Total No. of Questions : 8]

SEAT No. :

PB3596

[Total No. of Pages :3

[6261]-1
S.E. (Civil Engineering)
GEOTECHNICAL ENGINEERING
(2019 Pattern) (Semester-IV) (201008)

Time : 2½ Hours] *[Max. Marks : 70*

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 whenever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data, if necessary and mention it clearly.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Explain the process of field compaction and its control using Proctor needle. **[6]**

b) Discuss the moisture-density relation graph for standard and modified proctor test. Also explain the significance of ZAV line in the graph. **[5]**

c) Write the equations for stresses in soil for point loading by Boussinesq's and Westergaard's theory and assumptions in these theories. **[6]**

OR

Q2) a) Explain the factors affecting Compaction of soil. **[6]**

b) What is pressure bulb? Explain its significance and draw a neat sketch of pressure bulb for concentrated point load. **[5]**

c) A concentrated load of 300 KN is applied at the ground surface. Compute the vertical pressure: **[6]**

i) At a depth of 6 m below the load.

ii) At a distance of 5 m at the same depth.

Q3) a) Explain the factors affecting shear strength of cohesion less soil and cohensive soil. **[6]**

b) A soil sample fails under and axial stress of 150 kN/m^2 when it is laterally unconfined. The failure makes an angle of 55^0 with the horizontal. Calculate C and Φ. **[5]**

c) What are the different methods to measure shear strength of soil. State merits and demerits of Direct shear test. **[6]**

OR

P.T.O.

Q4) a) The following results were obtained from a triaxial test on two soil specimens, **[6]**

Sample No.	Confining Pressure (kPa)	Deviator Stress at Failure (kPa)	Pore water Pressure (kPa)
1	200	244	55
2	300	314	107

Determine the shear strength parameters of the soil terms of

i) Total stress

ii) Effective stresses

b) Explain in detail Vane shear test. Explain the limitations of Vane Shear test. **[5]**

c) Explain how shear tests are conducted with different drainage conditions. **[6]**

Q5) a) Explain Earth pressure at rest, active earth pressure and passive earth pressure with respect to Wall movement with sketches. **[6]**

b) Explain step by step method of Coulomb's Wedge Theory for determination of earth pressure of retaining wall. **[6]**

c) In a cohesionless soil deposit having unit weight of 18 kN/m^3 and $\Phi = 32^0$. Determine active and passive lateral pressure intensities at depth of 10m. **[6]**

OR

Q6) a) Derive the equation for lateral earth pressure in active state for dry cohesionless backfill with uniform surcharge. **[6]**

b) Explain Culman's method for evaluation of earth pressure. **[6]**

c) A smooth vertical wall retains a level backfill with $\Upsilon = 18$ KN/m^3, $\Phi = 30^0$ and c = 0 to a depth of 8 m. Draw the lateral pressure diagram and compute the total active pressure in dry condition and when water table rises to the GL. Assume Υsat = 22 KN/m^3 **[6]**

Q7) a) Explain landslide causes and remedial measures. **[6]**

b) Explain Taylor's stability number. A slope is of 10 m with stability number equal to 0.055. What is factor of safety? Given $\Upsilon = 20$ kN/m^3, C = 25 kN/m^2, $\Phi = 0$ **[6]**

c) Explain modes of failure of finite and infinite slopes. **[6]**

OR

Q8) a) Explain steps involved in the stability of slopes by method of slices. **[6]**

b) Derive the expression F.O.S for dry infinite slope in sandy soil. **[6]**

c) Write a short note on slope classification. Determine the critical height of excavation of vertical cut in cohesive soil If C = 25 kN/m^2 and unit weight = 17 kN/m^3 $\Phi = 0$. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB-3597

[Total No. of Pages : 2

[6261]-2
S.E.(Civil)
SURVEY
(2019 Pattern) (Semester - IV) (201009)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Ql or2, Q3 or 4, Q5 or 6, Q7or8***
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) Derive the formula for horizontal distance in case of horizontal sight when external focussing telescope. **[6]**

b) Elaborate the characteristics of contours with neat sketches. **[6]**

c) Determine the constants of a tacheometer from the following taken with it: **[6]**

Distance of staff from the tacheometer vertical axis	Reading against stadia wires	
	Lower wire	Upper wire
30m	l.086m	1.383m
60m	0.924m	1.521 m

OR

Q2) a) Enlist & explain various errors in the tacheometry survey. **[6]**

b) State the different methods of contouring. Explain any one with sketch. **[6]**

c) Two distances of 20 m and 100 m were accurately measured out and the intercepts on the staff between the outer stadia webs were 0.196 m at the former distance and 0.996 at the latter. Calulate the tacheometric constants. **[6]**

P.T.O

Q3) a) Explain the method of setting out simple circular curve by offsets from long chord. **[6]**

b) Two tangent intersect of chainage of 1750m. The angle of intersection is 152°. Calculate all data necessary for setting out curve of 246m by the reflection angle method. The peg interval is considered as 25m. Prepare a setting out table if the least count of vernier is 20". Apply check also. **[6]**

c) Explain the types of vertical curve with sketches. **[5]**

OR

Q4) a) Explain. Rankine's method of Deflection for setting out curve. **[6]**

b) Two straights meet at chainage 1800m with deflection angle 60°. The radius of curve is 100m. Find **[8]**

i) Tangent Length

ii) Long Chord

iii) Length of curve

iv) Chainage of T.

c) Explain necessity of transition curves. **[3]**

Q5) a) Describe horizontal and vertical controls in construction surveys. **[6]**

b) Explain in detail – Different segments of SBPS. **[6]**

c) Write not on – Survey for Roads / Railways. **[6]**

OR

Q6) a) Write note on – Use of GPS in surveying. **[6]**

b) Elaborate Survey for Tunnel. **[6]**

c) Write applications of SBPS in surveying. **[6]**

Q7) a) What is hydro graphic surveying and what are its objectives. **[5]**

b) Explain the classification of various triangulation systems. **[6]**

c) Write note on - Classification of aerial photographs. **[6]**

OR

Q8) a) Explain the concept of strength of figure in Geodetic Surveying. **[5]**

b) Describe how a shore line survey is conducted in hydro graphic surveying. **[6]**

c) What are general hints used for flight Planning in aerial photogrammetry. **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PB3598

