rate offered by each system. [2]
- c) What is the speech coding and channel coding in GSM, explain with relevant diagrams and mathematical equations. [5]
- Q4)** a) Draw a general UMTS network architecture and explain the function of each subsystem. [6]
- b) A vehicle travels at a speed of 40 m/s and uses a carrier frequency of 2 GHz. What is the maximum Doppler shift? What is the approximate fade duration? [2]
- c) What are the traffic measurements for a switching system? [2]
- Q5)** What are the specific functions of following channels with reference to GSM TCH/FS, TCH/HS, BCH, BCCH, FCCH, SCH, CCCH, PCH, RACH, AGCH, DCCH, SDCCH. [10]
- Q6)** a) Draw the block diagram of Reverse CDMA channel modulation process and explain the function of each block. [5]
- b) Define the term fading, slow fading and fast fading in wireless communication channel? [5]
- Q7)** a) Specify the following for UMTS ; Spectrum Allocation, Channel spacing, Centre Frequency, Power control steps and data rate. [3]
- b) Write a detailed note on Okumar/Hata propagation model for Typical Urban, Typical suburban and rural conditions with all the assumptions and equations. [7]
- Q8)** a) Explain the sequence of call making from Mobile to Landline with illustrative flow chart. [5]
- b) Compare cdmaone and cdma2000 with reference to the architecture and features, services. [5]





Total No. of Questions : 7]

SEAT No. :

**P4800**

[Total No. of Pages :3

**[5355] - 651**

**M.E. (E & TC) (Signal Processing)**

**MATHEMATICS FOR SIGNAL PROCESSING**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Question number One is Compulsory.*
- 2) *Answer any four questions from remaining six questions.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

**Q1) Justify True or False :**

**[10]**

- a) Ergodic Process are always stationary.
- b) Autocorrelation function and PSD forms a Fourier transform pair.
- c) The area under the PSD function gives rms power of the signal.
- d) If the Occurrence of one event prohibits the Occurrences of all the other events the it is called as mutually exclusive events.
- e) Poisson distribution is limiting case of Binomial distribution.
- f) If A and B are the two events possible from an experiment and possibility of occurrence of B simply does not depend on occurrence of event A then this events are called as statistically dependent events.
- g) The Plot of Gaussian PDF has even symmetry around mean value.
- h) Binomial and Poisson distribution are used to describe continuous Random variable.
- i) The second moment is called as Variance of Random Variable.
- j) The derivative of PDF with respect to some dummy variable is called as CDF.

**P.T.O.**

- Q2) a)** Explain the terms : **[5]**
- i) Ensemble Averages
  - ii) Time Averages
  - iii) Stationary Random Processes
  - iv) Wide sense Stationary Process
  - v) Ergodic Processes
- b) Determine the autocorrelation function and ESD of **[5]**
- $$x(t) = e^{-at}u(t)$$
- Q3) a)** Consider the random process  $v(t) = \cos(\omega_0 t + \theta)$ , where  $\theta$  is a random variable with PDF, **[6]**
- $$f_{\theta}(\theta) = \frac{1}{2\pi} \text{ for } -\pi \leq \theta \leq \pi$$
- $$= 0 \text{ elsewhere}$$
- Show that the first and second moment are independent of time.
- b) Explain the properties of PSD and ESD. **[4]**
- Q4) a)** Calculate the PSD and Power of a sinusoid given by **[5]**
- $$x(t) = A \cos(\omega_c t + \phi)$$
- b) Find out mean and variance of the Poisson distribution. **[3]**
- c) Let  $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ , Compute  $A^{-1}$  **[2]**
- Q5) a)** Let  $v(t)$  is a Gaussian Ergodic Random process. Its mean value is zero and variance is 4 volt<sup>2</sup>.  $v(t)$  is measured by a dc meter, a true rms meter and a meter which first squares  $v(t)$  and then reads it as dc component. Summarize the time averages of an Ergodic process and then evaluate the outcome of each meter. **[7]**

- b) Find the rank of matrix A. [3]

$$A = \begin{bmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{bmatrix}$$

- Q6)** a) Calculate mean, mean square and the variance of random variable X whose pdf is given by [5]

$$f_x(x) = \frac{1}{3\sqrt{2\pi}} e^{-(x-4)^2/18}$$

- b) Solve the following matrices equations for  $a, b, c$  and  $d$ . [2]

$$\begin{bmatrix} a-b & b+c \\ 3d+c & 2a-4d \end{bmatrix} = \begin{bmatrix} 8 & 1 \\ 7 & 6 \end{bmatrix}$$

- c) Determine whether  $v_1=(1,1,2)$ ,  $v_2(1,0,1)$  and  $v_3=2,1,3)$  span the vectorspace  $R^3$ . [3]

- Q7)** a) Over a noisy channel 10000 digits are transmitted having a probability of error per digit of  $5 \times 10^{-5}$ . What is the Probability of getting only two digits in error? Also find mean and variance. [3]

- b) Consider the vectors  $\{[3,0,4] [-1,0,7], [2,9,11]\}$  Check that the vectors are linearly independent and use the Gram-Schmidt process to find orthogonal vectors. [7]



Total No. of Questions : 8]

SEAT No. :

P4801

[Total No. of Pages :2

[5355] - 652

M.E. (E & TC) (Signal Processing)

DIGITAL IMAGE AND VIDEO PROCESSING

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *All questions carry equal marks.*
- 3) *Attempt any five Questions.*
- 4) *Use of electronic calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** a) Explain spatial resolution and gray level resolution in case of digital image. [5]

b) Explain DCT transform. [5]

**Q2)** a) What is a color model? Explain HIS color model along with its applications [5]

b) Define 2D Fourier transform and explain its properties. [5]

**Q3)** a) Explain frequency domain image sharpening and smoothing in detail. [5]

b) Explain restoration of images using inverse filtering. [5]

**Q4)** a) Explain different gray level transformations technique in image enhancement. [5]

b) Describe various noise models. [5]

- Q5)** a) What is a histogram equalization and how is it achieved? [5]  
b) Draw and explain image degradation/restoration model in detail. [5]

- Q6)** a) What are the various data redundancies identified in an image? Explain them. [5]  
b) Explain local and global thresholding in image segmentation. [5]

- Q7)** a) For the following image, Generate Huffman code and find the compression ratio. [5]

20	40	40	50
10	40	50	50
30	40	50	50
40	40	50	10

- b) Write a short note on dilation and erosion. [5]
- Q8)** a) Explain MPEG 1 standard. [5]  
b) Write a short note on spatial resolution and frame rate in digital video. [5]



Total No. of Questions : 8]

SEAT No. :

P4802

[Total No. of Pages :2

[5355] - 653

M.E. (E & TC) (Signal Processing)

ADVANCED DIGITAL SIGNAL PROCESSING

(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) Figures to the right side indicate full marks.
- 4) Use of scientific calculator is allowed.
- 5) Assume suitable data if required.

**Q1)** a) Design a Butterworth filter using the bilinear transformation method for the following specifications given below. [5]

$$\begin{aligned} 0.8 \leq |H(e^{j\omega})| \leq 1 & \quad 0 \leq \omega \leq 0.2\pi \\ |H(e^{j\omega})| \leq 0.2 & \quad 0.6\pi \leq \omega \leq \pi \end{aligned}$$

b) Explain Design of linear phase FIR filter using frequency sampling method. [5]

**Q2)** a) Explain the polyphase structure for interpolator. [5]

b) Find the single stage, two stage realization of the decimator with the following specifications. Sampling rate of signal has to be reduced from 10 kHz to 500 Hz. The decimation filter  $H(z)$  has the pass band edge frequency ( $f_p$ ) to be 150Hz, stop band edge frequency ( $f_s$ ) to be 180 Hz. Pass band ripple = 0.002, Stop band ripple=0.001. [5]

**Q3)** a) Find DFT to following sequence for  $N=4$  and plot  $|X(k)|$  [4]

$$\begin{aligned} x(n) &= 1 \text{ for } 0 \leq n \leq 2 \\ &= 0 \text{ otherwise} \end{aligned}$$

b) Explain warping effect in case of bilinear transformation and describe pre-warping procedure. [4]

c) State and prove Circular frequency shift property of DFT. [2]

P.T.O.

- Q4)** a) Explain need of adaptive filters and write a short note on adaptive filters as system identifications. [4]  
 b) Discuss the sub band coding of speech signal with a suitable diagram. [4]  
 c) What is the need of anti-aliasing filter prior to down-sampling and an anti-imaging filter after up sampling a signal? [2]
- Q5)** a) If  $X(t) = A \cos(2\pi f_c t + \phi)$  is random process with  $\phi$  as a random variable uniformly distributed over  $(0, 2\pi)$ . Prove that  $x(t)$  is ergodic in mean. [4]  
 b) A wide sense stationary random process  $X(t)$  is applied to the input of LTI system with impulse response  $h(t) = 3e^{-2t}u(t)$ . Find the mean value of output  $Y(t)$  of the system if  $E[X(t)] = 2$ . [4]  
 c) Classify the different types of random processes. [2]
- Q6)** a)  $X(t) = A \cos(\omega t + \phi) f(\phi, t)$ , where  $A$  and  $\omega$  are constants,  $\Phi$  is a random variable that with equal probability takes two values :  $-\pi/4$  and  $\pi/4$ . Find mean value, variance and auto correlation function of random process  $X(t)$ . [4]  
 b) Define the terms related to Random Process. [4]  
 i) Mean  
 ii) Autocorrelation  
 iii) Power spectral density with mathematical formula  
 c) Explain Ergodic process. [2]
- Q7)** a) Explain the following terms: [4]  
 i) Pipeline Depth  
 ii) Interlocking  
 b) Explain parallel and pipelining process in digital signal processor. [4]  
 c) If a sum of 256 products is to be computed using a pipelined MAC unit, if the MAC unit execution time of the unit is 100 nsec, what will be the total time required to complete the operation? [2]
- Q8)** a) Explain VLIW architecture in detail. [4]  
 b) Explain any two features which facilitate high speed of operation in a digital signal processor. [4]  
 c) Explain the super Harvard Architecture in DSP processors. [2]



Total No. of Questions : 8]

SEAT No. :

**P5298**

**[5355]-656**

[Total No. of Pages : 2

**M.E.(E&TC) (Signal Processing)**  
**SPEECH PROCESSING**  
**(2017Pattern) (Semester - II)**

*Time : 3Hours]*

*[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.*
- 5) *Your answers will be valued as a whole.*
- 6) *Use of logarithmic tables is allowed.*
- 7) *Assume suitable data, if necessary.*

- Q1)** a) Explain with block diagram parallel processing approach for calculation of pitch frequency. **[5]**  
b) Explain phoneme classification with consonants in detail. Explain the production of consonants |p| and |t| in detail. **[5]**
- Q2)** a) Define pitch. Explain Auto correlation method for finding pitch period. **[4]**  
b) With the help of neat block schematic, explain formant measurement using cepstrum. **[6]**
- Q3)** a) Explain the Homomorphic speech processing in detail. **[5]**  
b) Explain Mel scale and Bark scale in detail. **[5]**
- Q4)** a) Explain Levinson-Durbin recursive algorithm for calculation of prediction coefficients. **[5]**  
b) What is MFce? Explain the method to calculate MFce using block diagram. **[5]**
- Q5)** a) What is speech enhancement? Explain the spectral subtraction method of speech enhancement in detail. **[5]**  
b) What is PLP? Compare MFce with PLP. **[5]**

**P.T.O.**



- Q6)** a) Explain forward and backward adaptive quantizer in detail. [6]  
b) State G.726 Standard for ADPCM. [4]
- Q7)** a) Samples of a signal have values given by 0.2, 0.4, 0.55, 0.7, 0.75, 0.85, 0.9, and 1V. If the data is to be 4 bit coded find:  
i) Step size  
ii) Variance of signal  
iii) Quantization noise power  
iv) SNR in dB. [6]  
b) Explain the echo cancellation application in detail. [4]
- Q8)** What is ASR? What are the hurdles in ASR design? Explain different modes of ASR system. [10]



Total No. of Questions : 8]

SEAT No. :

P4804

[Total No. of Pages :2

[5355] - 661

M.E. (E & TC) (VLSI & Embedded Systems)

DIGITAL CMOS DESIGN

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Assume Suitable data if necessary.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of nonprogrammable calculator is allowed.*

**Q1)** a) Starting with the cross section of enhancement type MOSFET, explain various operating regions. Explore drain & transfer characteristics. Give the expressions for drain current. [5]

b) What is  $\lambda$  parameter? List at least 5 design rules for CMOS layout. [5]

**Q2)** a) Explore logical efforts in detail. [5]

b) Derive the expression for power delay product. What is its significance?[5]

**Q3)** a) What is SPICE model? List 4 parameters & explain their meaning. How are they considered in design? [4]

b) Draw & explain MOSFET capacitance model in detail. Compare these capacitances. [4]

c) Write note on stick diagram. [2]

**Q4)** a) Why is transistor sizing important? Derive the expression for optimum aspect ratios in case of CMOS logic. [4]

b) What is noise margin? Explain its significance in the interface of logic ckts. [4]

c) Write note on short ckt power dissipation. [2]

- Q5)** a) With the help of schematic, explore the sources of hazards. Why are such hazards not considered significantly in clock based synchronous designs? [4]
- b) With the help of schematic, explain the concept of weak 1 produced by n-MOSFET & weak 0 produced by p-MOSFET. Can transmission gate provide solution to it? [4]
- c) Why is NAND preferred over NOR? [2]
- Q6)** a) Design CMOS logic for  $F = AB + C + DE$ . Compute area on chip in terms of channel length L. [4]
- b) Draw FSM diagram for Tea/Coffee vending machine & write HDL code. Assume coin, tea/coffee option as inputs. [4]
- c) Draw 4:1 MUX using transmission gates. Compare with conventional method. [2]
- Q7)** a) Explain the concept and example ckts of Cascode Voltage Switch Logic? What are its merits & demerits? [4]
- b) Explore psudo NMOS ckts in detail. [4]
- c) Write note on NORA logic. [2]
- Q8)** a) With the help of schematic, explain sense amplifier ckts & its utility in detail. [4]
- b) Explain any one technique of low power design. [4]
- c) What are the advantages & limitations of static CMOS? [2]



Total No. of Questions : 8]

SEAT No. :

**P4805**

[Total No. of Pages :2

**[5355] - 663**

**M.E. (E & TC) (VLSI & Embedded Systems)**

**EMBEDDED SYSTEM DESIGN**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a) Define design metrics. Explain [4]**

- i) Time to market
- ii) NRE cost.

**b) Explain the advantages and disadvantages of system on chip. [3]**

**c) Discuss in detail spiral type life cycle model with its advantages, disadvantages and applications. [3]**

**Q2) a) Explain the development tools [4]**

- i) Cross compiler
- ii) Linker

**b) Write down the features of Raspberry Pi Microcontroller. Discuss its IDE and application areas. [3]**

**c) Write down the features of Arduino Microcontroller. Discuss its IDE and applications. [3]**

**Q3) a) What are the features of ARM cortex microcontroller? [4]**

**b) Compare cortex processors over ARM7 for embedded system design. [3]**

**c) Describe the features of LPC 1768. [3]**

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

- Q4)** a) Explain CMSIS standard for firmware development in ARM Cortex based system. [4]  
b) Explain the need of pin connect block in ARM cortex controllers. [3]  
c) Explain the CAN protocol with suitable diagram and frame structure with reference to ARM M3 microcontroller. [3]
- Q5)** a) What is Embedded Linux? Explain development tools required for Linux application development. [4]  
b) Differentiate BIOS versus Boot Loader. [3]  
c) What do you mean by kernel initialization in Linux. [3]
- Q6)** a) What are different types of device drivers? Explain any one with reference to embedded Linux. [4]  
b) Explain file structure and its uses in Embedded Linux. [3]  
c) Explain various storage considerations in Embedded Linux. [3]
- Q7)** a) Discuss Digital camera as Embedded system case study with its design considerations. [4]  
b) Explain reliability and failure analysis of Embedded systems. [3]  
c) How certification and documentation is done for packaging of Embedded systems? [3]
- Q8)** a) Discuss Automated meter reading (AMR) as Embedded system case study with its design considerations. [4]  
b) Discuss steps involved in certification and documentation of EMI/RFI analysis. [3]  
c) Explain testing process documentation carried out for Embedded system. [3]



Total No. of Questions : 8]

SEAT No. :

P4806

[Total No. of Pages : 3

[5355] - 665

M.E. (E & TC) (VLSI & Embedded Systems)

ANALOG CMOS DESIGN

(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

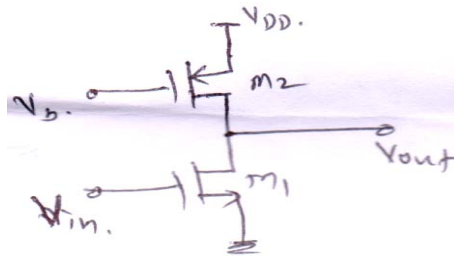
Instructions to the candidates:

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

Q1) a) What is need of voltage / current reference. Draw a circuit of supply independent current source and explain its working. [5]

b) For common source amplifier with current source load shown in figure 1,

find small signal voltage gain if  $\left(\frac{W}{L}\right)_1 = \frac{50}{0.5}$ ,  $\left(\frac{W}{L}\right)_2 = \frac{50}{2}$  and  $I_{D1} = I_{D2} = 0.5$  mA. Assume  $\mu_n C_{ox} = 2\mu_p C_{ox} = 60 \mu\text{A}/\text{V}^2$  and  $T_n = 0.1$  and  $T_p = 0.2 \text{ V}^{-1}$  at  $L=0.5$ . [5]



Q2) a) Using suitable schematic and expressions, explain how MOSFET can work as a switch, diode and active resistor. [5]

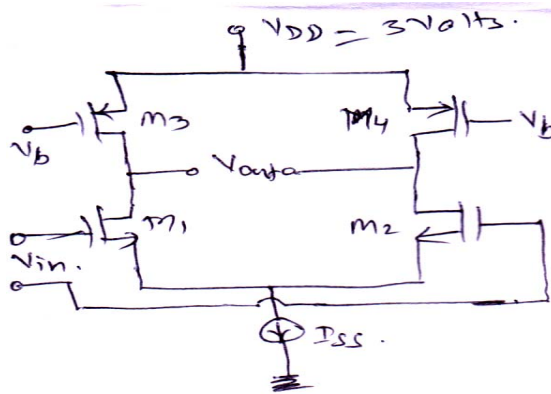
b) Draw a circuit diagram of cascode current mirror source and derive expression for its output resistance. [5]

P.T.O.