[Total No. of Pages : 5

[6261]-3

S.E. (Civil)

CONCRETE TECHNOLOGY

(2019 Pattern) (Semester - IV) (201010)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of non programmable calculator is allowed in the examination.***
5) ***Your answers will be valued as a whole.***
6) ***If necessary assume suitable data and indicate clearly.***
7) ***Use of IS codes 10262,456 is not allowed.***

Q1) a) Write short note on: **[9]**

i) Creep of concrete

ii) Shrinkage of concrete

iii) Modulus of elasticity of concrete

b) Describe any two factors affecting the strength of concrete. **[4]**

c) Explain the relationship between compressive strength and tensile strength of concrete. **[4]**

OR

Q2) a) Enlist non destructive tests for concrete. Explain the principal of rebound hammer with neat sketch. Discuss the limitations of rebound hammer test. **[9]**

b) Calculate the compressive strength of following specimens of concrete **[4]**

Sr. No.	Specimen and size	Crushing load in kN
i	Cube 1 :150mm × 150mm × 150mm	580
ii	Cube 2 :150mm × 150mm × 150mm	567
iii	Cylinder 1 : 150 mm diameter × 300 mm height	452
iv	Cylinder 2 : 150 mm diameter × 300 mm height	462

P.T.O.

c) Calculate the split tensile strength of following specimens of concrete **[4]**

Sr. No.	Specimen and size	Splitting load in kN
i	Cylinder 1: 150 mm diameter × 300 mm height	135
ii	Cylinder 2: 150 mm diameter × 300 mm height	145
iii	Cylinder 3: 150mm diameter × 300mm height	155
iv	Cylinder 4: 150 mm diameter × 300 mm height	175

Q3) a) What do you mean by concrete mix, design? What are the objectives in mix design? **[8]**

b) Write step by step procedure for concrete mix design by using IS 10262 method. **[10]**

OR

Q4) a) Design a concrete for grade M30 using IS code method for following data: **[14]**

Parameter	**:**	**Details**
Grade designation	:	M30
Standard deviation,*s*	:	5.00
Factor based on the grade of concrete, X	:	6.50
Type of cement	:	OPC 53 grade conforming to IS 8112
Workability	:	75 mm(slump)
Exposure conditions		Severe (for RCC)
Degree of supervision	:	Good
Maximum cement content	:	450 kg/m^3
Type of aggregate	:	Angular coarse aggregate
Specific gravity of cement	:	3.10
Specific gravity of coarse aggregate and fine aggregate	:	2.75
Water absorption of coarse aggregate	:	0.50 %
Water absorption of fine aggregate	:	1.00 %
Free surface moisture for coarse aggregate	:	Nill
Free surface moisture for fine aggregate	:	Nil

Sieve Analysis

Coarse aggregate

IS Sieve (mm)	Analysis of coarse aggregate fraction		Percentage of different fractions			Remarks
	I	II	I (50%)	II (50%)	Combined (100%)	
20	100	100	50	50	100	Conforming to Table 7 of IS 383
10	2.80	78.30	1.4	39.15	40.55	
4.75	0	8.70	0	4.35	4.35	

Fine aggregate: Conforming to grading Zone II of Table 9 of IS 383

Water content per m^3 of concrete for 50mm slump:

Sr. No.	Nominal maximum size of aggregate (mm)	Maximum water content (kg/m^3)
i)	10	208
ii)	20	186
iii)	40	165

Volume of coarse aggregate per unit volume of total aggregate for water-cement/water-cementitious material ratio of 0.30 :

Sr. No.	Nominal maximum size of aggregate (mm)	Volume of coarse aggregate per unit volume of total aggregate for different zones of fine aggregate		
		Zone III	Zone II	Zone I
i)	10	0.56	0.54	0.52
ii)	12.5	0.58	0.56	0.54
iii)	20	0.68	0.66	0.64

Approximate air content:

Sr. No.	Nominal maximum size of aggregate (mm)	Entrapped air, as % of volume of concrete
i)	10	1.0
ii)	12.5	0.8
iii)	20	0.5

Minimum cement content, maximum W/C and minimum grade of concrete for different exposures with normal weight aggregates of 20 mm nominal maximum size:

Sr. No.	Exposure	Minimum cement content (kg/m^3)	Maximum W/C	Minimum grade of concrete
i)	Mild	300	0.55	M20
ii)	Moderate	300	0.50	M25
iii)	Severe	320	0.45	M30
iv)	Very severe	340	0.45	M35
v)	Extreme	360	0.40	M40

b) What do you mean by : **[4]**

i) Mean strength

ii) Variance

iii) Standard deviation

iv) Coefficient of variation

Q5) a) Write short note on : **[8]**

i) Ready mix concrete (RMC)

ii) Under water concreting

b) Enlist concrete compaction equipments and explain any two of them. **[9]**

OR

Q6) a) Write short note on : **[8]**

i) Fiber reinforced concrete

ii) Ferrocement technique

b) What do you meant by light weight concrete and discuss its types. **[9]**

Q7) a) State the durability of concrete. Enlist the factor affecting the durability of concrete and explain any two of them. **[9]**

b) Write short note on: **[9]**

i) Attack by sea water on concrete

ii) Chloride attack on concrete

iii) Carbonation of concrete

OR

Q8) a) Discuss corrosion of reinforcement in concrete. Explain in detail corrosion monitoring techniques of reinforcement and preventive measures against corrosion. **[9]**

b) What do you meant by the retrofitting of concrete structures? Discuss the application of fiber reinforced polymer (FRP) and polymer impregnated concrete for the retrofitting of concrete structures. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3599

[Total No. of Pages :3

[6261]-4

S.E. (Civil)

STRUCTURAL ANALYSIS

(2019 Pattern) (Semester- IV) (201011)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat sketches 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 allowed.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) Analyze the beam shown in figure 1 by slope deflection method and draw B.M.D Assume uniform flexural rigidity. **[12]**

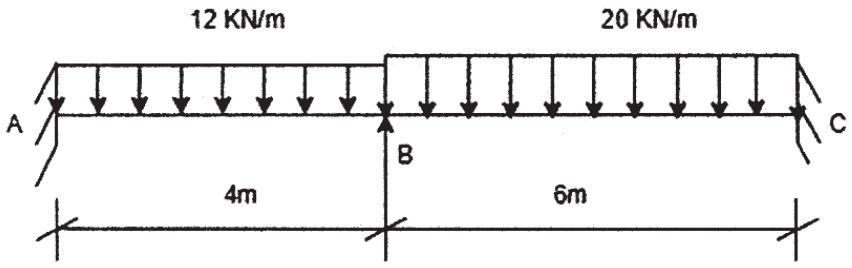


Figure 1

b) Find the rotation B (θB) for the beam with uniform flexural rigidity as shown in figure 2. **[6]**

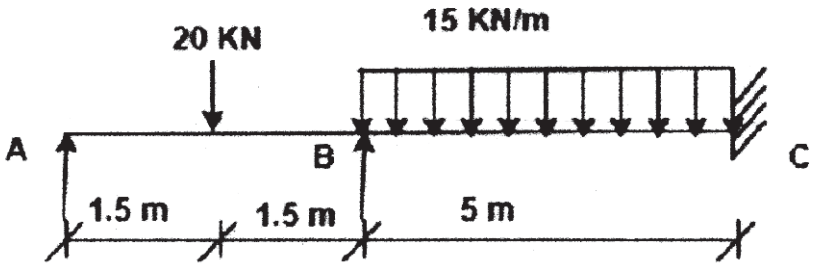


Figure 2

OR

P.T.O.

Q2) Analyze the frame shown in figure 3 by slope deflection method and draw BMD. Assume uniform flexural rigidity. **[18]**

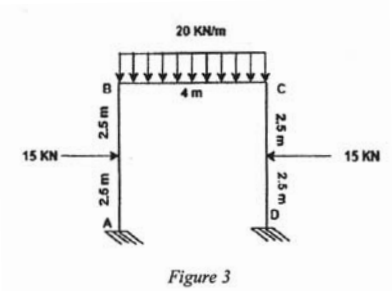


Figure 3

Q3) a) Analyze the beam shown in figure 4 by moment distribution method. Assume uniform flexural rigidity. **[12]**

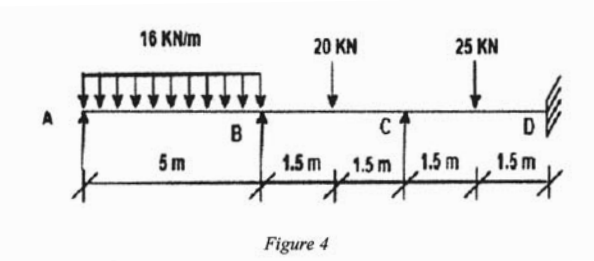


Figure 4

b) Define member stiffness, carry over moment and distribution factor. **[6]**

OR

Q4) Calculate final end moments for the frame shown in figure 5 by moment distribution method and draw BMD. Assume uniform flexural rigidity. **[18]**

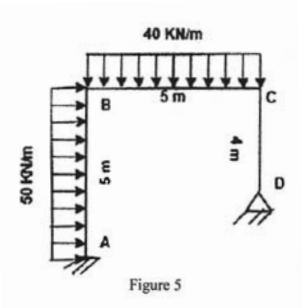


Figure 5

Q5) a) Analyze the beam ABC shown in figure 6 by stiffness method and draw BMD. **[13]**

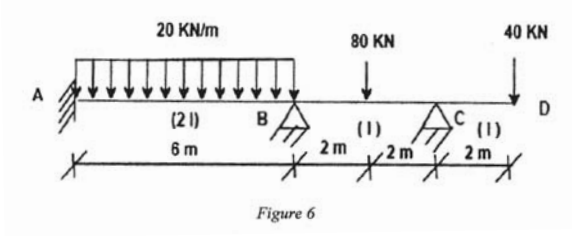


Figure 6

b) Explain degrees of freedom and stiffness. **[4]**

OR

Q6) Analyse the frame shown in figure 7 by stiffness method and draw BMD. **[17]**

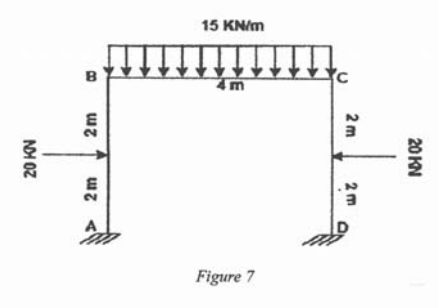


Figure 7

Q7) a) Determine plastic moment of resistance for the beam of uniform section as shown in figure 8. **[12]**

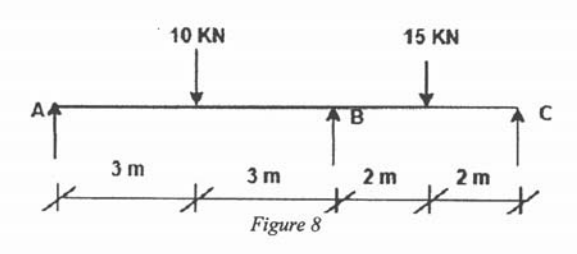


Figure 8

b) Explain lower bound theorem and upper bound theorem. **[5]**

OR

Q8) a) Calculate plastic section modulus, shape factor and plastic moment for the figure 9.