- Q3) a)** Compare various types of inverting CMOS amplifiers on the basis of voltage gain and output resistance. [5]
- b) What is need of cascode amplifier. Draw a circuit diagram of CS-CG cascode amplifier and compare with single stage inverting amplifier. [5]

- Q4) a)** In the circuit of figure 2, calculate differential voltage gain if  $I_{ss} = 1\text{mA}$ ,  $\left(\frac{W}{L}\right)_{1,2} = \frac{50}{0.5}$  and  $\left(\frac{W}{L}\right)_{3,4} = \frac{50}{1}$ . Assume  $\mu_n C_{ox} = 2\mu_p C_{ox} = 60 \frac{\mu\text{A}}{\text{V}^2}$  and  $T_n = 0.1 \text{ V}^{-1}$ ,  $T_p = 0.2 \text{ V}^{-1}$  at  $L = 0.5$

Also find minimum allowable input common mode level if  $I_{ss}$  requires at least 0.4 volts across it. [6]



- b) What is need of a folded cascode amplifier, draw its schematic and discuss its advantages / disadvantages over cascode amplifier. [4]

- Q5) a)** Draw a comparator and discuss its static and dynamic characteristics. What is typical application of comparator. [5]

- b) Explain the neutralisation and unilaterisation with suitable circuit diagram. [3]

- c) Find propagation delay of a comparator that has slew rate  $1 \text{ volt}/\mu\text{s}$ . and output voltage swing is 10 volts. [2]

- Q6) a)** What is need of compensation, explain with the help of gain and phase response of multistage amplifier. [5]

- b) What are different methods to improve slew rates in CMOS operational amplifiers. [5]

- Q7)** a) Draw a schematic of single ended low noise amplifier (LNA). What are its draw backs and how these are over come in differential LNA. [5]
- b) Explain in brief the design considerations for RF chip design. [5]
- Q8)** a) Explain in detail open and short circuit techniques for bandwidth estimation. [5]
- b) What is difference between active and passive mixers. Draw and explain their architectures. [5]





Total No. of Questions : 8]

SEAT No. :

**P4808**

[Total No. of Pages :2

**[5355]-667**

**M.E. (E & TC) (VLSI & Embedded Systems)**

**EMBEDDED AUTOMOTIVE SYSTEMS**

**(2017 Pattern) (Credet System) (Semester - II)**

*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) What is hybrid technology? Explain various operating models and compare advantages and disadvantages of each. [6]

b) Compare active safety & passive safety with suitable example. [4]

**Q2)** a) Draw & explain obstacle avoidance RADAR when used as a vision enhancement system. [6]

b) State possible faults for the following common symptoms in comfort system, [4]

i) Radio Interference

ii) Electric windows not operating

**Q3)** a) With the aid of a neat sketch explain the construction and theory of operation of a typical oxygen sensor used in vehicle. [6]

b) What are selection criteria of sensors for automotive applications? [4]

**Q4)** a) Which types of sensors ensure Passenger safety in various automotive vehicles? Explain with suitable examples. [6]

b) Outline the construction of flap type & Hot wire type air flow sensor with suitable example. [4]

**P.T.O.**

- Q5)** a) With suitable block diagram explain automatic cruise control system. List sensors used in such system. [6]  
b) Explain the closed loop ignition control with its waveform. [4]
- Q6)** a) What is the role of control system strategies in fine tuning of automotive systems? [6]  
b) Comment on Anti-lock braking system & Electronic steering system. [4]
- Q7)** a) What is CAN? Explain functionality of Data link layer in CAN? What is bit stuffing in CAN? State use of bit stuffing? [6]  
b) What is needed to find faults in automotive systems? Explain in brief. [4]
- Q8)** a) Enlist various types of automotive buses. Compare any three types of automotive buses. [6]  
b) List the six-stage diagnostic process. Explain the same with suitable example. [4]



Total No. of Questions : 8]

SEAT No. :

P4809

[Total No. of Pages :2

[5355]-671

**M.E. (Electrical Control System)**

**OPTIMIZATION TECHNIQUES IN CONTROL SYSTEM**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answers Q.1 or 2, Q.3 or 4, Q.5 or 6, Q. 7 or 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** Explain what do you understand by local, Global extremum and unimodal function. **[9]**

OR

**Q2)** Use the Lagrange multiplier approach to minimize the function **[9]**

$$F(x)=4x_1^2+5x_2^2 \text{ subjected to } g(x)=2x_1+3x_2-6=0.$$

**Q3)** Find the maximum of  $f=X(1.5-X)$  in the interval 0–1 within 10% of exact value by Dichotomous search method. **[9]**

OR

**Q4)** Write & Explain Revised Simplex method for solving LPP. **[9]**

**Q5)** Explain the multistage Decision process in dynamic programming. **[16]**

OR

**Q6)** Explain the concept of suboptimization and principle of optimality used in multistage decision problem. **[16]**

**P.T.O.**

**Q7) a)** Explain the integer nonlinear programming. **[8]**

b) Write and explain Dynamic Programming. **[8]**

OR

**Q8)** Minimize  $f=3x_1-4x_2$  **[16]**

$$\text{Subject to } 3x_1-x_2+x_3 = 10$$

$$3x_1+11x_2+2x_4 = 64$$

$$x_i \geq 0, i=1 \text{ to } 4 \text{ and } x_i \text{ is integer}$$



Total No. of Questions : 6]

SEAT No. :

P4810

[Total No. of Pages :2

[5355]-672

**M.E. (Electrical) Control System**  
**AUTOMATION IN MANUFACTURING**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any 3 questions from question 1 to 4.*
- 2) Question No. 5 and 6 are compulsory. out of the remaining.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logarithmic tables slide rule, electronic pocket calculator and steam tables is allowed.*
- 6) Assume Suitable data, if necessary.*

**Q1)** Classify thermocouples according to material pair used. Compare various thermocouples on basis of sensitivity and temperature range. Explain the laws of intermediate temperature and intermediate metals with their practical applications. **[6]**

**Q2)** State the conventional methods to translate rotational motion to linear motion explain ball screw arrangement and its superiority over nut and screw arrangement .State the problems associated with ball screw arrangement. **[6]**

**Q3)** Classify broadly the pneumatic valves according to their functions. With neat labeled sketch of 5/2 pilot operated directional control valve explain its operation. Explain what is meant by internal and external pressure source.**[6]**

**Q4)** Write note on 'online control and optimization of cyber physical system'. Explain time driven and event driven methodology. **[6]**

**Q5)** Explain organization and function models of digital manufacturing in detail.[16]

**Q6)** Explain six identified industry 4.0 design principles that manufacturers and producers use in their automation efforts for their production processes.[16]



Total No. of Questions : 6]

SEAT No. :

P4811

[Total No. of Pages :2

[5355]-673

**M.E. (Electrical) (Control Systems)**  
**NON LINEAR CONTROL SYSTEM**  
**(2017 Pattern)**

*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.*

**Q1)** a) State and explain different non-linearities observed in Physical Control System. [6]

b) Draw the phase plan trajectory for the following equation using Isocline method and also comment on Stability [6]

$$\dot{x} + 2\ddot{x} + 3x = 0, \text{ given } \dot{x} = 2.0, x = 0$$

c) An autonomous system is given by [6]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Examine the Stability using Liapunov direct Method.

OR

**Q2)** a) Express Scalar function given below in Quadratic form & test it for definiteness [6]

$$V(x) = 8x_1^2 + 5x_2^2 + x_3^2 + 4x_1x_2 - 2x_1x_3 - 3x_2x_3$$

b) Draw Phase - Plane Trajectory portrait for Vander Pol Equation. [6]

c) Explain different singular points for non-autonomous system. [6]

**P.T.O.**

- Q3)** a) Explain Feedback Linearization [6]  
b) Write a short note on Input - Output Linearization. [5]  
c) Write a short note on Input State Linearization. [5]

OR

- Q4)** Explain terms [16]  
i) Sliding Phase  
ii) Reaching Phase  
iii) Chattering as used in Sliding Mode Control  
iv) Notion for Sliding Mode Control

- Q5)** Explain [16]  
i) Effect of disturbance on Sliding Mode Control.  
ii) Matched & Unmatched uncertainty in case of Sliding Mode. Control.

OR

- Q6)** A Non-Linear system is represented by  $\dot{x}_1 = x_1 - x_1^2 - x_1x_2$  [16]

$$\dot{x}_2 = x_2 - 2x_2^2 - 3x_1x_2$$

Obtain all equilibrium points of the system.





Total No. of Questions : 6]

SEAT No. :

P4812

[Total No. of Pages :2

[5355]-674

**M.E. (Electrical) (Control System)**

**RESEARCH METHODOLOGY**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Your answers will be valued as a whole.*
- 4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

- Q1)** a) Describe with illustration the various type of research. [4]  
b) Compare the structure of survey, Conference and Journal Papers. [4]  
c) Write short notes on the following [5]  
i) I10 index  
ii) H index  
iii) Article matrices  
iv) Journal matrices  
d) Express polynomial  $V=y^2-2y+2$  in linear combination of [5]  
 $v_1=y^2-3y$   $v_2=2y^2+3y+1$   
 $v_3=4y^2+y+5$   
Using unknown scalar  $x,y,z$ . Also find magnitude of  $x,y,z$

OR

- Q2)** a) Discuss in brief various types of technical report with their significance. [4]  
b) Explain in brief types of technical papers and their advantages. [4]  
c) Write in brief on [5]  
i) Copy Right  
ii) Royalty  
iii) IPR  
d) Explain with illustration Linear dependence and independence. [5]

**P.T.O.**

**Q3) a)** Comment on solution of the system equation with r equations and n unknown with all possibilities [8]

b) reduce the given system equations. Also analyze the obtained solution [8]

$$x + 2y - 2z = -1 \qquad y - 3z = 4$$

$$2x + 3y - 5z = -4$$

OR

**Q4) a)** Find augmented matrix M and Coefficient Matrix A for following given system [8]

$$x + 3y - z = 2, x - 2y + 3z = 4$$

$$2x + 4y - 3z = 5$$

b) Write short notes on [8]

i) Homogeneous and non homogeneous system

ii) Gaussian elimination method for solving linear equations

**Q5) a)** For a given system find eigen values, eigen vectors and Diagonal matrix D such that  $D = P^{-1}AP$  where P is nonsingular [10]

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 4 \\ 2 & 1 & 0 \end{bmatrix}$$

b) Write software program for finding eigen values and eigen vectors if system matrix A is given. [6]

OR

**Q6) a)** Write short note on Diagonal form and Jordan form of matrix representation. [6]

b) For a given system

$A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$  find eigen values, eigen vectors, Diagonal matrix and characteristic equation. [10]



Total No. of Questions : 6]

SEAT No. :

P4813

[Total No. of Pages :2

[5355]-675

**M.E. (Electrical) (Control System)**

**MULTIVARIABLE AND OPTIMAL 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) *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 following presentation of MVCS

- i) Transfer Matrix form
- ii) State space form [4]
- b) Write short note on Luenberger observer. [5]
- c) Compare sliding mode observer and extended state observer. [5]
- d) Explain the factors to be considered in formulation of an optimal control problem using quadratic performance criteria. [4]

OR

**Q2) a)** A multivariable control system is represented in state space form [4]

$$A = \begin{bmatrix} 0 & 1 & 0 \\ -1 & -2 & -3 \\ 0 & 0 & -1 \end{bmatrix} B = \begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 1 & 1 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

Obtain transfer matrix of the system.

- b) Write short note on sliding mode observer. [5]
- c) Elaborate mathematical model of Extended state observer. Also write applications of it. [5]

- d) Define Hamiltonian. Explain in short the procedure for solving. Optimal control Problem using Hamiltonian method. [4]

- Q3)** a) State merits and demerits of optimal control. [6]  
b) Explain Hamilton. Jacobi method for solving optimal control law. [10]

OR

- Q4)** a) Explain in details Numerical solution of matrix Riccati equation. [8]  
b) State and explain pontryagin's minimum principle. [8]

- Q5)** a) Define and explain the singular control solution. [6]  
b) With neat block diagram, explain the outline procedure for solving minimum time optimal control problem. [10]

OR

- Q6)** a) Explain in detail Bang-bang control strategy, it's advantages and limitations. [8]  
b) For the system described by equation [8]

$$\dot{x} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

Find optimal control  $u^*(t)$  where

$|u(t)| \leq 1$  which transfer system from initial state to origin in minimum time



Total No. of Questions : 8]

SEAT No. :

P4814

[Total No. of Pages :2

[5355]-676

**M.E. (Electrical Control Systems)**

**CONTROL OF POWER ELECTRONICS CIRCUITS**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 & Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1)** a) Explain the role & objective of Power Electronic Converters? [5]

b) What are the requirements of modelling, simulation & control of power Electronic converters? [5]

OR

**Q2)** a) What are the control goals in power Electronic converter operation? [6]

b) Explain different control families of power electronic converter? [4]

**Q3)** a) Draw & explain Buck converter circuit with model of the converter? [6]

b) Write the normalization of the Boost converter? [2]

OR

**Q4)** What are the digital control issues and approaches in digital control design of converter control using dynamic compensation by pole placement? [8]

**Q5)** a) What are the introductory issues in case of DC-AC & AC-DC power converters? [8]

b) What is Resonant converters & also explain the necessity of Resonant control? [8]

**P.T.O.**

OR

**Q6)** Draw & explain Implementation of Resonant controllers? [16]

**Q7) a)** Explain variable structure control of power Electronic converters? [8]

b) Explain the concept of sliding surface in detail? [8]

OR

**Q8)** Explain variable structure control design with one application as DC-DC power stage. [16]



Total No. of Questions : 8]

SEAT No. :

P4815

[Total No. of Pages :2

[5355]-677

M.E. (Electrical - Control System)

DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS

(2017 Pattern)

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) Define the region of convergence (ROC) and important properties of the ROC for the z - transform. [4]
- b) For two-sided z - transform state and prove following properties: [5]
- i) Time shifting
  - ii) Scaling in z - domain or Multiplication by exponential

OR

- Q2)** a) Determine inverse z-transform of  $X(z) = \frac{1}{1-1.5z^{-1} + 0.5z^{-2}}$ . [5]
- For
- i) ROC:  $|z| > 1$
  - ii) ROC:  $0.5 < z < 1$
- b) What is meant by sampling? State the sampling theorem. [4]

- Q3)** a) Define DFT of sequence x(n). Explain the following properties of DFT. [4]
- i) Shifting property
  - ii) Circular time shift
  - iii) Circular frequency shift
  - iv) Circular convolution
- b) Classify FFT algorithms. Explain Radix-2 DIT FFT algorithm. [5]

P.T.O.

OR

- Q4)** a) Explain the bilinear transformation method of IIR filter design. What is warping effect? Explain the poles and zero mapping procedure clearly. [5]  
b) Using Cascade and parallel structures realize the IIR systems. [4]

- Q5)** a) Explain the process of windowing using illustrations. What is a Rectangular window function? Obtain its frequency-domain characteristics. What are the desirable features of window functions? [10]  
b) Discuss in details Direct form and Cascade form realizations of FIR filters. [6]

OR

- Q6)** a) Obtain direct form and Cascade form realizations for the transfer function of an FIR system given by: [6]

$$H(z) = \left(1 - \frac{1}{4}z^{-1} + \frac{3}{8}z^{-2}\right) \left(1 - \frac{1}{8}z^{-1} - \frac{1}{2}z^{-2}\right)$$

- b) A low pass filter is to be designed with the following desired frequency response: [10]

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega} & -\pi/4 \leq \omega \leq \pi/4 \\ 0 & \pi/4 \leq \omega \leq \pi \end{cases}$$

Determine the filter coefficients  $h_d(n)$ , if the window function is defined as

$$w(n) = \begin{cases} 1 & 0 \leq n \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

Also, determine the frequency response  $H(e^{j\omega})$  of the designed filter.

- Q7)** a) Explain various advantages of digital signal processing (DSP) methods of speed control of various electrical machines in comparison to other conventional methods? Discuss the various methods of speed control of electrical machines by DSP. [8]  
b) Discuss PWM generation by DSP. [8]

OR

- Q8)** a) Explain Various methods of measurement of power by DSP. [8]  
b) Discuss frequency measurement by DSP. [8]





Total No. of Questions : 6]

SEAT No. :

P4816

[Total No. of Pages :3

[5355]-681

**M.E. (Electrical) (Power Electronics and Drives)**

**LINEAR SYSTEMS THEORY AND DESIGN**

**(2017 Pattern)**

*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)** Perform the following : **[4]**

- i) Find the product of vectors a and b where  $|\vec{a}| = 7$  and  $|\vec{b}| = 11$  and the angle between them is  $63^\circ$ .
- ii) For the vectors  $\vec{a} = 3\vec{i} + 8\vec{j} + \vec{k}$  and  $\vec{b} = 6\vec{i} + 8\vec{j} + 2\vec{k}$ , deduce the direction cosines of  $\overline{AB}$

b) Determine if the following sets of vectors are linearly dependent or independent. **[5]**

- i)  $\vec{v}_1 = (12, -8)$  and  $\vec{v}_2 = (-9, 6)$
- ii)  $p_1 = 2x^2 - x + 7$ ,  $p_2 = x^2 + 4x + 2$  and  $p_3 = x^2 - 2x + 4$
- iii)  $\vec{v}_1 = \begin{bmatrix} 8 & -2 \\ 10 & 0 \end{bmatrix}$  and  $\vec{v}_2 = \begin{bmatrix} -12 & 3 \\ -15 & 0 \end{bmatrix}$

OR

**Q2) a)** For the vectors  $\vec{a} = 5\vec{i} + 4\vec{j} + 2\vec{k}$ ,  $\vec{b} = 4\vec{i} - 5\vec{j} + 3\vec{k}$  and  $\vec{c} = 2\vec{i} - 1\vec{j} - 2\vec{k}$ , find the direction cosines of the vector product  $(\vec{a} \times \vec{b})$  and the angle that the product vector makes with the vector c. **[4]**

b) For the two bases for  $\mathbb{R}^2$ ,  $B = \{1, -1\}$ ,  $(0, 6)\}$  and  $C = \{(2, 1), (-1, 4)\}$ , find the transition matrix from C to B. **[5]**

**Q3) a)** Consider matrix A and diagonalize the matrix A, by calculating the eigenvector matrix and the diagonal matrix of the eigenvalues. **[6]**

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 1 & 2 & 1 \\ -1 & 0 & 1 \end{bmatrix}$$

**P.T.O.**

OR

- b) For the following data sets, compare the mean, standard deviation, variance and range. [6]

Group A	196	198	198	199	200	200	201	201	202	205
Group B	192	194	195	198	200	201	203	204	206	207

- c) For the matrix B test for orthogonality and skew symmetry [3]

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

- Q4)** a) The number of hours of life of a torch battery is normally distributed with a mean of 150 h and standard deviation 12 hours. In a quality control test, two batteries are chosen at random from a batch. If both batteries have a life less than 120 hours, the batch is rejected. Find the probability that the batch is rejected. [8]
- b) The time taken by the milkman to deliver to the High Street is normally distributed with a mean of 12 minutes and standard deviation 2 minutes. He delivers milk every day. Estimate the number of days during the year when he takes: [8]
- Longer than 17 minutes
  - Less than ten minutes
  - Between 9 and 13 minutes

OR

- Q5)** a) The random variable X is distributed normally such that  $X \sim N(-8, 12)$ . Find [6]
- $P(X > -8.2)$
  - $P(X < -9.8)$
- b) The heights of a certain group of boys follow a normal distribution with mean 150.3 cm and variance 25 cm. Find the probability that a boy picked at random has height: [10]
- Less than 153 cm
  - More than 158 cm
  - Between 150 cm and 158 cm
  - More than 10 cm difference from the mean height

**Q6) a)** For the given data set, **[8]**

$x_i$	2	4	6	8	10	12
$y_i$	7.35	8.25	9.20	10.20	11.00	12.05

Determine the equation of the best fitting straight line using:

- i) Graphical method
  - ii) Method of least squares
- b) A particular set of machines wears out depending on the temperature it is exposed to according to the data set below: **[8]**

Temperature (T) °C	Amount of wear (y)
100	3.2
150	5.2
200	5.8
250	7.8
300	9.6
350	11.7

Determine the coefficients for the curve using

- i) Method of sequential differences
- ii) Method of extended differences



Total No. of Questions : 6]

SEAT No. :

P4817

[Total No. of Pages :2

[5355]-682

**M.E. (Electrical) (Power Electronics & Drives)**

**MODELING AND ANALYSIS OF ELECTRICAL MACHINES**

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

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

- Q1)** a) Discuss the primitive machine model of dc machine. Draw the Kron's Machine model for 3 phase Induction motor. **[9]**
- b) Using dynamic model of dc separately excited motor, derive equations for steady state speed and torque and discuss steady state and transient analysis of the motor. **[9]**

OR

- Q2)** a) Derive the transformations for currents between a rotating 2-phase and a pseudo-stationary 2- phase winding. Show that the transpose of current transformation matrix is equal to its inverse. **[9]**
- b) Discuss d-q model of three-phase induction motor in synchronously rotating reference frame. Use space phasor diagram to explain the model. **[9]**
- Q3)** a) Discuss voltage equations in the dynamic model of synchronous machine in arbitrary reference frame. **[8]**
- b) Explain how Park's transformations transform equations in [a, b, c] variables to [d, q, 0] variables. **[8]**

**P.T.O.**

OR

**Q4)** a) Derive equations for armature to field mutual inductances and armature self inductances for a salient pole synchronous machine. [8]

b) Using impedance matrix of 3-phase salient-pole synchronous machine, obtain an expression for instantaneous torque. [8]

**Q5)** a) Discuss the method to linearise dynamic model of induction motor. [8]

b) Write and discuss linearised model of 3-phase induction machine. [8]

OR

**Q6)** a) Write and discuss linearised model of synchronous machine. [8]

b) Explain theory of small displacement stability and Eigen values. [8]



Total No. of Questions : 6]

SEAT No. :

**P4819**

[Total No. of Pages : 2

**[5355]-684**

**M.E. Electrical (Power Electronics and Drives)**

**RESEARCH METHODOLOGY**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figures to the right indicate full marks.*
- 2) *Assume Suitable data if necessary.*

- Q1)** a) Explain the advantages of Latex over other tools for technical writing. **[6]**  
b) With examples, explain what the primary and secondary sources are. **[4]**  
c) Discuss the various ways in which research misconduct can take place. **[4]**  
d) With reference to data processing and analysis explain the following operations **[4]**  
i) Coding  
ii) Classification

OR

- Q2)** a) How LATEX tool is used in writing the supplementary parts of report such as list of symbols, list of tables, annexure? **[4]**  
b) What are the steps in formulation of a research problem? **[6]**  
c) What are important processing operations to be performed on collected data? **[4]**  
d) Explain the following terms in details. **[4]**  
i) Copyright  
ii) Patent

**P.T.O.**

- Q3)** a) What are the different steps involved in preparing a research proposal?[8]  
b) Explain the following types of papers to report the research work [8]  
i) Review Paper  
ii) Poster Paper

OR

- Q4)** a) What are the different parts of a Research proposal? [8]  
b) What are the standard parts of a journal paper? [8]
- Q5)** a) Explain the significance of writing a research report and give the detailed components of it. [8]  
b) What are the different steps involved in making an effective oral presentation? [8]

OR

- Q6)** a) Explain different forms of technical communication [8]  
b) What are the different types of reports? Explain the supplementary parts of a technical report [8]



Total No. of Questions : 6]

SEAT No. :

**P4820**

[Total No. of Pages :2

**[5355]-685**

**M.E. (Electrical) (Power Electronics & Drives)**

**AC& DC DRIVES (503307)**

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

*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 diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

**Q1) a)** Explain converter topologies for motor drives. **[9]**

b) Explain principle of operation for separately excited dc motor fed by single phase full wave converter. **[9]**

OR

**Q2) a)** Explain Steady state analysis of series DC motor fed by choppers. **[9]**

b) Explain principle of operation for Static Kramer's drive with phasor diagram. **[9]**

**Q3) a)** Explain Principle of operation for Induction Motor with neat circuit diagrams **[8]**

b) Explain speed vector estimation method for to control the Induction Motor. **[8]**

OR

**Q4) a)** Explain the following to control the Induction Motor with neat circuit diagrams

i) Flux vector estimation. **[8]**

ii) Indirect vector control. **[8]**

**P.T.O.**



**Q5) a)** Explain the Principle of operation for the following with neat circuit diagrams

i) Brushless DC motor [8]

ii) Stepper motor [8]

OR

**Q6) a)** Explain the Principle of operation for PMDC motor drive. [8]

b) Draw the performance characteristics for PMDC motor drive. [8]



Total No. of Questions : 5]

SEAT No. :

P4821

[Total No. of Pages : 2

[5355]-686

M.E (Electrical) (Power Electronics and Drives)

Power Converters II

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Figure to the right indicate full marks.*
- 2) *All questions are compulsory.*

**Q1)** Answer any three

**[18]**

- a) How can sinusoidal PWM technique be achieved in Three phase inverters?
- b) Explain with circuit diagram and switching pattern diode clamped multilevel inverter.
- c) Explain the necessity and importance of soft switching in converters
- d) Explain with circuit diagram and output waveform push pull converter

**Q2)** Draw the diagram of heat transfer and explain

- a) Specific heat flow rate b) thermal resistance c) thermal resistivity d) thermal coefficient e) thermal conductivity

**[16]**

OR

**Q3)** Explain in detail four types of heat transfer mechanisms in detail

**[16]**

**Q4)** a) An inductor is to be designed to meet the following specifications:  $L = 5$  milli henries ;  $I_{rms} = 3$  A sinewave ;  $f = 100$  kHz;  $T_s = 90$  C and  $T_a = 30$  C. The inductor is to be fabricated on a double-E core made from 3F3 ferrite. The windings are be made with foil conductors which have  $k_{cu} = 0.6$ . A core size of  $a = 2$  cm is chosen for the design. The emissivity  $E$  of the surface of the completed inductor equals 0.9 and that the vertical height is  $3a$ .

**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 four distributed air gaps. [8]
- b) What is snubber? Explain turn on snubber circuit. [8]

OR

- Q5** a) Explain with flow chart single pass inductor design procedure. [8]
- b) Explain turn on snubber and overvoltage snubber. [8]



Total No. of Questions :5 ]

SEAT No. :

[Total No. of Pages : 2

P4822

[5355]-687

M.E Electrical (PED) (Computer applications in Power systems)

Advanced control systems (2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Q1 is compulsory.
- 2) Solve Q2 or Q3 and Q4 or Q5.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.
- 5) Use of scientific non-programmable calculator is allowed.
- 6) Assume suitable data, if necessary.

Q1) Solve any three

[18]

- a) Maximize  $6x_1^2 + 5x_2^2$  subjected to  $x_1 + 5x_2 \geq 3$  and  $x_1, x_2 \geq 0$ .
- b) Minimize  $f(X) = 5x_1^2 + x_2^2 + 2x_1x_2 - 8$  with starting point  $\begin{bmatrix} 0 \\ -2 \end{bmatrix}$  using newton's method (perform one iterations)
- c) With the help of flowchart explain contingency analysis and security evaluation procedure.
- d) Derive AC-DC load flow equation. Also state the assumptions.

Q2) The incremental production cost of two thermal plants is as follows

$$\frac{dc_1}{dp_1} = 27.5 + 0.165 p_1 \quad \$/MWh$$

$$\frac{dc_2}{dp_2} = 19.8 + 0.264 P_2 \$/MWh$$

The limits are  $p_{\min} = 10MW$ .  $P_{\max} = 100MW$  . On a typical day. demand with respect to time is given. Complete the following table for economical load dispatch.

[16]

P.T.O.

Time	Load (PD) MW	$\lambda$ \$/MWh	$P_1$ (MW)	$P_2$ (MW)
12 midnight - 6AM	50	?	?	?
6AM-12 noon	100	?	?	?
12noon-2PM	75	?	?	?
2PM-6PM	125	?	?	?
6PM-9PM	175	?	?	?
9PM - 12midnight	50	?	?	?

OR

**Q3) a)** The cost characteristic of two units in a plant are

$$C_1 = 0.4P_1^2 + 160P_1 + K1 \text{ Rs/h}$$

$$C_2 = 0.45P_2^2 + 120P_2 + K2 \text{ Rs/h}$$

where  $p_i$  is power generated by  $i^{th}$  station in MW. Find the optimal load allocation between the two units, when the total load is 162.5 MW. What will be the daily loss if the units are loaded equally. [8]

b) Explain solution economic load dispatch problem using. Newton-Raphson method. [8]

**Q4) a)** The transmission loss-coefficient are given below on a base of 100MVA [8]

$$B = \begin{bmatrix} 0.01 & -0.001 & -0.002 \\ -0.001 & 0.02 & -0.003 \\ -0.002 & -0.003 & 0.03 \end{bmatrix}$$

Three plants supply as follow :

$$P_1 = 100MW, P_2 = 200MW, P_3 = 300MW .$$

Calculate the transmission loss and the incremental transmission losses with respect to plan 1,2 and 3.

b) Derive transmission loss coefficient using sensitivity factor. [8]

OR

**Q5) a)** Derive economic dispatch using exact loss formula. [8]

b) Write the short note on GSD and GGSD. [8]



Total No. of Questions : 6]

SEAT No. :

P4823

[Total No. of Pages : 2

[5355]-691

M.E. (Power Electronics and Drives)

ADVANCED CONTROL SYSTEMS

Computer Applications in Power system

(2017 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4 but Q.5 and Q.6 are compulsory
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of electronic calculator is allowed.

Q1) a) Aregulator system has a plant described by.

[5]

$$x = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } y = [1 \ 0 \ 0]x$$

Design a luenberger Observer such that the observer error poles are required to be located at  $-2 \pm j3.464, -5..$

b) What is chattering? What are different methods to attenuate chattering?[4]

OR

Q2) a) Define and explain sliding Mode Control and gao's reaching laws. [5]

b) Explain different methods of PID tuning. Explain any one in detail. [4]

Q3) a) Desing sliding Mode observer for double integrator system. [5]

b) Explain various types of converter. [4]

P.T.O.

OR

**Q4)** a) Explain observer based buck converter. [5]

OR

b) Explain observer based boost converter [5]

c) Clearly differentiate between linear and nonlinear extended state observer. [4]

**Q5)** a) Explain the various methods to analysis stability of nonlinear system [8]

b) Use variable gradient method to find a Lyapunov function for the nonlinear system. [8]

$$\dot{x}_1 = x_2,$$

$$\dot{x}_2 = -2x_2 + 2x_1x_2^2$$

**Q6)** a) Explain any one of the following with an example. [8]

i) Input output Linearization

ii) Feedback Linearization

b) Is the following system IO linearizable. If yes, transform it into the normal form [8]

$$\dot{x}_1 = x_1 + x_2, \dot{x}_2 = 3x_1^2 x_2 + x_1 + u, y = -x_1^3 + x_2$$



Total No. of Questions : 5]

SEAT No. :

P4824

[Total No. of Pages : 2

[5355]-692

M.E. (Electrical) (Power system)

POWER SECTOR ECONOMICS AND MANAGEMENT

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Solve any three from the following

**[18]**

- a) What is the necessity of restructuring the power sector?
- b) Explain ISO models used in restructured power sector.
- c) Calculate life cycle cost of the project with capital investment of Rs.1000000 and annual saving for subsequent five years are Rs. 200000, Rs. 250000, Rs. 300000, 250000 and sRs. 300000 With discounting factor of 12% judge the economic feasibility of the project.
- d) Explain performance based regulation. Also describe regulator Assets.
- e) What are the effects of renewable energy and captive plants on tariff?
- f) Discuss operation of Indian energy exchange. Is it different than worlds leading energy markets?

**Q2)** a) Discuss the terms demand elasticity and price elasticity. How these affect market operation? Explain. **[8]**

- b) Explain operation and settlement process for a day head market and forward market. **[8]**

**P.T.O.**



OR

**Q3)** a) What is market clearing price? How it is arrived? What the factors affecting market clearing price? [8]

b) Explain the term market efficiency. Also discuss the factors affecting market efficiency. [8]

**Q4)** a) Why there exists the congestion in power system? How congestion can be avoided? [8]

b) Explain methods used for pricing transmission services. [8]

OR

**Q5)** a) What are physical transmission rights? What are the effects of these on operation of restructured power industry? [8]

b) Explain role of regional and national load dispatch centres. [8]



Total No. of Questions : 6]

SEAT No. :

P4825

[Total No. of Pages : 2

[5355]-693

**M.E Electrical (Power Systems) (2017 Pattern)**  
**POWER SYSTEM MODELING**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve total three questions. answer 1 question from Q1 or Q.2, Q3 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  $F^{abc} = [p] F^{dqo}$ , where Park's transformation*

$$[P] = \begin{bmatrix} k_d \cos \theta & k_q \sin \theta & k_0 \\ k_d \cos \left( \theta - \frac{2\pi}{3} \right) & k_q \sin \left( \theta - \frac{2\pi}{3} \right) & k_0 \\ k_d \cos \left( \theta + \frac{2\pi}{3} \right) & k_q \sin \left( \theta + \frac{2\pi}{3} \right) & k_0 \end{bmatrix}$$

*(where,  $K_d = K_q = \sqrt{2/3}$  and  $K_0 = \sqrt{1/3}$ )*

---

**Q1)** State and explain various types of transformers used in power system and then develop a mathematical model of Tap changing transformer. [18]

OR

**Q2)** explain various methods of modeling of physical system. What is the need of modeling in power system? Explain any simple model of simple electrical power system. [18]

**Q3)** Lists various types of excitation control scheme used for alternators in power system. Draw appropriate diagrams and explain working of any two. [16]

OR

**Q4)** With the help of equivalent circuit diagram, develop the mathematical model of separately excited dc exciter. Also, draw the diagram to represent it clearly. [16]

**P.T.O.**

**Q5)** With the help of appropriate transformation using  $\alpha$ - $\beta$  variables, develop the model of long transmission line. Discuss about the assumptions and approximations involved in it. **[16]**

OR

**Q6)** what is the significance of load modeling in power system? Write down in details the various types of static load modeling represented in power system. Discuss about the assumptions and approximations involved in it. **[16]**



Total No. of Questions : 6]

SEAT No. :

P4826

[Total No. of Pages : 2

[5355]-694

M.E (Electrical) (Power System)

RESEARCH METHODOLOGY

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** State and explain the characteristics of process of research also write the objectives of research. [6]

**Q2)** Explain how to write research proposal differentiate technical papers, conference papers, survey papers. [6]

**Q3)** Explain intellectual property rights and legal procedure in granting patents. [6]

**Q4)** Write the standard form of linear programming problem and the transformations required in problem for writing it in standard form [6]

- Q5)** a) Explain what do you understand by convex programming problem. [8]
- b) Write down what do you understand by characteristics of constrained problem. [8]

**P.T.O.**

- Q6)** a) Explain the simulated annealing optimization techniques. **[8]**
- b) Explain genetic algorithm of optimization. Explain how it is different from other methods of optimization. **[8]**



Total No. of Questions : 6]

SEAT No. :

P4827

[Total No. of Pages : 1

[5355]-695

M.E (Electrical) (Power Systems)

POWER SYSTEM DYNAMICS

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve total three questions. Answer any one from Q1 or Q2, Q3 or Q4, and Q5 or Q6 each.*
- 2) *Assume suitable data if necessary.*
- 3) *Write down all the assumptions made.*

**Q1)** Derive an expression for power flow for a system consists of 'm' machines. Also state mechanical power equation prior to disturbance. [18]

OR

**Q2)** Classify and discuss the various states of operations and the security of the system as per Dy liacco, and fink and carlson. [18]

**Q3)** Derive rotor voltage equations for synchronous generator by model 1.1. [16]

OR

**Q4)** Derive an expression for calculation of initial conditions for the analysis of dynamics of synchronous generator connected to infinite bus system. [16]

**Q5)** Derive the stator voltage expressions for the small signal analysis of single machine model with field circuit only. Write down assumptions involve in it. [16]

OR

**Q6)** Derive the rotor mechanical and electrical torque equations for the small signal analysis of single machine model with field circuit only. Write down assumptions involve in it. [16]



Total No. of Questions : 8

SEAT No. :

P4828

[Total No. of Pages : 2

[5355]-696

M.E. (Electrical) (Power System)

POWER SYSTEM PLANNING AND RELIABILITY

(2017 Pattern) (Semester-II)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve total five questions.*
- 2) *Answer any two questions from Q1, Q2 and Q3 and Answer any one question from Q4 or Q5 and Q6 or Q7 each. Q8 is compulsory.*
- 3) *Assume suitable data if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of electronic scientific pocket calculator is allowed.*

**Q1)** Explain in detail Medium Term Planning and Long Term Planning. [9]

**Q2)** In detail explain Customer Composite Damage Function (CCDF) [9]

**Q3)** Elaborate mathematical expectation probability concept pertaining to reliability calculations. [9]

**Q4)** Elaborate on inter-regional transmission planning in India. [10]

OR

**Q5)** What are the different long term transmission planning methods, explain any one method in detail. [10]

**Q6)** Explain the monitoring of distribution system by reconfiguration algorithm. [10]

OR

**Q7)** What are different types of distribution system? What are causes of interrupts in distribution network, explain any two causes. **[10]**

**Q8)** What is a distribution system reliability index? How its evaluation is carried out in distribution network planning. **[12]**





Total No. of Questions : 5

SEAT No. :

P4829

[Total No. of Pages : 2

[5355]-697

M.E. (Electrical) (Power System)

HVDC AND FLEXIBLE AC TRANSMISSION

(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 side indicate full marks.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

**Q1)** Solve any Three :

**[18]**

- a) Explain different configurations of multi terminal HVDC system.
- b) Explain 12 pulse converter operation in HVDC system.
- c) Explain CIA control for HVDC link
- d) Compare HVDC and HVAC Transmission systems.
- e) Explain HVDC protection schemes used against over voltages.

**Q2)** a) Explain the basic principle of operation of STATCOM with diagram. **[8]**

b) Write the comparison of different SVC's in terms of performance, efficiency & limitations. **[8]**

OR

**Q3)** a) Explain working principle of, V-I characteristics & control schemes of TCSC. **[8]**

b) Explain the advantages & disadvantages of series & shunt compensation in power system. **[8]**

**P.T.O.**

- Q4)** a) Explain the operation and function of UPSC with a block diagram. [8]  
b) Compare UPFC with other FACTS devices in terms of their improvements in power systems. [8]

OR

- Q5)** a) Explain the transient performance of UPSC. [8]  
b) What are the major constraints in scheduling the control of UPFC in steady state condition. [8]



P4830

[5355]-701

**M.E (Instrumentation & Control/Process Instrumentation)**  
**MATHEMATICAL METHODS IN INSTRUMENTATION**  
**(2017 Pattern)**

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 side indicate full marks.
- 4) Use of calculator is allowed.

- Q1)** a) Find the norm of each vector and distance between vectors  $u = (1,1,2)$  and  $v = (1,-1,1)$ . **[4]**
- b) Show that the vectors  $(1,1,1), (1,1,0), (1,0,0)$  is linearly independent in  $\mathbb{R}^3$ . **[4]**
- c) Define linear combination of vector with suitable examples. **[2]**
- Q2)** a) Let  $\bar{v}_1 = \left(\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}\right)$   $\bar{v}_2 = \left(-\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}\right)$  be an orthonormal set of vectors in  $\mathbb{R}^3$ , if  $\bar{u} = (1,2,3)$  find orthogonal projection  $\bar{u}$  on  $W$  and orthogonal component of  $\bar{u}$  to  $W$ . **[5]**
- b) Use gram-schmidt process to transform the basis  $\{(1,1,1), (0,1,1), (1,2,3)\}$  for  $\mathbb{R}^3$  into an orthogonal basis for  $\mathbb{R}^3$ . **[5]**
- Q3)** a) Discuss the convergence of Newton Raphson method. **[5]**
- b) Solve by Gauss-Elimination method **[5]**
- $$10x_1 + x_2 + x_3 = 12,$$
- $$2x_1 + 10x_2 + x_3 = 13.$$
- $$x_1 + x_2 + 5x_3 = 7.$$

**Q4) a)** determine the value of  $y$  when  $x = 0.1$ , by euler modified method given that  $\frac{dy}{dx} = 1+xy, y(0) = 1$  and  $h = 0.1$ . [5]

b) Find first four moments about origin and about the mean for a random variable  $X$  having density function [5]

$$f(x) = \frac{4x(9-x^2)}{81}, 0 \leq x \leq 3. \text{ and } f(x) = 0, \text{ otherwise.}$$

**Q5) a)** A joint density function of two random variable  $X$  and  $Y$  is given by [6]

$$f(x, y) = \frac{xy}{96}, 0 < x < 4, 1 < y < 5 \text{ and } f(x, y) = 0, \text{ otherwise.}$$

Find (i)  $E(X)$ , (ii)  $E(Y)$ . (iii)  $E(2X+3Y)$ .

b) Find variance and standard deviation of the sum obtained in tossing a pair of fair dice. [4]

**Q6) a)** Define uniform distribution show that mean and variance of uniform distribution are  $\mu = \frac{1}{2}(a+b)$  and  $\sigma^2 = \frac{1}{12}(b-a)^2$ . [5]

b) Explain the terms axioms of probability. [5]

**Q7) a)** Find singular value decomposition of the matrix [5]

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

b) The first four central moments of a distribution are 0, 2.5, 0.7 and 18.75. comment on the skewness and kurtosis of the distribution. [5]

- Q8)** a) Show that the vectors  $\bar{v}_1 = \left(-\frac{3}{5}, \frac{4}{5}, 0\right)$ ,  $\bar{v}_2 = \left(\frac{4}{5}, \frac{3}{5}, 0\right)$ ,  $\bar{v}_3 = (0, 0, 1)$  form an orthonormal basis of  $\mathbb{R}^3$ . With Euclidean inner product. Find the coordinate of  $(1, -1, 2)$  relative to the basis. **[5]**
- b) If on an average one ship in every ten is wrecked, find the probability that out of five ships expected to arrive, 4 at least will arrive safely. **[5]**



Total No. of Questions : 5]

SEAT No. :

[Total No. of Pages : 2

**P4831**

**[5355]-702**

**M.E (Instrumentation & control) (Process/Instrumentation)**

**Transducer Design**

**(2017 pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All question are compulsory.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figure to the right candidates indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following. **[5]**

- a) Discuss different types of transducers.
- b) List different pressure transducers. Explain any electrical type temperature transducer. **[5]**
- c) With neat sketch explain different signal conditioning circuits used for conversion of resistance in to voltage. **[5]**

**Q2)** Attempt any two of the following

- a) Explain requirements of different electronics circuits for transducer design **[5]**
- b) Design temperature indicator for 0-100°C range using J-type thermocouple having sensitivity  $50 \mu V/^{\circ}C$  with cold junction compensation. **[5]**
- c) Explain design of load cell using strain gauge load cell in detail. **[5]**

**Q3)** Attempt any two of the following

- a) List different chemical and explain each sensors application. **[5]**
- b) Write note on biosensors and its application **[5]**
- c) Give different types gas sensors with their applications. **[5]**

**P.T.O.**

**Q4)** Attempt any two of the following

- a) What is SMART sensor? Explain any SMART sensor in detail. [5]
- b) Write note on recent trends in sensor technology. [5]
- c) Explain manufacturing process of MEMS with neat sketch. [5]

**Q5)** Attempt any two of the following

- a) Explain different types of sensors used in home automation application. [5]
- b) List transducers used in aerospace. Explain any two in detail. [5]
- c) Discuss role of sensors in automobile application. [5]



Total No. of Questions :6]

SEAT No. :

[Total No. of Pages : 2

**P4832**

**[5355]-703**

**M.E (Instrumentation & Control)**

**(Process Instrumentation)**

**Industrial Automation**

**(Semester - I) (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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary*

- Q1)** a) Develop programmable ladder diagram for two lights are to flash on and off at different intervals. One is on 5 second and off 5 seconds. The other is on for 9 seconds and off 9 seconds. Two lights are to flash alternately, one for 4 seconds, one for 7 seconds. After five cycles both lights must go off. **[5]**
- b) Draw typical architecture of DCS system. **[5]**
- Q2)** a) Draw a famous automation hierarchy for an industrial application. Explain the function of each level of automation hierarchy. **[5]**
- b) Explain in brief safety life cycle. **[5]**
- Q3)** a) Explain with an example 'Sequential Function chart'. **[5]**
- b) Discuss the various selection criteria that must be considered for selection of a suitable PLC for a specific process control. **[5]**
- Q4)** a) Explain in brief different types of sequencer. **[5]**
- b) Explain in brief application of safety system. **[5]**

**P.T.O.**



- Q5** a) Describe in brief SCADA systems in terms of their architecture and interface to process hardware. [5]  
b) Explain with example hazard and operability study. [5]
- Q6** a) Two linear input signals of 0–4 volts are to be multiplied and the result put on a linear output of 0–150 volts. Trace the numbers if the inputs are 2.85 and 3.45 volts. [5]  
b) There are three ejector pumps in a waste system. Only one is to be able to run at a time. The pump which is to be run is chosen at random by an operating technician. Devise a PLC circuit for this situation. [5]



Total No. of Questions :7]

SEAT No. :

[Total No. of Pages : 2

P4833

[5355]-704

**M.E (Process Instrumentation & Control)**

**Research Methodology**

**(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) *Figures to the right candidatas indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data if necessary*

**Q1)** a) What 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 scope and objectives of research problem [5]

b) Write a short notes on linear scaling for receiver and fidelity of instrument [5]

**Q3)** a) Explain primary and secondary data collection methods [5]

b) Use following data to workout linear regression analysis. [5]

Sr. No	Price	Sales
1	100	120
2	120	80
3	140	95
4	160	70
5	180	65

Find linear regression equation, Coefficient of correlation.