Properties of ISHT : Ixx = 573.7 cm^4, Zxx = 46.491 cm^3, A = 37.42 cm^2. **[13]**

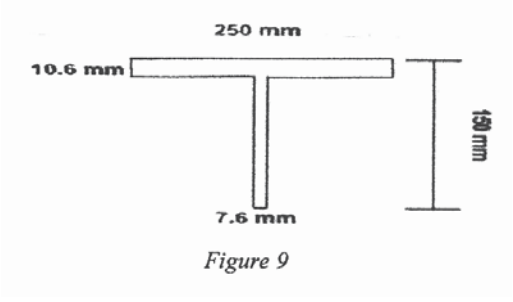


Figure 9

b) Define load factor and shape factor. **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PB3600

[Total No. of Pages : 3

[6261]-5

S.E. (Civil)

PROJECT MANAGEMENT

(2019 Pattern) (Semester - IV) (201012)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicates full marks.***
3) ***Neat figures must be drawn wherever necessary.***
4) ***Assume suitable data if required.***

Q1) a) Write a short note on: **[6]**

i) Purchase Order

ii) Material Receipt

b) How doyou inspect quality of material like sand and aggregate on your site? **[5]**

c) Define Inventory and list out step by step process to conduct ABC analysis. **[6]**

OR

Q2) a) A construction Company purchases 12000/- Bags of Cement Annually with effective cost Rs. 315/-per Bag, the cost of procurement = Rs. 150 per lot & holding cost is 20%. Calculate EOQ. **[5]**

b) What are the objectives of Materials Management? Explain any two. **[6]**

c) What safety precautions would you take to avoid accidents on tunneling site? Explain safety programme undertaken. **[6]**

P.T.O.

Q3) a) What is MSP? State its Importance in Construction Sector. **[5]**

b) Write a short notes on: **[6]**

i) Objectives of Resource Smoothening.

ii) Steps in Resource Smoothening.

c) Explain different methods of EVA. Explain any one in details. **[6]**

OR

Q4) a) Explain Step by step process of Network Crashing? **[5]**

b) What is Cost Slope and how it is determined? **[4]**

c) Following table shows the data of small construction project.

Draw the network diagram and update the network by using the following conditions at the end of 10 days. **[8]**

i) What is the change in the project duration?

ii) What is remaining duration of project?

Activity	1-2	2-3	2-4	3-5	4-5	5-6	5-7	6-7
Duration (Days)	4	6	5	2	2	1	4	6

At the end of 10 days review was taken which indicates

1) Activity 1-2 & 2-4 was completed as originally planned.

2) Activity 2-3 & 3-5 delayed drastically and requires 5 & 6 more days respectively for their completion.

3) Activity 4-5 & 5-6 is in progress and both require 8 more days for their completion.

4) Activity 6-7 yet to start and the original time estimate still appear to be accurate.

5) Activity 5-7 requires 8 days in place of 6 days for its completion.

Q5) a) Define : Cost, Value, Wants & Goods. **[6]**

b) Explain Fixed & Working Capital. **[6]**

c) What is Annuity? Explain how future value of Annuity is Calculated. **[6]**

OR

Q6) a) Define : Price, Wealth, Rent & Money. **[6]**

b) Explain Law of Diminishing Marginal Utility. **[6]**

c) Explain factors affecting price determination. **[6]**

Q7) a) Write a short note on 'Role of PMC' in pre-tendering. **[6]**

b) What do you mean by Project Appraisal? Explain Methods of Project Appraisal. **[6]**

c) Explain importance of Project Feasibility Report. **[6]**

OR

Q8) a) Write a Short note on 'Cost Benefits Analysis'. **[4]**

b) Following Data pertains to 2 Projects. Rank the Projects based on B/C ratio & NPV values **[8]**

Particulars	Project A	Project B
Investment	Rs. 1,10,000/-	Rs. 1,10,000/-
Cash Inflow Year 1	Rs. 31,000/-	Rs. 71,000/-
Cash Inflow Year 2	Rs. 40,000/-	Rs. 40,000/-
Cash Inflow Year 3	Rs. 50,000/-	Rs. 40,000/-
Cash Inflow Year 4	Rs. 70,000/-	Rs. 20,000/-
Interest Rate	14%	14%

c) Explain 'Pay-back Period' with example. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3601

[Total No. of Pages : 3

[6261]-6
S.E. (Civil Engineering)
BUILDING TECHNOLOGY AND ARCHITECTURAL PLANNING
(2019 Pattern) (Semester - III) (201001)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat figures wherever necessary.***
4) ***Assume necessary data.***
5) ***Use of scientific calculator is allowed.***

Q1) a) Draw a neat labeled sketch of semicircular-arch and show: **[6]**

i) Key stone

ii) Crown

iii) Springing line

b) State the types of flat terraced roofing and explain any one of them. **[6]**

c) Explain swing door with the help of a sketch. **[6]**

OR

Q2) a) Enlist various types of fixtures for doors and explain anyone with a neat sketch. **[6]**

b) Enlist any four types of floor finishes and explain mosaic flooring. **[6]**

c) Explain in brief, the following: **[6]**

i) Timber Linter

ii) Stone lintel

Q3) a) Enlist various types of residential buildings and explain any one in detail. **[5]**

b) Draw to a suitable scale developed plan of a single storey framed residential building with the following units-Living room- 3.5 × 5.2, bedroom-3.0 × 3.0, Kitchen-3.2 × 3.0, W.C - 1.0×1.2, Bath - 1.2 × 2.1, Staircase: Rise = 0.16m & Tread = 0.27m, Width of each flight = 1.2m, Wall thickness 0.23 m (outer) & 0.15m (inner), Floor height 3.2m. Room sizes are in 'm'. **[12]**

OR

P.T.O.