**P.T.O.**

- Q4)** a) Write a short notes on asymptotic analysis [5]  
b) Write a short notes on Sensitivity theory [5]
- Q5)** a) Explain hypothesis in details. State the qualities of good hypothesis [5]  
b) Write a short notes on Common errors when writing research aims and objectives [5]
- Q6)** a) Discuss the structure of a typical Engineering research proposal and in short elaborate each point. [5]  
b) Enumerate the different methods of collecting data [5]
- Q7)** a) Explain linear regression Equation [5]  
b) Explain different steps in writing research report. [5]



[5355]-705

**M.E Instrumentaion & Control (Process Instrumentation)**

**Process Dynamics and Control**

**(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) *Figures to the right side indicate full marks.*
- 4) *Use of colculator is allowed.*
- 5) *Assume suitable data if necessary*

**Q1) a)** Explain in brief procedure for calculating Relative Gain Array for 2×2 systems. Decide the pairing of variables for a given relative gain matrix[5]

$$\begin{bmatrix} 1 & 1 & -1 \\ 3 & -4 & 2 \\ -3 & 4 & 0 \end{bmatrix}$$

b) Discuss in detail with suitable example, how major categories of control objectives influence the control design. [5]

**Q2) a)** Explain with suitable block diagram "Gain scheduling adaptive control".[5]

b) Design a cascade control configuration for the shell & tube heat exchanger, controlling the outlet stream temperature using steam flow as the manipulated variable. [5]

**Q3) a)** Derive fundamental model of stirred tank heater. [5]

b) Explain with suitable application protection of equipment by override control [5]

**P.T.O.**

- Q4)** a) Explain in brief model forms of MPC [5]  
b) Explain in brief decoupling of loops [5]
- Q5)** a) What is the significance of SPC in process plants? [5]  
b) Discuss in brief effect of zeros and time delay. [5]
- Q6)** a) Explain with suitable block diagram "Internal model control". [5]  
b) Explain in brief procedure for calculating relative gain array for  $2 \times 2$  systems. [5]



Total No. of Questions :5 ]

SEAT No. :

[Total No. of Pages : 2

**P4836**

**[5355]-707**

**M.E (Instru. & Control) (Process instru.)**

**Control system**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of electronic pocket calculator.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Attempt any two of the following.

- a) Differentiate linear and nonlinear systems in detail. **[5]**
- b) Explain jump response characteristics of nonlinear system with example. **[5]**
- c) Explain concept of phase plane in control system analysis. **[5]**

**Q2)** Attempt any two of the following

- a) Define describing function? Find describing function for saturation element. **[5]**
- b) Explain concept of describing function analysis for non-linear system with necessary diagrams. **[5]**
- c) Discuss explain limit cycle and its types with necessary diagrams. **[5]**

**P.T.O.**

**Q3)** Attempt any two of the following

- a) Explain stability in the sense of Lyapunov with graphical representation. **[5]**
- b) Explain positive and negative definite functions with example. **[5]**
- c) Determine the stability of a non-linear system governed by equation **[5]**

$$\begin{aligned}\dot{x}_1 &= -2x_2 \\ \dot{x}_2 &= -x_2 - x_1\end{aligned}$$

**Q4)** Attempt any two of the following

- a) Explain zero dynamics in feedback linearization with example. **[5]**
- b) Explain input-output linearization in detail with example **[5]**
- c) Explain input-state linearization in detail with example. **[5]**

**Q5)** Attempt any two of the following

- a) Design a sliding mode control for any system. Also draw its outputs. **[5]**
- b) With reference to sliding mode control theory explain control, surface and reachability in detail with necessary diagrams. **[5]**
- c) What is chattering in SMC? Also explain techniques used for avoidance of chattering. **[5]**



Total No. of Questions :6 ]

SEAT No. :

[Total No. of Pages : 2

**P4837**

**[5355]-711**

**M.E (Computer Engineering)**

**Research Methodology**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *figures on right indicate full marks.*
- 3) *Draw neat Diagrams where necessary.*

**Q1)** a) State and explain different types of research. What are the objectives of research? **[9]**

OR

b) What is research process? State the steps of research process and explain the activities in each step. **[9]**

**Q2)** a) Explain the following terms. (Any four) **[8]**

- i) Citations
- ii) Impact factor
- iii) h-index
- iv) I-index
- v) Plagiarism

OR

b) What you mean by code of ethics in research? What are IEEE and ACM code of ethics for Engineering Research? **[8]**

**Q3)** a) What are errors? What are sources of errors in data analysis? Explain one dimensional and multidimensional statistics. **[8]**

OR

b) what is hypothesis? What do you mean by hypothesis testing? What is Null hypothesis? **[8]**

**P.T.O.**



**Q4) a)** What do you mean by optimization? Explain the two parameter and multi parameter optimization with examples. [9]

OR

b) What is difference in Gradient and simplex methods used of optimization? [9]

**Q5) a)** What are ergonomic and human factors associated with surveys conducted for research? What are general survey conduction guidelines? [8]

OR

b) State the use of following tools (Any two) [8]

i) Open MDAO

ii) AQAD

iii) CAT

iv) SOFA

**Q6) a)** What are methods to disseminate the research findings? What are various types of reports for research reporting? [8]

OR

b) Write notes on [8]

i) IPR

ii) Copyright

iii) Patents

iv) In PASS



Total No. of Questions :7 ]

SEAT No. :

[Total No. of Pages : 2

**P4838**

**[5355]-712**

**M.E (Computer Engineering)**

**Bio-inspired Optimization Algorithms**

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

*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) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) What is natural computing? [1]  
b) Write simulated annealing algorithm [4]  
c) What is positive feedback? List examples of positive feedback [3]
- Q2)** a) Discuss selection and mutation of Evolutionary Programming [4]  
b) List features of evolutionary system. Explain any one [4]
- Q3)** a) Explain ant foraging behavior [4]  
b) Write particle swarm optimization algorithm [4]
- Q4)** a) Write pseudocode of cuckoo search algorithm and discuss idealized rules of cuckoo search algorithm [4]  
b) Discuss self tuning framework and self tuning of firefly algorithm [4]
- Q5)** a) Interpret the immunological terminology into the computational domain of AIS [4]  
b) Illustrate procedure to generate antibodies from gene libraries [4]

**P.T.O.**

- Q6** a) Discuss architecture of framstick [4]  
b) Illustrate boid flocking [4]
- Q7** a) What is artificial life? What are the goals of artificdial life [4]  
b) Discuss ant system for travelling salesman problem [6]



Total No. of Questions : 12]

SEAT No. :

**P4839**

[Total No. of Pages : 2

**[5355]-713**

**M.E. (Computer Engineering) (Semester-I)**

**SOFTWARE DEVELOPMENT AND VERSION CONTROL**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 OR Q2, Q3 OR Q4, Q5 OR Q6, OR Q7, OR Q8, Q9 OR Q10, Q11 OR Q12*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary*

**Q1)** Explain the incremental and object based software development process. **[9]**

OR

**Q2)** Write the process for software design of social networking site with suitable example. **[9]**

**Q3)** What is product line engineering? Describe briefly the three main phases of product line engineering. **[8]**

OR

**Q4)** Describe any two distributed architecture styles with their advantages and limitations. **[8]**

**Q5)** Explain what is architecture implementation and testing. **[8]**

OR

**Q6)** Explain the architecture reconstruction process. What guidelines would you follow for reconstruction of software architecture? **[8]**

**P.T.O.**

**Q7)** Why is environment configuration control important? Explain the principles of environment configuration control. [8]

OR

**Q8) a)** Explain the various aspects of configuration management [5]

b) Why is source code management important? [3]

**Q9)** Explain the types of version control systems in detail. [8]

OR

**Q10)a)** Describe best four version control practices. [4]

b) Explain the following commands with respect to distributed version control. [4]

i) Clone

ii) Push

**Q11)** Write short notes on [9]

a) Mercurial

b) Bazaar

c) SVN

OR

**Q12)** Explain the setup of Git version control tool with respect to basic configuration, naming and history [9]



Total No. of Questions : 12]

SEAT No. :

P4840

[Total No. of Pages : 2

[5355]-714

M.E (Computer Engineering)

EMBEDDED AND REAL TIME OPERATING SYSTEM

(2017 Pattern)

*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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** What are the essential structural units in **[8]**

- a) Microprocessor
- b) Embedded processor
- c) Microcontroller?

List each of these.

OR

**Q2)** Compare and Describe an embedded system and real time system. **[8]**

**Q3)** What are the challenges faced in designing an embedded system. **[8]**

OR

**Q4)** Name and explain power management modes of bluetooth. **[8]**

**Q5)** Write a note on parallel device protocols a) ISA, b) PCI and c) ARM bus **[9]**

**P.T.O.**

OR

**Q6)** What do you mean by SPI and SCI? Explain them with the help of interfacing. [9]

**Q7)** Compare hard verses soft real time system and their time constraints. [8]

OR

**Q8)** How precedence constraint decides in real time tasks? Explain. [8]

**Q9)** Write a detail note on Inter-process communication (IPC). [8]

OR

**Q10)** Explain with example resource conflicts and blocking. [8]

**Q11)** Write in detail synchronization in Real-time operating system. [9]

OR

**Q12)** Explain with example validation and debugging in an embedded systems. [9]



Total No. of Questions : 5]

SEAT No. :

P4841

[Total No. of Pages : 4

[5355]-715

**M.E. (Computer Engineering)**

**OPERATION RESEARCH**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Use of non programmable calculator is allowed.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use Graph Paper whenever required.*

**Q1)** Answer any two from the following :

**[2 × 5 = 10]**

- a) Define Non Negative constraints of Linear Programming. What are different types of solutions to linear programming problems?
- b) Use graph paper to solve following linear programming problem  
A furniture manufacturing company plans to make two products: Chairs and Tables, from its available resources, which consist of 400 board feet of wood and 450 man-hours. Company knows that to make a chair it requires 5 board feet and 10 man-hours and has a profit of Rs 45, while each table uses 20 board feet and 15 man-hours and has a profit of Rs 80. Objective is to maximize the profit. How many chairs and tables the company can make, keeping within its resource constraints?
- c) Solve the following using Artificial Basis Technique

$$\text{Max } Z = 5X_1 + 8X_2$$

$$\text{Subject to } 3X_1 + 2X_2 \geq 3$$

$$X_1 + 4X_2 \geq 4$$

$$X_1 + X_2 \leq 5$$

$$X_1, X_2 \geq 0$$

**P.T.O.**



**Q2)** Answer any two from the following :

**[2 × 5 = 10]**

- Describe steps of Dual simplex algorithms.
- Find the initial basic feasible solution to the following transportation problem using North -West corner rule

	D1	D2	D3	D4	D5	Ai
O1						2
O2						4
O3						7
Bj	3	2	4	2	2	

- Apply the principle of duality to solve the following Linear Programming Problem

$$\text{Max } 4X_1 + 2X_2$$

$$\text{Subject to } X_1 + X_2 \geq 3$$

$$X_1 - X_2 \geq 2$$

$$X_1, X_2 \geq 0$$

**Q3)** Answer any two from the following :

**[2 × 5 = 10]**

- Discuss steps of MODI method for finding optimal solution of Transportation Problem.
- Calculate the optimal solution for assignment problem of following cost matrix

	I	II	III	IV	V
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	15

c) Solve the following  $2 \times 3$  game graphically on graph paper

		P2		
		Y1	Y2	Y3
P1	X1	1	3	11
	X2	8	5	2

**Q4)** Answer any two from the following : **[2 × 5 = 10]**

a) Obtain solution for the following game by algebraic method

		Player B	
Player A	3		1
	2		4

b) Suppose a salesman has to reach city numbered 10 starting from city number 1 by his car. Though his starting and destination cities are fixed, he has option of travelling through route. Cost  $C_{ij}$  for as a standard policy for car driving running from city I to city j is given below. Find the safest route of travelling so that the total travelling cost is minimum.

					5	6	7		8	9		10
	2	3	4	2	7	4	6	5	1	4	8	3
1	2	4	3	3	3	2	4	6	6	3	9	4
				4	4	1	5	7	3	3		

c) Discuss Gomory's cutting plane method for integer programming Problem.

**Q5)** Answer any two from the following : **[2 × 5 = 10]**

a) Calculate the total float, free float, and independent float for the project whose activities are given below.

Jobs	1-2	1-3	2-4	3-4	3-5	4-5	4-6	5-6
Duration	6	5	10	3	4	6	2	9

- b) A decision problem has been expressed as the following pay-off table. Determine which action the executive has to choose if he adopts
- i) Maximin Criterion
  - ii) Maximax Criterion
  - iii) Hurwicz Criterion with  $\alpha = 0.7$
  - iv) Laplace Criterion
  - v) Minimax Regret Criterion

Action	Events		
	I	II	III
A	10	20	26
B	-30	30	60
C	40	30	20

- c) Discuss basic principles in sensitivity analysis.



Total No. of Questions : 12]

SEAT No. :

P4842

[Total No. of Pages : 2

[5355]-716

**M.E. (Computer Engineering)**  
**SYSTEM SIMULATION AND MODELING**  
**(2017 Pattern)**

*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 diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** Model a 2-bit binary counter using a finite state machine. If the input is  $x = 0$  then the counter stops counting, and if  $x = 1$  then the counter continues on from where it last left off. The output of the counter should produce the sequence 3, 1, 5, 2, 3, 1, 5, 2 ... since there are four different output values; there are four different state values too. Clearly there are only two input values. Model this state machine using bit vectors. **[9]**

OR

**Q2)** Explain Runge Kutta method and how it can overcome drawbacks of Taylor and Euler Method. **[9]**

**Q3)** Why linear congruential generators (LCG) method requires “seed” to begin? Determine the Sequence of Numbers generated by LCG with  $a = 5$ ,  $C = 3$ ,  $M = 16$  and  $Z_0 = 7$ . **[8]**

OR

**Q4)** Why random signals are used in simulations? Explain general ARMA model with the help of suitable block diagram. **[8]**

**P.T.O.**

**Q5)** What is difference between interpolation process and extrapolation process? Consider the sinusoidal signal  $x(t) = \sin t$  over the interval  $[0,10]$  with a sampling frequency of  $f_1 = 5$  samples per second and a desampling frequency of  $f_2 = 12$  samples per second. Show the results of sampling the continuous signal and then trying to invert the sampling process. [8]

OR

**Q6)** Write and perform a simulation for the dining philosophers problem. From this simulation, determine whether or not deadlock can occur. [8]

**Q7)** What is distributed delays'? Consider a single-stage distributed delay with constant delay  $\Delta$ . Assuming a zero initial state at  $t = 0$  and a unit-step input, derive an explicit solution for the output  $y(t)$ . [8]

OR

**Q8)** Explain representation of a general queuing system with suitable diagram. How will you simulate an M/M/2 queuing model? [8]

**Q9)** Explain different reasons why output data analyses have not been conducted in an appropriate manner. Describe random nature of the simulation output. [8]

OR

**Q10)** Why is determining the required number of tellers for a bank different from determining the hardware requirements for a computer or communication system? [8]

**Q11)** Explain common sources of randomness in manufacturing systems. [9]

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. :

**P5299**

[5355]-717

[Total No. of Pages : 2

**M.E. (Computer)**  
**MACHINE LEARNING**  
**(2017 Course) (Semester-II) (510110)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) Explain reinforcement learning algorithm. **[4]**

b) Discuss parametric and non-parametric methods. **[4]**

**Q2)** a) Define PCA. Discuss it with suitable mathematical formulae. **[4]**

b) Differentiate feature extraction and selection. **[4]**

**Q3)** a) Explain KNN algorithm with suitable example. **[5]**

b) What is linear and non-linear classifier? Explain SVM in detail. **[5]**

**Q4)** a) What is ensemble? Differentiate Bagging and Booting. **[4]**

b) Discuss ID<sub>3</sub> algorithm in detail. **[4]**

**P.T.O.**

**Q5) a)** Explain hidden markov model in short. **[4]**

b) Discuss Naive Bayes classifier with suitable example. **[4]**

**Q6)** Write a short note on: **[8]**

a) Detecting malicious activities in websites.

b) Credit card fraud detection.



Total No. of Questions : 12]

SEAT No. :

**P4843**

[Total No. of Pages : 2

**[5355]-721**

**M.E. (Computer Networks)  
RESEARCH METHODOLOGY  
(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve: 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) *Figures to the right indicate full marks.*

**Q1)** Explain essential components of Research Process. What is significance of research? **[10]**

OR

**Q2)** What is research problem? What are the techniques used to define research problem. **[10]**

**Q3)** Explain Impact factor, h-index, I-index, plagiarism in research publication. **[8]**

OR

**Q4)** a) Why should engineers be ethical? **[3]**

b) What are the types of research publications? Give in brief. **[5]**

**Q5)** Write short notes on GNU, PSPP and SOFA tools. **[8]**

OR

**Q6)** Explain various sources of error and uncertainty in measurement. **[8]**

**Q7)** Explain multi-parameter optimization technique with suitable example. **[8]**

**P.T.O.**



OR

*Q8)* Write short notes on Google optimization tool and open MDAO. [8]

*Q9)* Why undertake a survey? Explain general survey guidelines. [8]

OR

*Q10)* Explain importance of statistical analysis and reporting in research? [8]

*Q11)* Explain with suitable example reporting research through IEEE/ACM paper templates. [8]

OR

*Q12)* Explain technique of interpretation? What are precautions needed in the interpretation? [8]



Total No. of Questions : 12]

SEAT No. :

**P4844**

[Total No. of Pages : 2

**[5355]-722**

**M.E. (Computer) (Computer Networks)**

**NETWORK SECURITY**

**(2017 Pattern)**

*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) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Explain what network and computer attacks are? Is there any relationship between network and computer attacks? **[9]**

OR

**Q2)** What is attack in network security? State and explain four primary classes of attacks to network security. **[9]**

**Q3)** What is network sniffing? Explain tools used for network sniffing. Why is network sniffing useful? **[8]**

OR

**Q4)** Who are hackers? List different types of hackers and their intention. Explain tools used for hacking. **[8]**

**Q5)** Write short on : **[8]**

- a) BeEF with Better Cap,
- b) BeEF with man-in-the-middle framework (MITMF)

**P.T.O.**

OR

**Q6)** What is Cross-Site Scripting (XSS) attack? What are preventive measures against XSS attacks? How user can reduce chances of being attacked? [8]

**Q7)** What is an man-in-the-middle(MITM) attack? Which are popular tool used for conducting MITM attacks? [8]

OR

**Q8)** What is Open Web Application Security Project (OWASP) ZAP? Which types of vulnerability are tested on it for weak points of targeted website?[8]

**Q9)** How network sniffing can be used for monitoring wireless networks? What are its advantages and disadvantages? [8]

OR

**Q10)**What is *Ack-storm DoS attacks*? How it can be launched? How Ack-DoS attacks can be prevented? [8]

**Q11)**What is an intrusion detection and prevention system? How it works? Which is more difficult among intrusion detection system or intrusion prevention system? [9]

OR

**Q12)**What is Availability Attacks in Wifi? State and explain any two tools may be used for availability attack. [9]



Total No. of Questions : 8]

SEAT No. :

**P4845**

[Total No. of Pages : 2

**[5355]-723**

**M.E. (Computer) (Computer Networks)**

**WIRELESS SENSOR NETWORKS**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** Discuss about Placement of aggregation points. **[6]**

b) Discuss Challenges and Constraints of WSN. **[6]**

OR

**Q2) a)** Explain Data-centric storage. **[6]**

b) With suitable diagram explain the XYZ Node Architecture. **[6]**

**Q3) a)** Describe Contention-Free MAC Protocol: Y-MAC. **[6]**

b) Explain Single-hop localization: i) RADAR ii) Cricket **[6]**

OR

**Q4) a)** Describe Contention-Based MAC Protocol : Pattern MAC. **[6]**

b) Explain Positioning in multihop environments: Iterative and collaborative multilateration. **[6]**

**Q5) a)** Explain several data transport tasks to provide Reliability requirements in sensor networks. **[7]**

b) Explain the Coverage of random deployments: general sensing model. **[6]**

**P.T.O.**

OR

**Q6)** a) In Pump Slowly Fetch Quickly (PSFQ) block delivery in the sink-to-sensors protocol how a duplicate packet, an in-sequence packet and an out-of-order packet in handled. [6]

b) Explain Single packet delivery using multiple path. [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) Defenses Against Aggregation Attacks

b) Key Management

c) Security attacks on Routing and on Transport Layer



Total No. of Questions : 12]

SEAT No. :

**P4846**

[Total No. of Pages : 2

**[5355]-724**

**M.E. (Computer Networks)**

**HIGH PERFORMANCE NETWORKS**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Explain the modes of communication and Switching in Networks. **[4]**

b) Briefly explain the reference model of ATM. **[4]**

OR

**Q2)** a) Compare MPLS with GMPLS. **[4]**

b) Explain in brief ISDN related protocols at User-Network interface in the context of OSI Model. **[4]**

**Q3)** a) Compare between Frame relay and X.25. **[4]**

b) Explain Gigabit Ethernet physical layer with respect to 1000 Base-TX family. **[4]**

OR

**Q4)** a) Differentiate between 10 Mbps, 100 Mbps and 1000 Mbps network characteristics. **[4]**

b) Deploying Gigabit Ethernet to the Desktop as an Application. Explain how it is achievable. **[4]**

**P.T.O.**

- Q5)** a) Draw the structure of typical Router Structure. Briefly explain IPP and OPP processors in it. [5]  
b) How is QoS implemented at IP networks? [4]

OR

- Q6)** a) What are various MPLS forwarding operations? Explain in brief. [5]  
b) Briefly explain MPLS encapsulation standards. [4]

- Q7)** a) What are the drawbacks of traditional IP routing? How it is overcome by MPLS. [5]  
b) Explain MPLS signaling and routing protocols. [4]

OR

- Q8)** a) Represent and Model an optical cross-connect mathematically and symbolically. [5]  
b) How is Routing achieved in All-optical Networks? [4]

- Q9)** a) Briefly explain basic optical networking devices. [4]  
b) Describe GMPLS. [4]

OR

- Q10)** a) How will you achieve Borderless Network Architecture at your campus? [4]  
b) What are the Campus Network Design Principles? [4]

- Q11)** a) Multi-Tier Borderless Campus Design Models is better than traditional networks. Justify with both pros and cons. [4]  
b) Give some Distribution-Layer Network Design Recommendations. [4]

OR

- Q12)** a) Explain how a Campus Distribution Layer Network Design will be achieved. [4]  
b) Design your Campus Network Design Model. [4]



Total No. of Questions : 6]

SEAT No. :

P4847

[Total No. of Pages : 3

**[5355]-725**  
**M.E. (Computer Networks)**  
**OPERATION RESEARCH**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any three question from Q1, Q2, Q3, Q4 and one from Q5, Q6.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) i) What are the applications, advantages and limitations of LP problem? [3]  
ii) Explain the concept of degeneracy in simplex method. [3]  
b) Formulate the dual linear programming problem and determine the optimum values of the dual variables. [6]

Minimize

$$3w_1 + 4w_2$$

Subject to:

$$3w_1 + 4w_2 \geq 24$$

$$2w_1 + w_2 \geq 10$$

$$5w_1 + 3w_2 \geq 29$$

$$w_1, w_2 \geq 0$$

- Q2)** a) Describe the revised simplex algorithm, in solving Linear programming Problem. [6]  
b) A farmer has 1,000 acres of land on which he can grow corn, wheat or soya beans. Each acre of corn costs Rs. 100 for preparation, requires 7 man-days of work and yields a profit of Rs. 30. An acre of wheat costs Rs. 120 to prepare. requires 10 man-days of work and yields a profit of Rs. 40. An acre of soya beans costs Rs. 70 to prepare, requires 8 man-days of work and yields a profit of Rs. 20. The farmer has Rs. 1,00,000 for preparation and 8,000 man-days of work. Set-up the linear programming equation for the problem. [6]

**P.T.O.**



- Q3) a)** Find the initial basic feasible solution using Vogels Approximation Method. [6]

	D1	D2	D3	D4	Supply
O1	20	22	17	4	120
O2	24	37	9	7	70
O3	32	37	20	15	50
Demand	60	40	30	110	

- b)** Solve the following game theory using dominance rule. [6]

Player A	Player B					
	I	II	III	IV	V	VI
	4	2	0	2	1	1
	4	3	1	3	2	2
	4	3	7	-5	1	2
	4	3	4	-1	2	2
	4	3	3	-2	2	2

- Q4) a)** What do you mean by two-person zero sum game? What is pure and mixed strategies in game theory? [6]

- b)** You work as a sales manager for a toy manufacturer, and you currently have three sales people on the road meeting 'buyers. Your sales people are in Austin, TX; Boston, MA; and Chicago, IL. You want them to fly to three other cities: Denver, Co; Edmonton, Alberta; and Fargo, ND. The table below shows the cost of airplane tickets in dollars between these cities. [6]

From/To	Denver	Edmonton	Fargo
Austin	250	400	350
Boston	400	600	350
Chicago	200	400	250

Where should you send each of your sales people in order to minimize airfare? Solve using Hungarian Method

- Q5) a)** Differentiate between PERT and CPM with examples. [7]

- b)** Discuss Goal programming and formulation algorithms? [7]

- Q6)** a) What are the certain and uncertain risks involved in decision making?[7]  
b) Draw the network diagram and determine the critical path for the following project: [7]

Activity	Time estimate (Weeks)
1-2	5
1-3	6
1-4	3
2-5	5
3-6	7
3-7	10
4-7	4
5-8	2
6-8	5
7-9	6
8-9	4



Total No. of Questions : 12]

SEAT No. :

**P4848**

[Total No. of Pages : 2

**[5355]-726**

**M.E. (Computer Networks) (Semester - II)**

**NETWORK DESIGN AND ANALYSIS**

**(2017 Pattern)**

*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 the right indicate full marks.*
- 3) Draw neat diagram wherever necessary.*
- 4) Use of scientific calculator is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1)** What are various Network design issues? Give Example. **[8]**

OR

**Q2)** How you can measure the performance of the network by using Performance Metrics? **[8]**

**Q3)** Draw and Explain Main Header and Extension Headers of IPV6 Protocol. **[8]**

OR

**Q4)** With neat diagram explain transition from IPV4 to IPV6. **[8]**

**Q5)** Draw the state transition diagram for discrete time M/M/1 queue also write the transition matrix. **[9]**

OR

**Q6)** What are queue performance parameters? Explain M/M/1 queue model performance. **[9]**

**P.T.O.**

**Q7)** What is the need of routing algorithm.? Explain and write Bellmon-ford algorithm. [8]

OR

**Q8)** Explain in detail about representation of networks with suitable example. [8]

**Q9)** State and Explain various QoS mechanisms to ensure QoS in networks.[9]

OR

**Q10)** Why it is necessary to study Queue management algorithms? Explain following terms in queuing analysis. [9]

- a) Queue throughput
- b) Efficiency ( $\eta$ )
- c) Traffic conservation

**Q11)** Define the following terms : [8]

- a) Next generation networks
- b) Cyber physical systems

OR

**Q12)** State and Explain different smart devices and their services. [8]



Total No. of Questions : 12]

SEAT No. :

**P4849**

[Total No. of Pages : 2

**[5355]-727**

**M.E.(Computer Networks)**

**DATA ALGORITHMS**

**(2017 Pattern)**

*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 whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary.*

**Q1)** What is secondary sort in Hadoop and how does it work? Explain with suitable example. **[8]**

OR

**Q2)** What is order inversion? Explain order inversion design pattern with suitable example. **[8]**

**Q3)** What is left outer join operation in map reduce join? Explain left outer join operation with real world example. **[8]**

OR

**Q4)** Explain role of left outer join implementation in Spark. **[8]**

**Q5)** List out various secondary sorting techniques. Why use for analysis of data. **[9]**

OR

**Q6)** Explain K- fold duplication approach for Reduce task granularity at the cost of greater data replication in the Map phase. **[9]**

**P.T.O.**

**Q7)** List out various application areas for Market Basket Analysis, market basket analysis using map reduce. [8]

OR

**Q8)** Explain market basket analysis algorithm implementation using HDFS. [8]

**Q9)** List out difference between basic scatter search design and advance designs. [9]

OR

**Q10)** Describe a training method for scatter search algorithms? How does it differ from traditional training in neural network? [9]

**Q11)** Explain the minimum cost flow problem and its solution with real application. [8]

OR

**Q12)** List out various optimization algorithm. Explain application of the simplex algorithm. [8]



Total No. of Questions : 5]

SEAT No. :

P4850

[Total No. of Pages : 3

[5355]-731

**M.E. (Information Technology)**  
**MATHEMATICAL FOUNDATION OF INFORMATION**  
**TECHNOLOGY**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1)** Solve any two :

- a) Suppose that a pair of fair dice is tossed and let the random variable X denote the sum of the points. **[5]**
  - i) Obtain the probability distribution for X.
  - ii) Construct a graph for this probability distribution.
- b) Explain in detail about the various operators involved in genetic algorithm. **[5]**
- c) Using your own institution and your own definition of universe of discourse, write & plot fuzzy membership functions for the designing of Washing Machine by considering parameters: {Dirt, Grease, WashTime}. Assume Dirt & grease on a scale of 0 - 100, WashTime on a scale of 0 - 60. **[5]**

**Q2)** Solve any two :

- a) Explain graph traversals algorithm with examples. **[5]**
- b) Two random sample drawn from two normal populations are: **[5]**

Sample 1	20	16	26	27	23	22	18	24	25	19		
Sample 2	27	33	42	35	32	34	38	28	41	43	30	37

Test using variance ratio at 5% & 1% level of significance whether the two populations have the same variance. ( $F_{0.05,11,9} = 3.11$ ,  $F_{0.01,11,9} = 5.20$ )

**P.T.O.**

- c) A continuous random variable X has the probability density given by [5]

$$f(x) \begin{cases} = 2e^{-2x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Find

- i)  $E(X)$ ,  
 ii)  $E(X^2)$ .

**Q3)** Solve any two :

- a) Set up an analysis of variance table for the following per acre production data of three varieties of wheat, each grown on 4 plots and state if the variety differences are significant. [5]

Plot of Land	Per acre production data		
	Variety of Wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

- b) Describe the concepts involved in real-coded genetic algorithm. [5]  
 c) Explain simplex algorithm with example. [5]

**Q4)** Solve any two :

- a) Consider two fuzzy sets given by [5]

$$\tilde{E} = \begin{matrix} y_1 & y_2 \\ x_1 & \begin{bmatrix} 0.6 & 0.3 \\ 0.2 & 0.9 \end{bmatrix} \\ x_2 & \end{matrix} \quad \tilde{I} = \begin{matrix} z_1 & z_2 & z_3 \\ y_1 & \begin{bmatrix} 1 & 0.5 & 0.3 \\ 0.8 & 0.4 & 0.7 \end{bmatrix} \\ y_2 & \end{matrix}$$

Obtain fuzzy relation  $\tilde{U}$  as a composition between the fuzzy relations.

- b) Find the probability that in tossing a fair coin three there will appear [5]  
 i) 3 heads,  
 ii) 2 tails and 1 head.  
 iii) at least 1 head,  
 iv) not more than 1 tail.  
 c) Explain types of problems in optimization. [5]



**Q5)** Solve any two :

- a) Prove Max-flow Min-cut theorem. [5]
- b) Genetic theory states that children having one parent of blood type A and the other of blood type B will always be of one of three types A, AB, B and that the proportion of three type will on an average be as 1 : 2 : 1. A report states that out of 300 children having one A parent and B parent, 30% were found to be type A, 45% type AB and remainder type B.  
Test the hypothesis by  $\chi^2$  test. ( $\chi^2_{0.05,2} = 5.991$ ) [5]
- c) Write a short note on the following : [5]
- i) Multicollinearity
  - ii) Partial association between two variables



Total No. of Questions : 7]

SEAT No. :

P4851

[Total No. of Pages : 2

[5355]-732

M.E.

**INFORMATION TECHNOLOGY**

**Advance Software Engineering & Project Management  
(2017 Pattern)**

*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 Prescriptive Process Model with examples. **[5]**

b) What is Software Requirement Engineering. Explain requirement elicitation in terms of Functional and non functional requirements using any suitable example. **[5]**

**Q2)** a) Discuss any two design concepts with suitable eg. **[5]**

b) Based on your experience with a bank ATM. draw an activity and sequence diagram that models the data processing involved when a customer withdraws cash from the machine. **[5]**

**Q3)** Write a short note on any two **[10]**

- a) UID
- b) Petrinets
- c) Crystal

**Q4)** a) Compare PERT and CPM techniques with respect to Project planning, scheduling and estimation. **[4]**

b) What is code cloning? Discuss various techniques of it with eg. **[6]**

**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) Discuss the various quality attributes used to assess quality of the software. [5]
- Q6)** a) Explain the various steps involved in webApp Design. [5]
- b) Explain Service-oriented Software Engineering with respect to case study. [5]
- Q7)** Write a short note on any two : [10]
- a) Aspect Oriented Programming
- b) Ishikawa's seven tools
- c) GERT
- d) CMMI-IPPD



[5355]-733

**M.E. (Information Technology)**  
**APPLIED ALGORITHMS**  
**(2017 Pattern) (Semester - I)**

Time : 3 Hours]

[Max. Marks : 50

*Instructions to the candidates:*

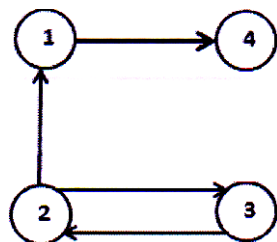
- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.

**Q1) a)** Find out minimum cost spanning tree using Kruskal's algorithm for given graph. [2]

Edge	Cost	Edge	Cost
(a,b)	3	(c,d)	6
(a,f)	5	(c,f)	4
(a,e)	6	(f,d)	5
(b,c)	1	(f,e)	2
(b,f)	4	(e,d)	8

- b) Solve a recurrence relation  $a_n = a_{n-1} + 2a_{n-2}$  with  $a_0 = 2$  and  $a_1 = 7$ . [4]
- c) Define a group on  $Z_n$  using addition modulo  $n$  and prove that the system  $(Z_n, +_n)$  is a finite abelian group. [4]

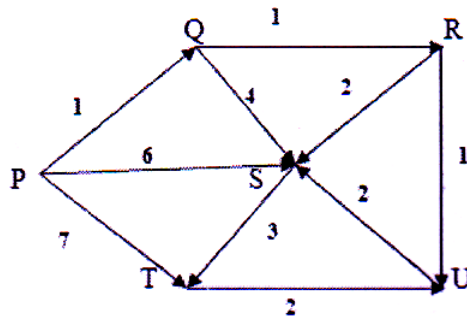
**Q2) a)** Find transitive closure of given graph using dynamic programming approach. [2]



- b) Write, explain and analyse Rabin-Karp algorithm. [4]
- c) Analyze best, average and worst case of Quick Sort in detail. [4]

**Q3) a)** Apply Dijkstra's algorithm for finding all shortest paths from a single source 'P' in a given graph. Also analyze the Dijkstra's algorithm using following data structures: [3]

- i) Adjacency Matrix and
- ii) Minheap/priority queue



b) Solve the following recurrence relation using backward substitution method. [3]

$$T(n) = 4T(n/3) + n^2 \dots \text{if } n \geq 2$$

$$T(1) = 1 \dots \text{if } n = 1$$

c) Write and explain an algorithm to determine whether any pair of line-segments intersect. [4]

**Q4) a)** State and prove Max-flow Min-cut theorem. [3]

b) Prove that for all integers a, k and n,  $\gcd(a, n) = \gcd(a + kn, n)$ . [3]

c) Prove that the running time of an algorithm is  $\Theta(g(n))$  if and only if its worst-case running time is  $O(g(n))$  and its best-case running time is  $\Omega(g(n))$ . [4]

**Q5) a)** What is randomized algorithm? Explain types of randomized algorithms. [5]

b) Write a parallel algorithm for expression evaluation. [5]

**Q6) a)** Solve the following salesman problem using approximation algorithm. **[5]**

0	11	10	9	6
8	0	7	3	4
8	4	0	4	8
11	10	5	0	5
6	9	5	5	0

b) What is online algorithm? Write and explain obstacle traversal algorithm. **[5]**

**Q7) a)** Show the result of inserting the keys, **[5]**

*F, S, Q, K, C, L, H, T, V, W, M, R, N, P, A, B, X, Y, D, Z, E in order into an empty B-tree with minimum degree 2.*

b) Discuss various parallel computational modules and explain how they achieve the parallelism in algorithmic design. **[5]**

**Q8) a)** What are the properties of the red-black tree? Explain delete operation with example. **[5]**

b) Write algorithm for pointer doubling problem. What is its time complexity. **[5]**



Total No. of Questions : 5]

SEAT No. :

P4853

[Total No. of Pages : 2

[5355]-734

M.E.