Q4) a) Mention Functional requirements and dimensions of Twin bungalows. **[6]**

b) What do you understand by Leadership in Energy and Environmental Design (LEED)? **[6]**

c) Give the classification of residential building explain any two types in brief. **[5]**

Q5) a) Plan and draw to a scale of 1:50 or suitable, a primary school building with the following requirements: **[12]**

i) Five classrooms - $50m^2$

ii) Principals office - $26m^2$

iii) Staff room - $30m^2$

iv) Store room - $35m^2$

v) Two toilet units separately for boys and girls - $15m^2$ each

vi) A hall - $200\ m^2$

Passages and verandahs can be provided suitably. Provide a staircase by following the requirements.

b) What are the salient features of engineering student's hostel building? **[6]**

OR

Q6) a) Draw a line plan of a Post Office using the following data: **[12]**

i) Entrance and moving space - $30m^2$

ii) Public dealing counters - Height 1.6m -1.8m, width 0.7m - 0.95m

iii) Post master's room - $15m^2$

iv) Working area for other staff - $30m^2$

v) Post-separation room - $30m^2$

vi) Safe custody area for cash - $10m^2$

vii) Cash transaction room - $12m^2$

viii) Water room and toilet (separate for male and female) - $7.5m^2$

b) What are the salient features of vegetable market building. **[6]**

Q7) a) What is TDR in construction? How does it work? Write a short note on land use zoning and mention the requirements of each. **[6]**

b) What is fire escape and explain fire escape elements? **[6]**

c) Elaborate need for earthquake resistant structures in relation with-loss of human life; property and infrastructure. **[5]**

OR

Q8) a) What is reverberation time and how is it calculated? **[6]**

b) Explain in detail Concept of TDR, List of documents to be submitted to local authority? **[6]**

c) What is fire escape and explain any one fire escape elements? **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3602

[Total No. of Pages : 3

[6261]-7
S.E. (Civil Engineering)
MECHANICS OF STRUCTURE
(2019 Pattern) (Semester-III) (201002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Assume suitable data, if necessary.***
3) ***Use of Non-programmable calculator is allowed.***

Q1) a) A simply supported beam of rectangular cross section, 350mm wide and 700mm deep is subjected to uniformly distributed load of 120kN/m on entire span of 3m.

Determine maximum bending stress and draw Bending stress Distribution diagram. **[8]**

b) A 'T' beam is having flange 1000mm×100mm and web 800mm × 80mm. The maximum shear force induced in the beam due to applied load is 400 KN. Draw shear strees distribution diagram for the beam. **[9]**

OR

Q2) a) A cantilever beam of span 1.2m is loaded with a point load of 70KN at its free end. The beam is rectangular in cross section having width 230mm and depth 500mm. Determine maximum bending stress & draw bending stress distribution diagram. **[8]**

b) A symmetric 'I' section having

flanges - 500mm × 25mm

web - 800mm × 20mm.

Maximum shear force induced in the beam due to applied loading is 300KN. Draw shear stress distribution diagram. **[9]**

Q3) a) A hollow circular shaft has an external diameter of 120mm and an internal diameter of 100mm. The maximum permissible shear stress is 80 MPa and the twist is not to exceed 3º in length of 3m. The shaft is rotating at 2RPS if the shear modulus of the material is 80 GPa, find the safe power that can be transmitted. **[9]**

P.T.O.

b) At a point in a material the stress on two mutually perpendicular plane are 140N/mm^2 and 70 N/mm^2, both tensile. Determine normal, tangential and resultant stress at a plane 20º to the major principal plane. **[8]**

OR

Q4) a) Find maximum torque that can be applied to a shaft of 100mm diameter. The permissible angle of twist is 1.2º in a length of 3m and permissible shear stress is 70 MPa.

G = 80 GPa **[9]**

b) An element is subjected to a tensile stress of 120 MPa and a shear strees of 60 MPa tending to rotate the element in an anticlockwise direction.

Determine the magnitude of normal and shear stress on a section inclined at 35º with the tensile stress. **[8]**

Q5) a) A hollow circular column with two ends hinged carrying 10kN axial load. If the outer diameter of the column is 60mm. The column is 6m long. Determine the inner diameter of the column. Factor of safety 2 against buckling. E = 80 GPa. **[6]**

b) Determine the crippling load for a hollow rectangular cast iron column of outer dimensions 300mm × 200mm. Thickness of the column is 30mm. The length of the column is 5m having one end fixed and other hinged. E= 160 GPa. **[6]**

c) A rectangular column 600mm × 400mm is subjected to compressive load of 200kN acting at an eccentricity of 50mm in a plane bisecting 400mm side. Determine maximum and minimum stresses. **[6]**

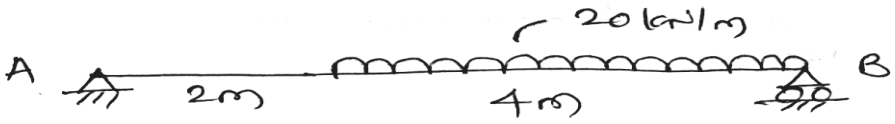
OR

Q6) a) A steel rod 5m long and 100mm diameter is acting as column with one end fixed and other free. Find crippling load by Euler's formula consider E = 210 GPa **[6]**

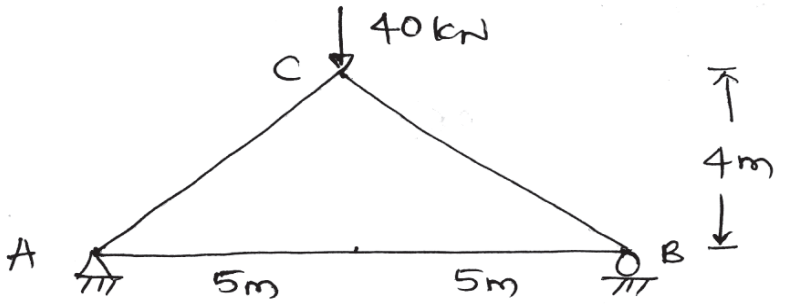
b) A hollow column, 4m long is fixed at both ends. The external diameter of the column is 350mm and thickness is 25mm. Determine Rankine's crippling load. taking f_c = 550 N/mm^2 and $\alpha = \frac{1}{1700}$ **[7]**

c) Determine the core of section for a circular section of diameter 'D'. **[5]**

Q7) a) Determine maximum slope and central deflection for a simply supported beam as shown below. Use Macaulay's method. **[9]**



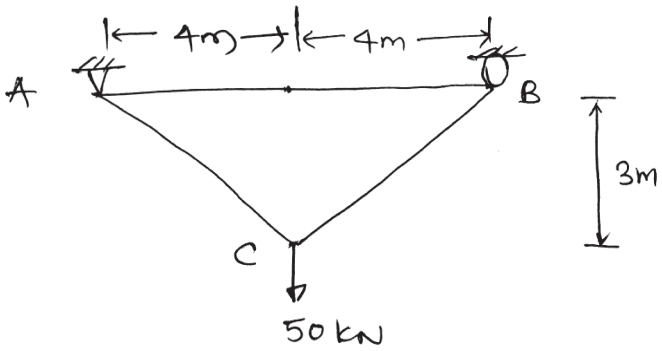
b) Determine the vertical displacement at joint C by using unit load method Area of the each member of the truss is 400mm^2. E = 210 GPa **[9]**



OR

Q8) a) A cantilever beam of span 'L' is subjected to uniformly distributed load of 'w' kN/m on entire span. Determine slope and deflection at the free end of the beam, using Macaulay's method. **[9]**

b) Determine horizontal displacement at joint 'C'. Area of each member of the truss is 450mm^2. E = 200 GPa. **[9]**



Total No. of Questions : 8]

SEAT No. :

PB3603

[Total No. of Pages : 3

[6261]-8
S.E. (Civil)
FLUID MECHANICS
(2019 Pattern) (Semester - III) (201003)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Answers to the all questions should be written in single answer - book.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) a) Using Buckingham - Pi method, prove that the drag force F on a sphere of diameter D moving at a constant speed V through a fluid of density ρ and dynamic viscosity μ may be expressed as **[8]**

$$F = \rho V^2 D^2 \phi \left(\frac{\mu}{\rho VD} \right)$$

b) Explain following similarities as applicable to model studies: **[4]**
   i) kinematic similarity
   ii) dynamic similarity

c) The velocity distribution in boundary layer is given by

$$\frac{u}{U} = \frac{y}{\delta}$$

Calculate displacement and momentum thickness. **[6]**

OR

Q2) a) The velocity and discharge for a $\frac{1}{40}$ scale model of a spillway are 0.45m/sec and 0.102 m3/sec, respectively. Calculate corresponding velocity and discharge in the prototype. **[6]**

b) Explain the growth of boundary layer over a thin flat plate held parallel to the direction of flow in a real fluid. **[6]**

c) Derive an expression for displacement thickness. **[6]**

P.T.O.

Q3) a) Explain in brief Moody's diagram. **[7]**

b) The difference of water levels of two reservoirs is 8m They are connected by a 40 m long pipe. For the first 25m length, the diameter of the pipe is 120 mm and for the remaining length, the diameter is 200 mm, the change in diameter being sudden. Calculate the discharge into the reservoir. Also calculate head loss in individual pipe Take Darcy - Weisbach friction factor f = 0.032. Neglect minor losses. **[8]**

c) Draw typical velocity distribution diagrams for fully developed laminar and turbulent flow through pipe. Also state the nature of velocity profile for each. **[2]**

OR

Q4) a) Explain in brief all types of minor losses in pipe. **[6]**

b) Prove that for steady uniform laminar flow through circular pipe, the velocity distribution diagram is parabolic. **[9]**

c) Calculate the value of Darcy Weisbach friction factor if Reynold's Number for flow through pipe is 100. **[2]**

Q5) a) Explain specific energy curve. **[5]**

b) A trapezoidal channel has side slope of V : 0.75 H and the slope of the channel bottom is 1: 2000. Determine the dimensions of most effcient channel section, if it has to carry water at 0.5 m^3/sec. Take Chezy's C = 80. **[8]**

c) A triangular gutter of 60º angle conveys water at a uniform depth of 0.3m. If bed slope is 1 in 150, calculate discharge. Take Manning's n = 0.018. **[5]**

OR

Q6) a) Derive Chezy's formula for uniform flow through open channel. **[8]**

b) Write five characteristics of critical flow in open channel. **[5]**

c) Water flows at the rate of $16m^3$/sec in a rectangular channel 10 m wide at a velocity of 1.6m/s. calculate

i) specific energy head,

ii) Froude Number and state the type of flow. **[5]**

Q7) a) Derive dynamic equation of GVF. **[9]**

b) Aflat plate 1 m ×1 m moves through air of density 1.15 kg/m^3 at 36kmph. Determine:

i) drag force

ii) lift force

iii) resultant force

iv) power required to maintain the plate in motion.

Take $C_D = 0.18$, $C_L = 0.70$. **[8]**

OR

Q8) a) In a wide rectangular channel of 100 m wide and 3m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Take Manning' s n = 0.035. Use direct step method and take two steps only. Sketch the water surface profile. **[10]**

b) Differentiate between stream lined and bluff body with suitable sketches. **[4]**

c) Draw a neat figure showing variation of drag coefficient (C_D) with Reynold's Number (R_e) for flow around a sphere of real fluid. Show appropriate vales of C_D and Re. **[3]**

❋ ❋ ❋

Total No. of Questions : 9]

SEAT No. : ____

PB-3604

[Total No. of Pages : 4

[6261]-9
S.E. (Civil)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207001)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question No. 1 is compulsory. Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
2) ***Figures to the right indicate full marks.***
3) ***Non-programmable electronic pocket calculator is allowed.***
4) ***Assume Suitable data, if necessary***
5) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt the following :

i) Standard deviation of three numbers 9, 10 and 11 is **[2]**

a) $\frac{2}{3}$ b) $\frac{1}{3}$

c) $\sqrt{\frac{2}{3}}$ d) $\sqrt{2}$

ii) If $\bar{a} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\bar{b} = \hat{i} - \hat{j} + 2\hat{k}$ then angle between $\bar{a}$ & $\bar{b}$ is _____. **[2]**

a) $\cos\left(\frac{2}{3\sqrt{6}}\right)$ b) $\cos^{-1}\left(\frac{2}{3\sqrt{6}}\right)$

c) $\cos^{-1}\left(\frac{2}{3}\right)$ d) $\cos^{-1}\left(\frac{1}{\sqrt{6}}\right)$

iii) For $\bar{F} = x^2\,\hat{i} + xy\,\hat{j}$ the value of $\int_C \bar{F}.d\bar{r}$ for curve $y^2 = x$ joining points (0, 0) and (1, 1) is - **[2]**

a) $\frac{1}{12}$ b) $\frac{7}{12}$

c) $\frac{5}{12}$ d) $\frac{2}{3}$

P.T.O.