**INFORMATION TECHNOLOGY**

**Research Methodology**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data, if necessary.*

**Q1) a)** Describe the various classification of research, Differentiate between fundamental research and action research. Elaborate your answer with examples. **[5]**

b) What are the different steps involved in a research process? What are the techniques involved in defining a research problem? **[5]**

**Q2) a)** Indicate the main characteristics of a good hypothesis and uses of a hypothesis in various types of research studies. Differentiate between alternative hypotheses and null hypotheses. **[5]**

b) Define the term 'Review of literature', how is it different from traditional meaning? Enumerate the objectives and significance of review of literature. **[5]**

**Q3) a)** Enumerate the different methods used for collecting data. Explain its merits and demerits. **[5]**

b) What are the main purposes and functions of data analysis? **[5]**

**P.T.O.**

- Q4) a)** Explain the following terms used in a research. **[5]**
- i) Research proposal or synopsis or outline of a research project,
  - ii) Research report, or thesis or dissertation,
  - iii) Research Summary, and
  - iv) Research Abstracts.
- b) Technical paper conveys specific information about a technical subject or topic to a specific audience for a specific purpose. What are the strategies and attributes in writing good technical paper? Explain. **[5]**
- Q5) a)** What is meant by Intellectual Property? What are Intellectual Property rights? Why does intellectual property need to be promoted and protected? **[5]**
- b) Copyright protects the rights of authors. How an author has been defined under the Copyright Act? Briefly explain the procedure relating to registration of copyright. **[5]**





Total No. of Questions : 5]

SEAT No. :

P4854

[Total No. of Pages : 2

[5355]-735

**M.E. (Information Technology)**  
**CYBER SECURITY AND FORENSICS**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*

**Q1)** Solve any two

- a) Distinguish between authentication and authorization. [5]
- b) 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]
- c) Classify the different types of spoofing attacks. [5]

**Q2)** Solve any two

- a) How the Reference Monitor Enforces Security Rules? [5]
- b) A company wants to ensure that system is accessed by authorized users only. Which security model should implemented to achieve this use case. [5]
- c) Explain the Clark-Wilson security model. [5]

**P.T.O.**

**Q3) Solve any two**

- a) Explain the role of third-party arbiter in successful implementation of public key infrastructure. [5]
- b) Explain Cross-site request forgery attack with example. [5]
- c) Explain forensic analysis and its types. [5]

**Q4) Solve any two**

- a) Explain the scientific process of cyber forensics analysis. [5]
- b) A cyber crime is classified as violent crime. Justify with reasons. [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 the evidence preservation mechanisms for digital data in forensic law. [5]
- b) Which attributes of NTFS master file table are useful for forensic analysis. [5]
- c) Explain the role of packet capturing tools in forensic examination. [5]



Total No. of Questions : 8]

SEAT No. :

P4855

[Total No. of Pages : 2

**[5355]-736**  
**M.E. (Information Technology)**  
**CLOUD AND DATA TECHNOLOGIES**  
**(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) *Assume Suitable data, if necessary.*

**Q1) a)** Enlist and explain in brief six characteristics of Cloud Computing. [6]

b) Explain any two Cloud deployment models. [4]

**Q2) a)** Explain in brief about hardened virtual server images. [6]

b) Write a short note on cloud storage levels. [4]

**Q3) a)** Explain zero downtime architecture with diagram. [6]

b) What is SLA? List two SLA guidelines. [4]

**Q4) a)** Draw and explain data science process. [6]

b) Write a short note on Naive Bayes classification method. [4]

**Q5) a)** Explain MapReduce with example. [6]

b) Write a short note on data leakage. [4]

**P.T.O.**

- Q6)** a) Explain Hadoop ecosystem with neat diagram. [6]  
b) Explain in brief dialectical relationship between Cloud computing and Big data. [4]
- Q7)** a) Compare k-means and k-NN algorithms. [6]  
b) List different cloud security threats. Explain virtualization attack with example. [4]
- Q8)** a) Write a short note on operating system based virtualization. [5]  
b) What is Big Data problem? Explain any Big Data problem in detail. [5]



Total No. of Questions : 6]

SEAT No. :

P4856

[Total No. of Pages : 5

[5355]-737

**M.E. (Information Technology)**  
**INFORMATION TECHNOLOGY ORIENTED**  
**OPERATION RESEARCH**  
**(2017 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any one of Q1 or Q2, rest all questions compulsory.*
- 2) *Assume Suitable data, if necessary.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

**Q1) a)** Solve using Simplex Method: **[7]**

Maximize  $Z = 2x_1 + 3x_2 + x_3 + 7x_4$

Subject to:  $8x_1 + 3x_2 + 4x_3 + x_4 \leq 6$

$$2x_1 + 6x_2 + x_3 + 5x_4 \leq 3$$

$$x_1 + 4x_2 + 5x_3 + 2x_4 \leq 7$$

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

b) Write short note on "Deriving the solution from the model". **[3]**

OR

**Q2) a)** Solve the following using dual simplex method: **[7]**

Minimize  $Z = x_1 + x_2$

Subject to:  $2x_1 + x_2 \geq 4$

$$x_1 + 7x_2 \geq 7$$

$$x_1, x_2 \geq 0$$

b) Construct the dual of the given Linear Programming Problem: **[3]**

Maximize  $Z = 4x_1 + 5x_2 + 12x_3$

Subject to:  $2x_1 + x_2 + x_3 \leq 4$

$$3x_1 - 2x_2 + x_3 = 12$$

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

**P.T.O.**

**Q3)** Attempt any two:

- a) Consider the problem of assigning 5 operators to 5 machines. The assignment cost are as given in table below: **[5]**

	m1	m2	m3	m4	m5
A	7	7	-	4	8
B	9	6	4	5	6
C	11	5	7	-	5
D	9	4	8	9	4
E	8	7	9	11	3

Operator A cannot be assigned to machine m3 and operator C cannot be assigned to machine m4. Find the optimal assignment schedule.

- b) Determine the initial basic feasible solution for the given transportation matrix using: **[5]**
- i) North-West Corner Rule
  - ii) Vogels Approximation Method

	1	2	3	4	5	Supply
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	

- c) Determine the optimal (Minimum) schedule for the given transportation matrix: **[5]**

	A	B	C	D	E	Supply
1	13	--	31	8	20	200
2	14	9	17	6	10	175
3	25	11	12	17	15	150
4	10	21	13	--	17	325
Demand	110	90	120	230	160	

**Q4)** Attempt any two:

- a) Mr. X has Rs. 10,000 to invest in one of three options: A, B, or C. The return of his investment depends on whether the economy experiences Inflation, Recession or No Change at all. The possible returns under each economic condition are given below: [5]

Strategy	State of Nature		
	Inflation	Recession	No Change
A	2000	1200	1500
B	3000	800	1000
C	2500	1000	1800

What should he decide using Pessimistic Criterion, Optimistic Criterion, Equally Likely Criterion and Regret Criterion?

- b) Explain “Expected Value of Perfect Information (EVPI)” with example. [5]
- c) Solve the following game using Maximin (Minimax) principle, whose pay matrix are given below: Include in your answer: [5]
- Strategy selection of each player,
  - The value of the game to each player. Does the game have saddle point?

Player A	Player B			
	B1	B2	B3	B4
A1	1	7	3	4
A2	5	6	4	5
A3	7	2	0	3

**Q5)** Attempt any two:

- a) Define the following Dynamic Programming terms: [5]
- Stage
  - State Variable
  - Decision Variable
  - Immediate Return
  - Optimal Return

- b) A student has to take an examination in 3 courses x, y and z. He has 3 days for studying. He feels that it would be better to devote a whole day to study one single course. So he may study a course of one day, 2 days or 3 days or not at all. His estimates of grades he may get according to days of study he puts in are as follows: [5]

Study Days	Course		
	x	y	z
0	1	2	1
1	2	2	2
2	2	4	4
3	4	5	4

How many days should he allocate to each course so that he gets the best result?

- c) Consider the problem of designing an electronic device that consists of 3 main components. The components are arranged in series so that the failure of one of them will result in the failure of the whole device. Therefore, it is decided that the reliability (probability of failure) of the device should be increased by installing parallel units on each component. Each component may be installed in, at the most, 3 parallel units. The total capital (in thousands Rs.) available for the device is 10. The following data is available: [5]

Number of Parallel Units $m_i$	Components					
	1		2		3	
	$R_1$	$C_1$	$R_2$	$C_2$	$R_3$	$C_3$
1	0.5	2	0.7	3	0.6	1
2	0.7	4	0.8	5	0.8	2
3	0.9	5	0.9	6	0.9	3

where  $R_i$  and  $C_i$  ( $i = 1, 2, 3$ ) is the reliability and the cost of the  $i$ th component, respectively. Determine the number of parallel units that will maximize the total reliability of the system without exceeding the given capital.



**Q6)** Attempt any two :

- a) Draw the network diagram from the following list of activities: **[5]**

Activity	Predecessor Activity
A	--
B	A
C	A
D	C
E	B, C
F	D, E
G	E
H	G
I	D, F
J	I, H
K	J

- b) For the following set of activities, the time required to complete the activity is given. **[5]**

Activity	Time in Days	Predecessor Activity
A	5	--
B	7	A
C	2	B
D	3	B
E	1	C
F	2	D
G	1	C
H	3	E, F
I	10	G, H

- i) What is the minimum completion time for the project.
- ii) Find the total float and free float (if any) for all the non-critical activities.
- c) What is Forecasting Model? Discuss some applications of the Forecasting Model. **[5]**



Total No. of Questions : 8]

SEAT No. :

P4857

[Total No. of Pages : 2

**[5355]-741**  
**M.E. (Chemical)**  
**MATHEMATICAL AND STATISTICAL METHODS**  
**(2017 Pattern) (Theory)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions from each section.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** Solve the differential equation by power series method. **[5]**

$$y'' = 2xy$$

b) Discuss the characteristics of Legendre's polynomial equation? **[5]**

**Q2) a)** Solve the following system of ODE using Laplace transform method using initial conditions as  $x(0) = 1$ ;  $y(0) = 0$  **[6]**

$$x' - y = -e^t$$

$$y' + x = \cos t$$

b) Write note on criteria for critical point stability. **[4]**

**Q3) a)** Obtain the Laplace's equation in two dimensions for heat flow. **[5]**

b) Write a note on series of complex terms. **[5]**

**Q4) a)** Evaluate  $\int_0^{1+i} (x^2 + iy) dz$  along the paths  $y = x$  and  $y = x^2$ . **[5]**

b) Discuss the solution techniques using a Fourier-Legendre series. **[5]**

**P.T.O.**

**Q5) a)** In a partially destroyed laboratory, record of an analysis of correlation data, the following results are legible: [6]

Variance of  $X = 9$ , Regression equation:

$$8X - 10Y + 66 = 0, 40X - 18Y = 214$$

What are

- i) The mean value  $X$  and  $Y$ .
  - ii) The correlation coefficient between  $X$  and  $Y$ .
- b) State the steps in constructing Latin square & differentiate between statistics and parameter? [4]

**Q6) a)** Discuss the procedure to calculate the mean from ungrouped data? [4]

b) Compute the coefficient between  $X$  and  $Y$  using following data: [6]

<b>X</b>	1	3	5	7	8	10
<b>Y</b>	8	12	15	17	18	20

**Q7) a)** Fit a normal distribution to the following data of weights of 100 students of Delhi University and test the goodness of fit. [5]

<b>Weights (kg) :</b>	60-62	63-65	66-68	69-71	72-74
<b>Frequency :</b>	5	18	42	27	8

b) In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to be defective. The blades are supplied in packets of 10, use poisson distribution to calculate the approximate number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets. [5]

**Q8) a)** Discuss the statistical quality control approach with typical examples?[5]

b) Fit a straight line  $y = a + bx$  to the following data by method of least squares. [5]

x: 0 1 3 6 8

y: 1 3 2 5 4



Total No. of Questions : 8]

SEAT No. :

P4858

[Total No. of Pages : 2

**[5355]-742**  
**M.E. (Chemical)**  
**PROCESS OPTIMIZATION**  
**(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) What is process optimization & its scope? [5]**

B) Write the types of optimization. [5]

**Q2) A) Explain constrained optimization. [5]**

B) Draw the flow chart for implementing Fibonacci method. [5]

**Q3) Minimize  $f(x) = x^3 + (9/(2+x)) + (1/(3+x^2))$ . Use Fibonacci Search Method. Write complete algorithm for this method and demonstrate at least 3 steps towards finding optimized solution for the above function. Do not try to solve it completely. [10]**

**Q4) 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. [10]**

**Q5) Write short notes: [10]**

- A) Gradient based search.
- B) Concavity Vs Convexity of a function.

**P.T.O.**

**Q6)** Explain in detail the Lagrange multiplier method for optimization. [10]

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

A) Genetic Algorithms.

B) Sufficient Conditions.

**Q8)** Minimize  $f(x) = (x_1 - 8)^2 + X_2^2$  [10]

Subject to linear constraints

$$x_1 \geq 0, x_2 \geq (-10), 7 - 2x_1 - x_2 \geq 0, 24 - 3x_1 - 2x_2 \leq 0.$$



Total No. of Questions : 8]

SEAT No. :

P4859

[Total No. of Pages : 2

**[5355]-743**  
**M.E. (Chemical)**  
**ADVANCED SEPARATION PROCESSES**  
**(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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1) a)** Discuss various conventional separation processes? What are recent advances in separation techniques based on size and ionic properties? **[8]**
- b) Differentiate between equilibrium governed separation processes and rate governed separation processes. **[2]**

- Q2)** Discuss details of Plate-and-Frame membrane system with typical schematic diagram? Also discuss advantages of membrane separation systems. **[10]**

- Q3) a)** What is concentration polarization & fouling? Discuss various methods to reduce fouling. **[7]**
- b) Explain Supercritical fluid extraction. **[3]**

- Q4)** What are different types and choice of adsorbents and adsorption isotherms? Discuss brief about the design procedure of adsorption column. **[10]**

- Q5) a)** Explain working principle, mechanism and Design aspects of Pervaporation along with schematic diagram. **[8]**
- b) Explain liquid membranes. **[2]**

**P.T.O.**

**Q6)** Describe brief about classification of various chromatographic techniques? Describe HPLC with principle, working mechanism along with typical schematic diagram? **[10]**

**Q7) a)** Discuss the reactive absorption for removal of hazardous gases like  $H_2S$ ,  $SO_x$ ? **[5]**

b) Write a note on oil spill management. **[5]**

**Q8) a)** Explain the concept of reactive distillation with suitable example. **[5]**

b) What is an electrophoresis technique? Differentiate between electrophoresis and di-electrophoresis techniques? **[5]**



Total No. of Questions : 8]

SEAT No. :

P4860

[Total No. of Pages : 2

**[5355]-744**  
**M.E. (Chemical)**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

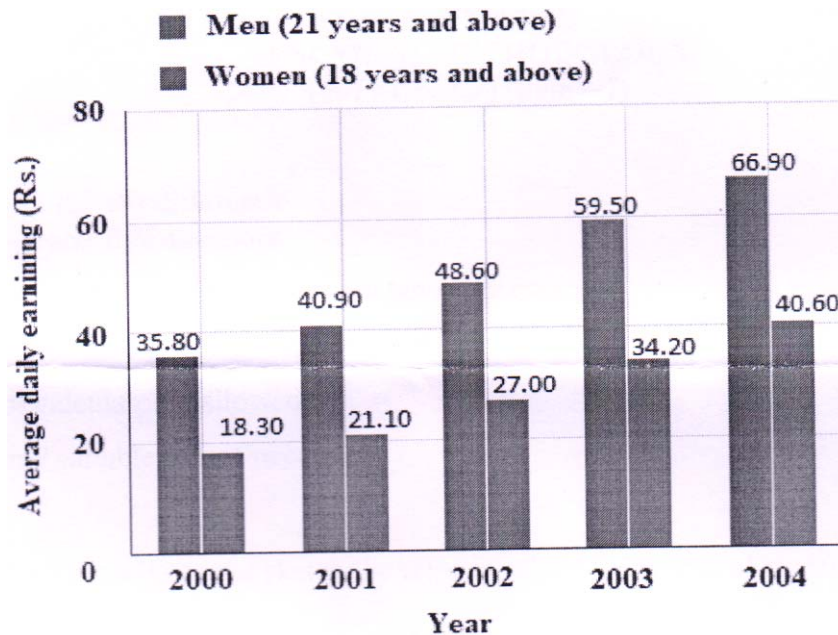
- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1)** a) Explain with a neat sketch the steps involved in process of research. [5]  
b) The task of defining Research Problem often follows a sequential pattern. Explain. [5]
- Q2)** a) What are the approaches to probability? Explain any two with suitable example. [5]  
b) What do you mean by regression? Explain Simple Regression. [5]
- Q3)** a) Write an explanatory note on factorial ( $2^k$ ) design. [5]  
b) What is Design of Experiments? Explain the significance of planning DOE. [5]
- Q4)** a) The following is a multiple bar chart showing men's and women's average daily earnings in certain industries. Study the chart and answer the questions given below. [7]  
i) The difference between the average daily earnings of men and women over successive years

**P.T.O.**



- ii) In which year is the ratio of man's average daily earnings to women's average daily earnings is the highest?
- iii) In which year is the percentage increase in the average daily earnings of men over the preceding year, the maximum?



- b) Define frequency distribution and percent frequency distribution. [3]

**Q5)** a) Discuss the types, characteristics and function of hypothesis in research. [5]

- b) What are the types of graphs? Enlist significance of graphs in research. [5]

**Q6)** a) Enlist the precautions for writing a research report. [5]

- b) Deciding the objective of research project is important for success of project, Explain. [5]

**Q7)** a) Explain in detail the different types of citation methods. [5]

- b) What is the significance of research report? Explain the various steps in writing a research report. [5]

**Q8)** a) What do you mean by Intellectual Property Rights? Explain patent. [5]

- b) Write down the procedure to file a patent in India. [5]



[5355]-745

**M.E. (Chemical Engineering)**  
**ADVANCED TRANSPORT PHENOMENA**  
**(2017 Pattern) (Theory)**

*Time : 3 Hours]**[Max. Marks : 50**Instructions to the candidates:*

- 1) *Answer any 5 questions from out of 8 questions, all questions carry equal marks.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of electronics calculator is allowed.*
- 4) *Assume suitable data. if necessary.*
- 5) *Figures to the right indicate full marks.*

**Q1) a)** A solid sphere of radius  $R$  is rotating slowly at a constant angular velocity  $\Omega$  in a large body of quiescent fluid. Develop expressions for the pressure and velocity distributions in the fluid and for the torque  $T_2$  required to maintain the motion. It is assumed that the sphere rotates sufficiently slowly that it is appropriate to use creeping flow version of equation of motion, use spherical coordinates. [6]

b) Derive the equation for velocity for flow through the annulus using starting following equations: [4]

$$v_z = -\frac{(P_o - P_L)R^2}{4\mu L} \left[ \left( \frac{r}{R} \right)^2 - 2\lambda^2 \ln \left( \frac{r}{R} \right) + C_2 \right]$$

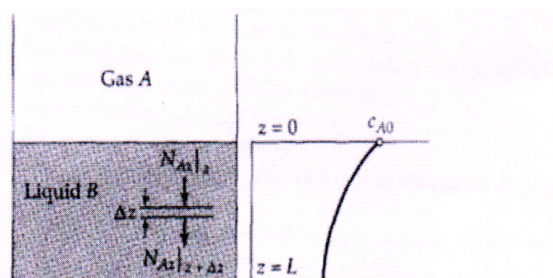
BC 1:  $r = kR, \quad V_z = 0$

BC 2:  $r = R, \quad V_z = 0$

**Q2) a)** Determine the temperature distribution in an incompressible liquid confined between two coaxial cylinders, the outer one of which is rotating at steady angular velocity  $\Omega_0$  and radius ratio  $K$  to be fairly small so that the curvature of the fluid streamlines must be taken into account. The temperatures of the inner and outer surfaces of the annular region are maintained at  $T_k$  and  $T_1$  respectively, with  $T_k \neq T_1$ . Assume steady laminar flow and neglect the temperature dependence of the physical properties. [6]

*P.T.O.*

- b) Discuss the Rheological behavior of non-Newtonian fluid with typical diagram? [4]
- Q3)** a) Heat conduction is flowing through an annular wall of inside radius  $r_0$  and outside radius  $r_1$ . The thermal conductivity varies linearly with temperature from  $k_0$  at  $T_0$  to  $k_1$  to  $T_1$ . Develop an expression for the heat flow through the wall. [6]
- b) Summarize all the steps required in obtaining the equation of change for the temperature. [4]
- Q4)** a) Obtain the equation of continuity for a multi-component mixture. Assume binary system with constant  $\rho^{DAB}$ , with constant  $C^{DAB}$  or with zero velocity. [7]
- b) Explain two-dimensional turbulent flows. [3]
- Q5)** a) Define the heat transfer coefficient, the Nusselt number, the Stanton number, and the Chilton - Colburn  $j_H$ . How can each of these be 'decorated' to indicate the type of temperature difference driving force that is being used? [4]
- b) What is the physical significance of the fact that the turbulent Prandtl number is of the order of unity? [2]
- c) Discuss the macroscopic mass, momentum and energy balance for multicomponent System. [4]
- Q6)** a) Derive the expression for diffusion with a homogeneous chemical reaction in which gas A dissolves in liquid B in a beaker and diffuses isothermally into the liquid phase. As it diffuses, A also undergoes an irreversible first-order homogeneous reaction:  $\mathbf{A} + \mathbf{B} \rightarrow \mathbf{AB}$
- (Refer the figure given below) [8]



Absorption of A by B with a homogeneous reaction in the liquid phase

- b) Write a short note on substantial time derivative? [2]
- Q7)** a) Develop expressions for mole fraction profile  $X_A(y)$  and the temperature profile  $T(y)$  for the system shown in figure, given mole fractions and temperatures at both film boundaries ( $y = 0$  and  $y = \delta$ ). A hot condensable vapor A is diffusing at steady state through a stagnant film of non-condensable gas B, to a cold surface at  $y = 0$ , where A condenses. Assume ideal gas behaviour, uniform pressure, and physical properties to constant. Neglect radiative heat transfer. [7]
- b) Discuss Stream function and potential flow. [3]
- Q8)** a) What are the characteristic dimensionless groups that arise in the correlation for Nusselt numbers for forced convection, free convection and mixed convection? [4]
- b) Explain creeping and inviscid flow. [2]
- c) Explain boundary layer separation and formation of wakes? [4]



Total No. of Questions : 8]

SEAT No. :

**P5300**

**[5355]-746**

[Total No. of Pages : 2

**M.E. (Chemical)**

**ADVANCED PROCESS CONTROL**

**(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 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) Deduce the equation for response of 1<sup>st</sup> Order System to Sinusoidal System. [5]  
b) Write Explanatory note on Linearization of Process Model. [5]
- Q2)** a) Explain Simple Performance Criteria for Controller Tuning. [5]  
b) Elaborate feed forward Control System with Example. [5]
- Q3)** a) Explain in Detail the Relative Gain Array and the Selection of Loops. [5]  
b) Write Explanatory note on Overhead Control. [5]
- Q4)** a) With a suitable sketch, explain the reconstruction of continuous single from their Discrete-Time Values. [5]  
b) Why key element in digital to analog converter makes it possible to use the Computer for implementing control action effectively? [5]
- Q5)** a) Explain in Detail Model Predictive Control (MPC). [5]  
b) Describe Objective Function used in MPC. [5]
- Q6)** a) What is plant wide control system? Explain in detail. [5]  
b) Explain the Flash Drum Control System, with Example. [5]

**P.T.O.**

- Q7)** a) Differentiate between plant wide control system and single equipment control system. [5]
- b) Explain in Detail about Flow sheet controllability analysis. [5]
- Q8)** Describe the Procedure for empirical model identification using least-square estimation method. [10]



Total No. of Questions : 7]

SEAT No. :

**P 5301**

[5355]-747

[Total No. of Pages : 2

**M.E. (Chemical)**  
**ADVANCED REACTION ENGINEERING**  
**(2017 Pattern) (Semester -II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Calculate the mass flux of reactant A to a single catalyst pellet 1 cm in diameter suspended in a large body of liquid. The reactant is present in dilute concentration and the reaction is considered to take place instantaneously at the external pellet surface (i.e.  $C_{AS} \cong 0$ ) The bulk concentration of the reactant is 1.0m and the free system liquid velocity is 0.1 m/s. The kinematic viscosity is 0.5 centistroke (1 centistroke =  $10^{-6}$  m<sup>2</sup>/s), and liquid diffusivity of A is  $10^{-10}$  m<sup>2</sup>/s, T=300k. **[10]**

**Q2)** Explain Langmuir - Hinshelwood model in detail. **[10]**

**Q3)** Develop the RTD for the plug flow reactor and a single ideal stippled tank reactor for reactors with known mixing conditions. **[10]**

**Q4)** Explain segregation model in detail. **[10]**

**P.T.O.**

**Q5)** The second order decomposition reaction  $A+B \rightarrow B+2C$  is carried out in a tubular reactor packed with catalyst pellets 0.4cm in diameter. The reaction is internal diffusion limited. Pure A enters the reactor at a superficial velocity of 3m/s, a temperature of 250°C, and a pressure of 500 kpa. Experiments carried out on smaller pellets where surface reaction is limiting yielded a specific reaction rate of 0.05 m<sup>6</sup>/mol g cat. Calculate the length of bed necessary to achieve 80% conversion.