iv) Two dimentional heat flow equation in steady state condition is **[2]**

a) $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ b) $\frac{\partial^2 u}{\partial t^2} = c^2 \left(\frac{\partial^2 u}{\partial x} + \frac{\partial^2 u}{\partial y^2} \right)$

c) $\frac{\partial u}{\partial t} = c^2 \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$ d) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

v) The vector product of two vectors is a - **[1]**

a) Vector b) Scalar

c) Neither vector non scalar d) none of these

vi) A card is drawn from a well shuffled a pack of 52 cards, probability of getting a club card is - **[1]**

a) $\frac{1}{4}$ b) $\frac{3}{4}$

c) $\frac{1}{3}$ d) $\frac{1}{2}$

Q2) a) If $\Sigma f = 27$, $\Sigma fx = 91$, $\Sigma fx^2 = 359$, $\Sigma fx^3 = 1567$, $\Sigma fx^4 = 7343$. Find first four moments about origin also find coefficient of skewness and kurtosis. **[5]**

b) From a record of analysis of correlation data the following results are available variance of x is 9 and lines of regression are $8x - 10y + 66 = 0$, $40x - 18y = 214$, Find (i) mean values of x & y series (ii) coefficient of correlation between x & y series (iii) standard deviation of y series. **[5]**

c) If ten percent of articles from a certain machine are defective. Waht is probability that then shall be 6 detective in a sample of 25? **[5]**

OR

Q3) a) Obtain the regression line y on x for following data. **[5]**

x	5	1	10	3	9
y	10	11	5	10	6

b) Find probability that almost 5 detective fuses will be found in a box of 200 fues if 2% of such fuses are defective. **[5]**

c) In a sample of 1000 cases the mean of a certain test is 14 and standard deviation is 2.5. Assuming that the distribution is normal find (i) How many students score between 12 and 15? (ii) How many score above 18? **[5]**

[Given :- A(0.8) = 0.2881, A(0.4) = 0.1554, A(1.6) = 0.4452)

Q4) a) For the curve $x = e^t\cos t, y = e^t\sin t, z = e^t$. Find the velocity and acceleration of the particle moving on the curve at $t = 0$. **[5]**

b) Find the directional derivative of $\phi = xy^2 + yz^3$ at (1, –1, 1) along the direction normal to the surface $x^2 + y^2 + z^2 = 4$ at (1, 2, 2) **[5]**

c) Show that the vector field $\vec{F} = (3x^2y + yz)\hat{i} + (x^3 + xz)\hat{j} + xy\hat{k}$ is irrotational. Find scalar potentional ϕ such that $\vec{F} = \nabla\phi$.

OR

Q5) a) If the vector field $\vec{F} = (x+2y + az)\hat{i} + (6x - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ is irrotational. Find a, b, c and determine ϕ such that $\vec{F} = \nabla\phi$ **[5]**

b) Attempt any one : **[5]**

i) $\nabla\cdot\left(\dfrac{\vec{a}\times\vec{r}}{r}\right) = 0$

ii) $\nabla^4\cdot\left(r^2\log r\right) = \dfrac{6}{r^2}$

c) Find directional derivative of $xy^2 + yz^2$ at (2, –1, 1) along the line $2(x – 2) = (y + 1) = (z – 1)$ **[5]**

Q6) a) Use Green's lemma to evaluate the integral

$$\oint_C\left[\left(2x^2 - y^2\right)dx + \left(x^2 + y^2\right)dy\right]$$

where C is the curve bounding $y \geq 0$ and $x^2 + y^2 \leq 1$ **[5]**

b) Evaluate $\iint_S\left(\nabla\times\bar{A}\right)\cdot d\bar{S}$ where S is the surface of the cone $z = 2 - \sqrt{x^2 + y^2}$ above the xy plane and $\bar{A} = (x - z)\hat{i} + (x^3 + yz)\hat{j} - 3xy^2\hat{k}$. **[5]**

c) Evaluate the surface integral $\iint_S curl\ \bar{F}\cdot d\bar{S}$ by transforming it into a line integral, S being that part of the paraboloid $z = 1 – x^2 – y^2$ for which $z \geq 0$ and $\bar{F} = y\hat{i} + z\hat{j} + x\hat{k}$. **[5]**

OR

Q7) a) Find the value of $\int_C\bar{F}\cdot d\bar{r}$ where C is part of the spiral $\bar{r} = (a\cos\theta\ ,\ a\sin\theta,\ a\theta)$ from $\theta = 0$, to $\theta = \dfrac{\pi}{2}$ and where $\bar{F} = r^2\hat{i}$ **[5]**

b) Obtain the equation of stream lines in case of steady motion of fluid defined by velocity $\bar{q} = \left(x^2 + y^2\right)\hat{i} + 2xy\,\hat{j} + \left(x+y\right)z^3\,\hat{k}$ **[5]**

c) Using Gauss Divergence theorem show that $\oint_S \nabla r^2 \cdot d\bar{S} = 6V_0$ where S is a smooth closed surface in the three dimensional space which contains a region of space whose numerical volume is V_0. **[5]**

Q8) a) A tightly stretched string of length l is initially in equilibrium position is set vibrating by giving to each of its points, the velocity $\left.\frac{\partial y}{\partial t}\right|_{t=0} = V_0 \sin^3\left(\frac{\pi x}{l}\right)$ find $y(x, t)$ if $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ **[8]**

b) Solve $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$ if, **[7]**

i) $u(0, t) = 0$

ii) $u(l, t) = 0$,

iii) $u(x, t)$ is bounded

iv) $u(x,0) = \frac{u_0 x}{l}$ for $0 \le x \le l$

OR

Q9) a) If $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ represents vibrations of string of length l, fixed at both ends, find the solution if, **[8]**

i) $y(0, t) = 0$

ii) $y(l, t) = 0$

iii) $\left.\frac{\partial y}{\partial t}\right|_{t=0} = 0$

iv) $y(x, 0) = k(lx - x^2)$ $0 \le x \le l$

b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, subject to conditions **[7]**

i) $u = 0$ as $y \to \infty$ $\forall_x$

ii) $u = 0$ if $x = 0$ $\forall_y$

iii) $u = 0$ if $x = l$ $\forall_y$

iv) $u = u_0 \sin\frac{\pi x}{l}$ if $y = 0$ for $0 < x < l$

Total No. of Questions : 8]