Data: Effective diffusivity =  $2.66 \times 10^{-8}$  m<sup>2</sup>/s

Ineffective diffusivity = 0.00 m<sup>2</sup>/s

Bed porosity - 0.4

Pellet density =  $2 \times 10^6$  g/m<sup>3</sup>

Internal surface area = 400 m<sup>2</sup>/g **[10]**

**Q6)** Write note on isothermal and adiabatic fixed bed reactors with suitable illustration. **[10]**

**Q7)** Derive the concentration profile and effectiveness factor for cylindrical pellets 0.2 cm in diameter and 1.5 cm in length. Neglect diffusion through the ends of the pellet. Assume that reaction is of first order isomerization. **[10]**





Total No. of Questions : 8]

SEAT No. :

P4862

[Total No. of Pages : 2

[5355]-751

**M.E. Environmental Engineering (Chemical)**  
**APPLIED STATISTICS FOR ENVIRONMENTAL**  
**ENGINEERING**  
**(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) *Your answers will be valued as a whole.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume Suitable data, if necessary.*

**Q1)** a) The mean weight loss of  $n=16$  grinding balls after a certain length of time in mill slurry is 3.42 grams with a standard deviation of 0.68 grams. Construct a 99% confidence interval for the true mean weight loss of such grinding balls under the standard condition. [5]

b) Explain the test of skewness. [5]

**Q2)** a) What is "Population standard deviation". [5]

b) Explain coefficient of variance. [5]

**Q3)** a) What is 't' distribution. [5]

b) Distinguish between statistics and parameters. [5]

**Q4)** a) A random sample of size  $n=100$  is taken from a population with  $\sigma=5.1$ . Given that the sample mean is  $X_{\text{mean}}=21.6$ . Construct a 95% confidence interval for the population mean  $\mu$ . [5]

b) Explain model equation for latin square design. [5]

**P.T.O.**

- Q5)** a) Explain convexity of the frequency curve related to kurtosis. [5]  
b) State and explain the assumptions in the analysis of variance. [5]
- Q6)** a) Discuss the phases of experimental design. [5]  
b) Explain the stepping stone method. [5]
- Q7)** a) Explain stratified sampling and systematic sampling. [5]  
b) Explain Transportation Algorithm. [5]
- Q8)** a) Explain randomized block design model. [5]  
b) Explain graphical sensitivity analysis in the light of Simplex method. [5]



Total No. of Questions : 8]

SEAT No. :

P4863

[Total No. of Pages : 2

[5355]-752

**M.E. Environmental Engg. (Chemical)**  
**ENVIRONMENTAL MANAGEMENT**  
**(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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data, if necessary.*

- Q1)** A) Explain various environmental management tools in detail. [5]  
B) Discuss the various advantages of Environmental Accounts and Auditing. [5]
- Q2)** A) Discuss Green funding and taxes. [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 impact of Legal and constitutional sub-systems of environment on Business? [5]
- Q4)** A) Write down the difference between Regulation, Law and Notification Bills. [5]  
B) What are the different environmental acts? [5]
- Q5)** A) Explain fundamental rights and duties of Indian citizens. [5]  
B) Write short note on general procedure for Risk assessment. [5]

**P.T.O.**

- Q6)** A) Discuss the various steps in rule notification. [5]  
B) Give the difference between regulations and laws. [5]
- Q7)** A) Explain the role of Central Pollution Control Board for sustainable growth. [5]  
B) Write short note on Kyoto 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. :

P4864

[Total No. of Pages : 1

[5355]-753

M.E. (Chemical Engineering) (Environmental)

ENVIRONMENTAL CHEMISTRY

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** Explain the Environmental significance of colloids & coagulation in detail. [10]

**Q2)** What is hard water? Describe the types of hardness and reasons thereof. [10]

**Q3)** Write notes on: [10]

- a) Acid Rain
- b) Global warming

**Q4)** Explain the process of Reclamation of contaminated land. [10]

**Q5)** What are the emerging areas of Environmental sciences & Engineering? [10]

**Q6)** What is CO<sub>2</sub> capture mechanism? [10]

**Q7)** What are different effects of Air pollutants on human health? [10]

**Q8)** What is Anion exchange capacity? How to determine it. [10]



Total No. of Questions : 8]

SEAT No. :

P4865

[Total No. of Pages : 2

[5355]-754

**M.E. (Chemical) Environmental Engineering**  
**RESEARCH METHODOLOGY**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume Suitable data, if necessary.*

**Q1)** a) Definition of scientific and technical research, Objectives of research. **[5]**

b) Explain in detail about the Mathematical tools for analysis. **[5]**

**Q2)** a) Discuss the criteria for choice of topic of research. **[5]**

b) Explain the importance of Literature review. **[5]**

**Q3)** a) Discuss about the problem based learning. **[5]**

b) How do you estimate mean deviation? Sum of squares between samples and sum of squares within sample? **[5]**

**Q4)** a) Discuss the Fundamentals of statistical analysis and inference. **[5]**

b) Explain how to carry out linear regression analysis using computer program. What is the significance of  $R^2$  value? **[5]**

**Q5)** Explain the Factorial experimental design and discuss various method for design of experiments. **[10]**

**P.T.O.**

**Q6)** How to prepare the research proposal? Discuss about the estimation of budget and activity chart for the proposed project? **[10]**

**Q7)** Explain the difference in journal publications, conference paper and short communication. Discuss about the Impact Factor of a journal. **[10]**

**Q8)** Explain the role of Computer in research. Discuss the various softwares and their application in data analysis and preparing research report. **[10]**



Total No. of Questions : 7]

SEAT No. :

P5249

[Total No. of Pages : 2

[5355]-755

**M.E. Environmental Engineering**  
**WASTE WATER TREATMENT & DESIGN**  
**(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 logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Given the following set of data obtained using a batch reactor. Determine the order of reaction and the reaction rate coefficient using integration and differential methods. **[10]**

Time, d	Concentration mole/lit
0	250
1	70
2	42
3	30
4	23
5	18
6	16
7	13
8	12

**Q2)** Determine the amount of liquid Alum required to precipitate the phosphorus in a wastewater that contains 8 mg/l. Also determine the required alum storage capacity if 30- day supply is to store at treatment facility. Based on the laboratory testing, 1.5 mole of alum is required per mole of phosphorus. The flow rate is 12000 m<sup>3</sup>/d. **[10]**

Data : Alum strength = 48%

density of alum solution = 1.2 kg/l

**P.T.O.**



**Q3)** The average flow rate at municipal WWTP is 20,000 m<sup>3</sup>/d. The highest observed peak daily flow. Rate is 50,000 m<sup>3</sup>/d. Design rectangular primary clarifier with a channel width of 6m. Estimate the BOD & TSS removed at average and peak flow. Use overflow rate of 40m<sup>3</sup>/m<sup>2</sup>d. at a average flow and side water depth of 4 m. **[10]**

**Q4)** Explain the principle, mechanism of filtration, in detail. **[10]**

**Q5)** Determine the Freundlich and Langmuir isotherm coefficient for the following GAC adsorption test data the liquid volume used in the batch adsorption test was 1L. The initial concentration of the adsorbate in solution was 3.37 mg/L. Equilibrium was obtained after 7 days. **[10]**

Mass of GAC mg	Equilibrium concentration of adsorbate in solution C <sub>e</sub> , mg/L
0.0	3.37
0.001	3.27
0.010	2.77
0.100	1.86
0.500	1.33

**Q6)** Explain the typical Ion Exchange reactions. **[10]**

**Q7)** Determine the effect of reducing the surface area of an aerated lagoon from 1 ha to 0.5 ha by doubling the depth for the following conditions. **[10]**

- a) Wastewater flow rate  $Q = 3800. \text{ m}^3/\text{d}$
- b) Wastewater temperature  $T_i = 15 \text{ }^\circ\text{C}$
- c) Air temperature during coldest month  $T_a = 2 \text{ }^\circ\text{C}$
- d) Proportionality constant = 0.5



Total No. of Questions : 5]

SEAT No. :

P4866

[Total No. of Pages : 2

[5355]-756

**M.E. (Chemical Environmental Engg.)**  
**SOLID WASTE MANAGEMENT**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** A landfill area of (150 m × 100 m) is available for handling 25 years' municipal solid waste (MSW) for a town of 5,00,000 people. Out of the total landfill area only 80% is actually available for land fill and other is used for auxiliary services. Assuming that average per capita MSW discard per year in town is 0.05 tonne, landfill density is 500 kg/m<sup>3</sup>, and that the 15 percent of the actual landfill cell volume is used for soil cover, estimate (a) the landfill lift in one year. (b) number of years for which the land fill can be used if the landfill can't be increased beyond 25 m. **[10]**

**Q2)** An Indian city is generating solid waste @ 1.2 kg/day per capita for four months and @ 0.5 kg per day per capita for eight months in a year. The population of the city is 2.489 million as per the census of 2011. It is planned to earmark land for land filling of the garbage for a period of five years. Assuming the landfill garbage density of 452 kg/m<sup>3</sup> and a 10.5 m lift determine the area for (a) 25% soil in cell volume (b) 30% soil in cell volume. **[10]**

**Q3)** Estimate the landfill area needed to handle 10 year's Municipal Solid Waste for a town of 250,000 people. Assume per capita solid waste generation is 0.5 kg/day and landfill density of 600 kg/m<sup>3</sup>, and a single 3m lift. Assume that 20 percent of the cell volume is soil used for cover. **[10]**

**P.T.O.**

**Q4)** A landfill site is producing  $3500 \text{ Nm}^3$  biogas daily.  $\text{H}_2\text{S}$  content of biogas is 0.87%. Determine the  $\text{SO}_2$  emission if this gas is used in I.C. engines for the generation of electricity. Also determine the electricity generation capacity. The heating value of biogas is  $18.58 \text{ MJ/Nm}^3$  and only 38.5% of the thermal energy is converted into electricity by IC engine coupled alternators. [10]

**Q5)** What is composting? Explain in detail. [10]



Total No. of Questions :8]

SEAT No. :

**P5302**

[Total No. of Pages :2

**[5355]-757**

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

**INDUSTRIAL WASTE TREATMENT**

**(2017 Course) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) Attempt any 5 questions.*
- 2) Neat diagrams must be drawn whenever necessary.*
- 3) Figures to the right indicates full marks.*
- 4) Assume suitable data, if necessary.*

- Q1)** a) What are organic, chemical and biological characteristics of wastewater? **[4]**  
b) Discuss the water budgeting. **[3]**  
c) Explain the reuse and recycling concept in water management. **[3]**

- Q2)** a) Discuss the oil and grease removal technique from Industrial waste. **[5]**  
b) Discuss Neutralization, Proportioning and Equalization in Industrial waste. **[5]**

- Q3)** a) Give the distinction between clean up and cleaner technologies. **[5]**  
b) Discuss the treatability aspects of raw industrial wastewater with domestic sewage. **[5]**

- Q4)** The BOD results given below are observed on a sample of wastewater. **[10]**

t, days	1	2	4	6	8	10
BOD, mg/lit	6.5	11	18	22	24	26

Plot BOD curve.

Calculate parameters  $K_1$  &  $L_u$ .

**P.T.O.**

- Q5)** a) Draw a flowsheet for the treatment of sugar industry wastewater. [5]  
b) Discuss the sources, characterization and treatments of wastewater in distillery industry. [5]
- Q6)** Discuss the Cost benefit analysis of Common Effluent Treatment Plant. [10]
- Q7)** Explain the concept, objective, design of common effluent treatment plant.[10]
- Q8)** Write a short note on; [10]  
a) Characteristics of dairy unit.  
b) Applications of Membrane Separation Process in wastewater treatment.



Total No. of Questions : 8]

SEAT No. :

P4867

[Total No. of Pages : 3

[5355]-761

**M.E. Production (Common to, Manufacturing &  
Automation And Cad Cam. Engg.)  
MATHEMATICS AND STATISTICS  
(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any 5 Questions Out of 8 Questions.*
- 2) *Neat diagrams should be drawn whenever necessary.*
- 3) *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 the function  $w = \log z$  is analytic , also find it's derivative. [5]

B) Evaluate,  $\int_C \frac{z^2 + z + 1}{z^2 - 7z + 12} dz$  where C is the ellipse  $4x^2 + 9y^2 = 1$   $|z| = 3$ . [5]

**Q2) A)** Solve the boundary value problem  $y'' - y + x = 0$   $0 \leq x \leq 1$ ;  
 $y(0) = y(1) = 0$  By Rayleigh-Ritz method. [5]

B) Find the curves on which the functional [5]

$\int_0^1 (y'^2 + 12xy) dx$  with  $y(0)=0$  and  $y(1)=1$  can be extremised.

**Q3) A)** Explain the standard 5-point formula to solve the Laplace equation [5]

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

**P.T.O.**

- B) Write-down the General second order partial differential equation in two independent variables and then classify it. [5]

Also determine whether the following equation is Elliptic or hyperbolic.

$$(x+1)u_{xx} - 2(x+2)u_{xy} + (x+3)u_{yy} = 0$$

- Q4)** A) If  $p_n(x)$  is a Legendre polynomial of first kind prove that

$$(n + 1)P_{n+1}(x) = (2n + 1)xp_n(x) - np_{n-1}(x) \quad [5]$$

- B) By using series expression for  $J_n(x)$  show that [5]

$$\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$$

- Q5)** A) The following table gives the number of accidents that took place in an industry during various days of the week. [5]

Day	Mon	Tues	Wed	Thurs	Fri	Sat
No.of Accidents	14	18	12	11	15	14

Test if the accidents are uniformly distributed over the week

Given  $\chi^2$  at 5% level for 5 deg. of freedom. is 11.09

- B) A random sample of size 16 has 53 as mean. The sum of squares of the deviations from the mean is 135. Can this sample be regarded as taken from the population having 56 as mean? Obtain 95% and 99% confidence limits of mean of the population. [5]

- Q6)** A) Consider the transformation

$w = ze^{i\frac{\pi}{4}}$  and determine the region in the w-plane corresponding to the triangular region bounded by lines  $x = 0$ ,  $y = 0$ , and  $x + y = 1$  in the z-plane. [5]

- B) Six dice are thrown 729 times. How many times do you expect at least three dice to show a 5 or 6? [5]

- Q7)** A) Fit a Poisson distribution to the set of observations: [5]

x: 0 1 2 3 4

f: 122 60 15 2 1

- B) Prove that the following function

$u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$  is harmonic.

Also find the conjugate function  $v$  and corresponding analytic function  $u+iv$ . [5]

- Q8)** A) In 256 sets of 12 tosses of a coin, in how many cases one can expect 8 heads and 4 tails. [5]

- B) Test whether the following Markov chain (transition matrix ) is ergodic or regular. [5]

$$\begin{bmatrix} \frac{1}{4} & \frac{1}{4} & \frac{1}{2} \\ \frac{1}{4} & \frac{3}{4} & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \end{bmatrix}$$





Total No. of Questions : 8]

SEAT No. :

P4868

[Total No. of Pages : 3

[5355]-762

**M.E. (CAD/CAM) (Production-Manufacturing & Automation)**  
**RESEARCH METHODOLOGY**  
**(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) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1) a)** What is Research Methodology? When is a Qualitative Research Methodology appropriate? [5]

b) What are the issues, or concerns in conducting observational research?[5]

**Q2) a)** Define and explain following concepts related to research design: [10]

- i) Experimental and non-experimental hypothesis-testing research
- ii) Treatments:
- iii) Control
- iv) Cofounded relationship
- v) Research hypothesis

**Q3) a)** What are factors affecting selection of appropriate data collection method. [5]

b) Do you agree or disagree with the following statement: "I don't trust telephone surveys anymore. More and more individuals - particularly young individuals - do not have a land line. Moreover, these individuals are likely to differ from older individuals on key issues such as support for Democratic candidates, acceptance of homosexuality, and support for the legalization of marijuana. If we are missing these younger individuals, our survey estimates will be biased". Explain. [5]

**P.T.O.**

**Q4) a)** Write short notes on: **[10]**

- i) Principles of experimental design
- ii) Pictorial techniques of data collection

**Q5) a)** Certain manufacturing company wants to manufacture 3 products based on their customer demand. Product demands for previous year were 25% for product A, 35% for product B, 40% for product C, The survey of current year conducted for 1500 customer shows that 500 customers preferred product A, 650 customers preferred product B, and 350 customers preferred product C. Determine Chi-square value. **[4]**

b) In a two way analysis of variance, variable X is having five levels and variable Y is having 4 levels as shown in Table. Determine the selection of which variable affects the process significantly? Assume  $f_{critical}$  values for column and row are 3.49 and 3.24 respectively. **[6]**

	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>
X <sub>1</sub>	58	56	37	129
X <sub>2</sub>	33	62	92	98
X <sub>3</sub>	88	33	100	86
X <sub>4</sub>	95	84	113	52
X <sub>5</sub>	89	108	107	41

**Q6) a)** Compare tournament selection and roulette wheel selection methods used in genetic algorithm. **[4]**

b) Using Analytic Hierarchy Method, determine the weights of the criteria for the relative importance matrix as shown below: **[6]**

$$A = \begin{bmatrix} 1 & 0.667 & 1.5 & 0.2 \\ 1.5 & 1 & 4 & 0.4 \\ 0.667 & 0.25 & 1 & 0.15 \\ 5 & 2.5 & 6.667 & 1 \end{bmatrix}$$

**Q7) a)** Why interpretation is considered as important step in research process?  
What are interpretation techniques? **[4]**

**b)** Explain following steps in writing research report: **[6]**

i) Logical analysis of the subject-matter

ii) Preparation of the final outline

iii) Preparation of the rough draft

iv) Rewriting and polishing

v) Preparation of the final bibliography

vi) Writing the final draft

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

a) Graph Theory and Matrix approach

b) Data Envelopment analysis



Total No. of Questions : 8]

SEAT No. :

P4869

[Total No. of Pages : 2

**[5355]-763**  
**M.E. Production (CAD/CAM)**  
**COMPUTER AIDED DESIGN**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.*
- 2) *Q7 and Q8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self - explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** What are the various interactive input devices used in CAD/CAM? List down their advantages and disadvantages. **[5]**

OR

**Q2)** Discuss the use of various display commands available in a drafting package. **[5]**

**Q3)** Explain the three types of coordinate systems used to input, store and display model geometry and graphics. **[5]**

OR

**Q4)** Why parametric representation of geometrical entities are preferred in CAD software? Explain your answer with non-parametric and parametric equations of appropriate geometric entity. **[5]**

**Q5)** Compare the splines created by B-spline and Bezier spline techniques for the same control points. **[7]**

OR

**Q6)** Explain the procedure of mass property calculations in CAD software. **[7]**

**P.T.O.**

- Q7)** a) What is Z-buffer algorithm for B-REP and CSG model? [8]  
b) What sweep representation scheme used for representation of a solid?[7]

**Q8)** Write short note on any three: [18]

- a) Types of animations
- b) Virtual Realism
- c) CAD/CAM integration
- d) Hidden line removal algorithm



Total No. of Questions : 6]

SEAT No. :

P4870

[Total No. of Pages : 2

**[5355]-764**  
**M.E. (Production) (CAD/CAM)**  
**COMPUTER AIDED MANUFACTURING**  
**(2017 Pattern)**

*Time : 3.00 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

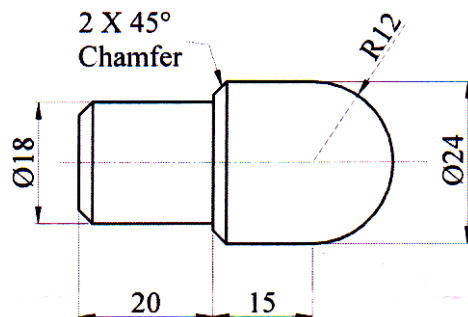
- 1) *Answer Q1 OR Q2; Q3 OR Q4 and Q5 & Q6 are compulsory.*
- 2) *Assume suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** Write a short note on virtual manufacturing. **[5]**

b) Explain various types of CNC machine tools. **[5]**

OR

**Q2)** Write NC program for the following job and also explain the meaning of each step (block). **[10]**



**Q3)** Write short note on (any two) **[10]**

- a) CNC-Press.
- b) CNC-WEDM.
- c) CNC-CMM.

OR

**Q4) a)** What aspects should be considered while designing the material handling system? **[5]**

b) With the help of neat block diagram explain various elements of ASRS. **[5]**

**P.T.O.**

- Q5)** a) Explain automated assembly system. [8]  
b) Explain various automatic inspection methods in brief. [7]
- Q6)** a) Explain use of bar code system for shop floor data collection. [7]  
b) Comment on: Digital Manufacturing. [8]



Total No. of Questions : 8]

SEAT No. :

P4879

[Total No. of Pages : 2

[5355]-765

**M.E. Production (CAD/CAM and Mfg. and Automation)**

**COMPUTER INTEGRATED MANUFACTURING**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4 and Q5 or Q6.*
- 2) *Q7 and Q8 are compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat self-explanatory sketches wherever necessary.*
- 5) *Use of calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1)** What are the components of PLM software? Explain. **[5]**

OR

**Q2)** Describe the need for CIM and the issues addressed by CIM. **[5]**

**Q3)** What is database? What are the objectives and disadvantages of a database?**[5]**

OR

**Q4)** Prepare a chart showing the data required and data generated in the various sections of a manufacturing Industry. **[5]**

**Q5)** Describe the principle of an automated storage and retrieval system used in FMS. **[7]**

OR

**Q6)** What are the different types of drives used in robots? Explain. **[7]**

**P.T.O.**



**Q7)** a) “Networks are today integral parts of CIM systems, which have made data sharing easy, peripheral changing or interfacing easy and information sharing possible.” Comment. **[8]**

b) Describe the three basic network topologies. **[7]**

**Q8)** Write short notes on any three **[18]**

a) Network operating systems

b) Robotic inspection

c) GKS implementation in a CAD workstation

d) AGV in CIM



Total No. of Questions : 8]

SEAT No. :

P4878

[Total No. of Pages : 2

[5355]-766

**M.E. Production (Manufacturing & Automation)**  
**ARTIFICIAL INTELLIGENCE AND ROBOTICS**  
**(2017 Pattern)**

*Time : 3 Hours]*

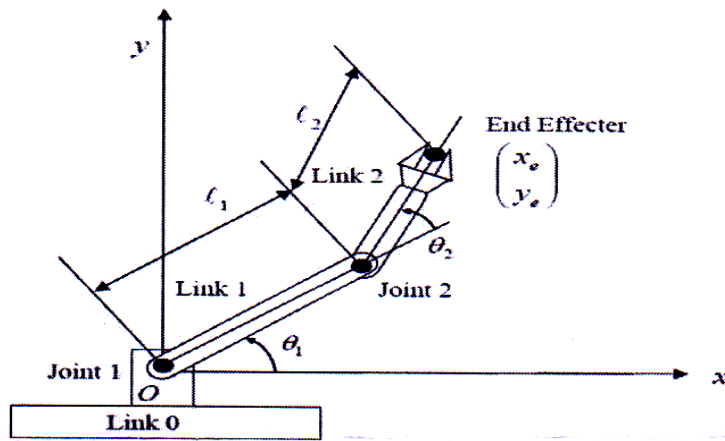
*[Max. Marks : 50*

*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) Discuss robot application in inspection and quality control. [4]  
b) Explain in detail the robot anatomy. [4]  
c) Sketch jointed arm configuration. [2]
- Q2)** a) Discuss D-H algorithm for the assignment of link coordinate system. [4]  
b) If  $a_{xyz} = (4, 3, 1)^T$  and  $b_{xyz} = (6, 2, 3)^T$  are the coordinates with respect to the reference coordinate system, determine the corresponding points  $a_{uvw}$  and  $b_{uvw}$  with respect to the rotated OUVW coordinate system if it has been rotated  $60^\circ$  about OZ axis. [4]  
c) Explain how a position vector P is expressed in homogeneous coordinate. [2]
- Q3)** a) Consider the forward transformation of the two-joint manipulator shown in fig. Given that the length of joint 1,  $L_1 = 100\text{mm}$ , the length of joint 2,  $L_2 = 100\text{mm}$ , the angle  $\theta_1 = 45^\circ$ , and the angle  $\theta_2 = 30^\circ$ , compute the coordinate position for the end-of-the-arm  $P_w$ . [4]

**P.T.O.**



- b) Explain electric control in robot. [4]  
 c) What are the limitations of friction based grippers? [2]
- Q4)** a) Explain vacuum type gripper. [5]  
 b) Discuss various criteria used in the selection of gripper. [5]
- Q5)** a) Describe the architecture of hybrid position-force control. [4]  
 b) Briefly discuss various programming languages? [4]  
 c) What is task level programming? [2]
- Q6)** a) Explain region growing for segmentation. [4]  
 b) Write a short note on contact sensors. [4]  
 c) State the steps in image analysis. [2]
- Q7)** a) Explain the factors on which the number of solution to give inverse kinematic model depends. [4]  
 b) What are the AI techniques to make robot smarter. [4]  
 c) What is Jacobian of a manipulator? [2]
- Q8)** a) How can potentiometer be used to sense position in robot? Explain. [5]  
 b) What is role artificial intelligence in robotics. [5]



Total No. of Questions :6]

SEAT No. :

**P5303**

[Total No. of Pages :2

**[5355]-767**

**M.E. (Production) (CAD/CAM)**

**COMPUTATION TECHNIQUES IN CAD/CAM**

**(2017 Course) (Semester - II) (511307)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2; Q3 or Q4.*
- 2) *Question No.s Q5 and Q6 are compulsory.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Figures to the right indicates full marks.*
- 5) *Assume suitable data, if necessary.*

**Q1)** Write short note on (any two). **[10]**

- a) Assembly of elements and matrices.
- b) Static Analysis by FEA.
- c) Dynamic Analysis by FEA.

OR

**Q2)** Define Engineering stress, strain and true stress-strain and also derive the relation between them. **[10]**

- Q3)** a) Write short note on turbulence model. **[5]**
- b) Explain in short numerical method for convection. **[5]**

OR

**Q4)** a) Solve the differential equation  $\frac{dy}{dx} = 1 + xy$  using Euler's method. **[5]**

Given:  $y(0) = 1$

And also find  $y$  for  $x = 0, 0.1, 0.5$ .

**P.T.O.**

- b) Solve the following equation  $\frac{dy}{dx} = x - 2y$  Using Runge-Kutta 4<sup>th</sup> order method. [5]

Given:  $y = 1$  when  $x = 0$

and find  $y$  at  $x = 0.1$  taking  $h = 0.1$ .

**Q5)** Write short note on (any three). [15]

- Geometric Programming.
- Point Elimination Method.
- Constraint Optimization Algorithms.
- Direct Search Method.

**Q6) a)** Minimize  $f(x_1, x_2) = x_1^2 + x_2^2 - 2x_1 - 4x_2 + 5$  [8]

Such that  $0 \leq x_1, x_2 \leq 4$  using steepest Descent (Cauchy) Method.

Perform first iteration only.

Assume initial point as  $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$

- b) What is a function value corresponding to coded substring value 1101 in Genetic Algorithm. (GA) to minimize the function [7]

$$f(x) = x_1^2 + 3x_2 + 10$$

with in  $0 \leq x_1, x_2 \leq 3$



Total No. of Questions : 8]

SEAT No. :

P4871

[Total No. of Pages : 2

[5355]-773

**M.E. (Production) (Manufacturing & Automation)**  
**ADVANCED MANUFACTURING PROCESSES**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) How melting and solidification of pure metals differs than metal alloys. [4]  
b) How blow molding process take place? [4]  
c) Which major limitations of conventional machining overcome by non-conventional machining processes? [2]
- Q2)** a) How to minimize welding defects occurs during fusion welding? [4]  
b) What you mean by non-destructive testing of weld joints. [4]  
c) Differentiate between destructive and Non-destructive testing's. [2]
- Q3)** a) Explain with neat sketch working principle Abrasive water jet machining. [4]  
b) Which are the major advantages and limitations of Electro Discharge Machining (EDM). [4]  
c) What you mean by non-destructive testing of weld joints. [2]
- Q4)** a) Which are the advantages and limitations of Electro discharge Machining. [5]  
b) Suggest some their causes and remedies for welding defects. [5]

**P.T.O.**

- Q5)** a) A rod of 10 mm diameter is to be reduced to wire of 4 mm diameter. The die angle is  $10^\circ$  and the coefficient of friction at dies and wire interface is 0.5. The flow stress of wire material is  $340 \text{ N/mm}^2$ . Determine drawing stress and drawing load if the drawing speed is 0.7 m/s. [4]
- b) What you mean by electromagnetic forming. [4]
- c) Write two names of non-conventional forming processes. [2]
- Q6)** a) Explain high energy rate forming with neat sketch. [4]
- b) How metal spinning place processes take? [4]
- c) Differentiate between hot forging and cold forging. [2]
- Q7)** a) Explain important process parameters of electro-hydraulic forming. [4]
- b) A tube of 25 mm external diameter and 2 mm thickness is to be reduced to 20 mm external diameter and 1 mm thickness. The die angle is  $24^\circ$  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 ironing? [2]
- Q8)** a) Which are various rolling problems? [5]
- b) Explain forming limit diagram. [5]



Total No. of Questions : 8]

SEAT No. :

P4872

[Total No. of Pages : 2

[5355]-774

**M.E. (Production Engineering) (Manufacturing & Automation)**  
**INDUSTRIAL AUTOMATION**  
**(2017 Pattern) (Semester - I)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** For a swash plate type of pump following data operates: Number of pistons = 9; Piston diameter = 15 mm; Pitch circle diameter of the cylinder = 125 mm; Input power = 5 KW; Volumetric efficiency = 90 %; Mechanical efficiency = 84 %. Calculate theoretical pump displacement and angle of swash plate if maximum pressure and speed at which pump operates is 100 bar and 1000 rpm respectively. **[6]**

b) Explain the following terms: **[2]**

- |                 |                           |
|-----------------|---------------------------|
| i) Viscosity    | ii) Bulk modulus          |
| iii) Fire point | iv) Neutralization number |

c) A 300 cm<sup>3</sup> sample of oil is compressed in a cylinder until its pressure is increased from one atmosphere to 40 atmosphere. Find the percent change in the volume of the oil if the bulk modulus is 1750 MPa. **[2]**

**Q2) a)** Explain fluidic 'NOR/OR' and 'AND/NAND' gates with suitable sketch. Hence draw a suitable pneumatic circuit for a clamping device for a drilling machine such that the clamps are activated before drill is fed to the work. **[6]**

b) Draw symbol and explain working of following valves used in pneumatic circuit. **[4]**

- |                          |                      |
|--------------------------|----------------------|
| i) Quick exhaust valve   | ii) Time delay valve |
| iii) Twin pressure valve | iv) Shuttle valve.   |

**P.T.O.**



- Q3)** a) How many status flag does 8085 have? Discuss the role of each flag. [6]  
 b) Explain criteria used to measure the performance of sensors. [4]

**Q4)** Write short notes on:

- a) Deceleration valve. [5]  
 b) Regenerative circuit and its applications. [5]

- Q5)** a) Write note on: Use of robot in assembly [6]  
 b) Explain with neat sketch revolving feeder. [4]

- Q6)** a) Explain following terms related to robotics: [4]  
 i) Control resolution  
 ii) Spatial resolution  
 iii) Repeatability error  
 iv) Positional accuracy  
 b) Explain SCARA robot application for inverse kinematic solutions. [6]

- Q7)** a) Explain the role of artificial intelligence in foundry management. [6]  
 b) A neuron with 3 inputs has the weight vector  $[0.2 \ -0.1 \ 0.1]^T$  and a bias  $\theta=0$ . If the input vector is  $X = [0.2 \ 0.4 \ 0.2]^T$  then what will be the total input to the neuron? [2]  
 c) Out of four images represented as follows. For which image value the value of entropy is maximum? [2]

$$I_1 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, I_2 = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}, I_3 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, I_4 = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$$

**Q8)** Write short notes on:

- a) Flexible manufacturing system [5]  
 b) Programmable logic controllers [5]



Total No. of Questions : 8]

SEAT No. :

P4873

[Total No. of Pages : 2

[5355]-775

**M.E. (Production Engg.) (Manufacturing & Automation)**  
**ADDITIVE MANUFACTURING**  
**(2017 Pattern) (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 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 calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) Classify the different additive manufacturing processes. [4]  
b) Explain the importance of additive manufacturing in product development. [5]

OR

- Q2)** a) What are the different tooling used in additive manufacturing. [4]  
b) What is additive manufacturing? What are its advantages and disadvantages? [5]

- Q3)** a) Explain the tool path generation in additive manufacturing. [4]  
b) Explain the different properties of prototype. [5]

OR

- Q4)** a) Explain the model reconstruction in additive manufacturing. [4]  
b) Explain the need of additive manufacturing and its various applications. [5]

- Q5)** a) Explain the Selective Laser Sintering with reference to its working process advantages and disadvantages. [8]  
b) Explain the medical and Bio-Additive manufacturing with its applications, advantages and disadvantages. [8]

**P.T.O.**

OR

- Q6)** a) Explain the solid based additive manufacturing process with reference to its principle, working process, advantages and disadvantages. [8]  
b) Explain the STL FORMAT in Rapid Prototyping, what are its advantages and disadvantages. [8]

- Q7)** a) Explain with neat sketch the Electron Beam Melting process. [8]  
b) Write short note on Fused deposition modeling. [8]

OR

- Q8)** a) Explain the Stereo-lithography with reference to its working process, advantages and disadvantages. [8]  
b) Explain the Bio-Additive manufacturing process. [8]



Total No. of Questions : 8]

SEAT No. :

P4874

[Total No. of Pages : 2

[5355]-781

**M.E. (Printing Engineering And Communication Technology)**  
**PROBABILITY, STATISTICS AND REGRESSION**  
**ANALYSIS (RESEARCH METHODOLOGY)**  
**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Draw neat diagram wherever necessary.*
- 2) *Figures to right indicate full marks.*
- 3) *Attempt any five questions.*

**Q1)** Draw and Explain operating characteristic curve. **[10]**

**Q2)** Explain following terms **[10]**

- a)  $\bar{X}$  and R chart
- b) P chart
- c) C chart
- d) Acceptance sampling plan

**Q3)** If 5 % of electric bulbs manufactured by a company are defective, use Poisson Distribution to find the probability that in a box of 100 bulbs:

(Given  $e^{-5} = 0.007$ ) **[10]**

- a) None is defective
- b) 3 bulbs are defective
- c) More than 3 bulbs are defective

**Q4)** The incidence of a certain disease is such that on average, 20 % of workers suffer from it. If 10 workers are selected random, find the probability that, **[10]**

- a) Exactly 2 workers where suffer from the disease
- b) Not more than 2 workers suffer from the disease
- c) At least 9 workers suffer from the disease

**P.T.O.**

**Q5)** 10 samples of mesh cloth 1 m<sup>2</sup> area are inspected and the number of defects found are tabulated in following, **[10]**

Sample No	1	2	3	4	5	6	7	8	9	10
Number of Defects	10	8	9	5	7	7	9	11	7	8

- Calculate  $\bar{C}$
- Calculate upper and lower control limit
- Draw Appropriate control Chart and comment about the process control

**Q6)** Following Data Shows values of sample mean  $\bar{X}$  and range and range R for 10 sample of size of 5 each. Calculate & Draw the control limits for Mean Chart and range chart. **[10]**

Sample No	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	31.8	34	30.8	35	33	33.8	35.8	34	33	33.8
R	4	2	5	5	19	4	14	7	9	5

Component Specification 40.37 +/- 0.1  $A_2 = 0.577$ ,  $D_3 = 0$ ,  $D_4 = 2.110$

- Calculate the value of  $\bar{\bar{X}}$  and  $\bar{R}$
- Calculate Upper limit & Lower limit for  $\bar{X}$  chart
- Calculate Upper limit & Lower limit for R chart
- Plot  $\bar{X}$  chart and R chart

**Q7)** Explain the concept of Statistical quality control state its merit **[10]**

**Q8)** Explain the analysis of variance concept. **[10]**



Total No. of Questions : 6]

SEAT No. :

P4875

[Total No. of Pages : 1

[5355]-782

**M.E. (Printing Engg. & Graphic Communication)**

**PRINTING TECHNOLOGY MANAGEMENT**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All quesitons compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

**Q1)** a) Explain organizational structure of a commercial printing business in detail. **[9]**

b) What are the different methods involved in market analysis. **[9]**

OR

**Q2)** What are the advantages of a systematic plant layout. Draw neat layout for a screen printing set up. **[18]**

**Q3)** a) Explain moving average forecasting. **[8]**

b) Explain how a customer driven quality program is necessary for book binding. **[8]**

OR

**Q4)** Explain activities of a quality assurance department in a digital printing department. **[16]**

**Q5)** Explain the Six Sigma process. What are its advantages in any processing industry. **[16]**

OR

**Q6)** Explain control charts for variables. Explain reasons of color variation in magazine printing by gravure. **[16]**

▽▽▽▽

Total No. of Questions : 3]

SEAT No. :

P4876

[Total No. of Pages : 1

[5355]-783

**M.E. (Printing Engineering & Graphic Communication)**

**MODERN TRENDS IN PRINTING**

**(2017 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Draw neat diagram wherever necessary.*
- 2) Figures to right indicate full marks.*

**Q1)** Explain in detail CI flexo press.

**[18]**

OR

Explain in detail stack flexo press.

OR

Explain in detail parameters affecting ink transfer in flexo.

OR

Explain the effect of flow properties of ink on gravure print quality.

**Q2)** Explain the working of ELS system for a web press.

**[16]**

OR

Explain the correlation of impression pressure and hardness on print quality.

**Q3)** Mention the care and maintenance for gravure process.

**[16]**

OR

Explain the factors affecting ink transfer in offset.



Total No. of Questions : 8]

SEAT No. :

P4877

[Total No. of Pages : 1

[5355]-784

M.E. (Printing Engineering and Communication Technology)

RESEARCH METHODOLOGY

(2017 Pattern)

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Draw neat diagram wherever necessary.*
- 2) Figures to right indicate full marks.*
- 3) Attempt any five questions.*

**Q1)** Explain the statistics in research. **[10]**

**Q2)** Explain research Objectives and its types. **[10]**

**Q3)** What points should be taken into consideration by researchers in developing a sample design for the research Project? **[10]**

**Q4)** Describe the Importance of literature review in defining a research problem. **[10]**

**Q5)** Explain case study method for data collection. **[10]**

**Q6)** Explain the Need of research design. **[10]**

**Q7)** Explain the Different steps in writing report. **[10]**

**Q8)** Describe the precaution to be consider for writing the technical report. **[10]**





Total No. of Questions : 6]

SEAT No. :

**P5304**

**[5355]-786**

[Total No. of Pages : 1

**M.E. (Printing)**

**WEB HANDLING ON PRESS**

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

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) 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)** Write short note on: [18]  
a) Load cells.  
b) Brakes in infeed.  
c) 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)** 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)** What is Static and Dynamic balancing. How is it measured and calculated? [16]

OR

- Q6)** State the surface structures of rollers used as web transport rollers. How is the deflection in the transport rollers measured. What problems occur due to deflection in rollers. [16]



Total No. of Questions :4]

SEAT No. :

**P5305**

[Total No. of Pages :1

**[5355]-787**

**M.E. (Printing Engg. & Graphic Communication)**

**SUBSTRATES AND INKS**

**(2017 Course) (Semester - II) (508109)**

*Time : 2 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) Neat diagrams must be drawn whenever necessary.*
- 2) Assume suitable data, if wherever necessary.*
- 3) Figures to the right indicate full 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

Calculate the total quantity of paper required in the size 45.5×58.5 cms for printing monthly magazine 500 copies in the size 210 mm × 297 mm assuming the magazine contains 32 pages. [16]

- Q4)** Comment on VOC and its significance in printing inks. [16]

OR

State & Explain Quality Control Tests for Substrate and Paper. [16]