SEAT No. :

PB3605

[Total No. of Pages :3

[6261]-10
S.E. (Civil Engg.)
ENGINEERING GEOLOGY
(2019 Pattern) (Semester-III) (207009)

Time : 2½ Hours] *[Max. Marks : 70*

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 indicates full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Define fold and Describe types of folds. **[6]**

b) Explain various concordant and discordant body of igneous intrusion. **[6]**

c) Perpendicular distance between any two successive strike line is 4.5cm, scale of the map is 1cm = 100m and contour interval is 50m. Calculate amount of dip (True Dip) **[5]**

OR

Q2) a) Explain with sketch disconformity, angular unconformity and non-conformity. **[6]**

b) Define fault and explain the significance of fault in Civil Engineering. **[6]**

c) Perpendicular distance between any two successive strike line is 3.0cm, scale of the map is 1cm = 100m and contour interval is 30m. Calculate amount of dip (True Dip) **[5]**

P.T.O.

Q3) a) Explain importance of preliminary geological explorations in civil engineering. **[6]**

b) Define Remote Sensing? Explain it's applications in civil engineering. **[6]**

c) Calculate RQD recovery and Core recovery from following table. **[6]**

Run in m	Piece No.	Length in cm	Nature of fracture
3 - 6 m	1	12	J
	2	10	J
	3	70	M
	4	55	M
	5	50	M
	6	13	J
	7	50	J
6 - 9 m	8	70	M
	9	80	M
	10	90	M
	11	10	M

OR

Q4) a) Discuss in detail core drilling method of subsurface geological exploration with its significance. **[6]**

b) Describe various applications of GIS in civil engineering. **[6]**

c) Calculate RQD and core recovery form following table. **[6]**

Run in m	Piece No.	Length in cm	Nature of fracture
0 - 3 m	1	10	J
	2	12	J
	3	50	M
	4	56	M
	5	60	M
	6	13	J
	7	50	J
	8	09	J
	9	06	J
3 - 6 m	10	60	M
	11	80	M
	12	10	M
	13	10	M

Q5) a) Explain significance of dipping strata in site selection for construction of dam. **[6]**

b) Explain influence of geological conditions on the choice and type of dam. **[6]**

c) A site is proposed for excavation of tunnel along A-B and M-N, passing through axial and limb region of fold respectively. Justify the suitability of tunnel is such conditions. **[5]**

OR

Q6) a) Explain Preliminary Geological Investigations carried out for Tunneling. **[6]**

b) Discuss on unfavorable geological conditions for reservoir area of dam. **[6]**

c) Discuss on tunnel excavated through faulted area. **[5]**

Q7) a) Describe in brief the various preventive measures against landslides. **[6]**

b) Describe requirements of good building stone. **[6]**

c) Define aquifers. Explain in brief the types of aquifers. **[6]**

OR

Q8) a) Explain geological conditions favourable for natural springs and artesian wells. **[6]**

b) Define earthquake and Describe the causes of earthquake. **[6]**

c) Explain in brief the geological work done by groundwater. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3606

[Total No. of Pages :4

[6261]-11
S.E. (Electrical)
POWER SYSTEMS - I
(2019 Pattern) (Semester-IV) (203145)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) State various components of overhead line hence discuss their use. **[6]**

b) Calcualate weight of conductor per meter and total weight if ultimate tensile strength is 5800 kg. Sag is 2.8 m, factor fo safety is 3 and line has span of 350 meters. **[6]**

c) Explain with neat sketch, working and application of **[6]**

i) Shackle insulator

ii) Post insulators

OR

Q2) a) Explain following methods used to improve string efficiency **[6]**

i) Capacitance grading

ii) Static shielding

b) Derive the expression for sag of transmission line when supports are at unequal level hence explain effect of ice loading on sag. **[6]**

c) A three phase line is supported by a string of 4 suspension insulators. The voltage across first and last units of a string are 10.9 kV and 26.8 kV respectively. If the ration of capacitance of each insulator unit to capcitance to earth of each section is 5:1 calculate line voltage and string efficiency.**[6]**

P.T.O.

Q3) a) Prove that, GMR for single phase two wire line is given by r' = 0.7788 *r. **[6]**

Where, r' = GMR of conductor and r = radius of conductor.

b) Calculate inductance per km and total inductance of three phase 250 km long line when conductors are arranged in the form of triangle with sides 4m, 4.5 m and 6.2 m. The conductors are regularly transposed and diameter of each conductor is 3 cm. **[6]**

c) With neat sketch, explain necessity of transposition. **[5]**

OR

Q4) a) Derive the expression for inductance of 3 phase line when conductors are symmetricallly spaced in the form of equilateral triangle **[6]**

b) What are bundle conductors, explain their advantages. **[5]**

c) 1 phase 2 wire line, 400 km long with 2.5 cm diameter conductors spaced 4.5 m apart from each other, calcualte **[6]**

i) Inductance of line per km

ii) Total Inductance

iii) Loop inductance per km

iv) Total loop inductance

Q5) a) With neat diagram, Derive the expression of capcitance of single phase transmission line considering effect of earth hence explain what is method of images. **[9]**

b) A single phase 66 kV, 50 Hz, 20 km long transmission line is 8.4 m above the ground. The diameter of each conductor is 2 cm and is separated by 6 m horizontally. Calculate **[8]**

i) Capacitance between conductors and charging current with effect of ground

ii) Capacitance between conductors and charging current neglecting effect of ground

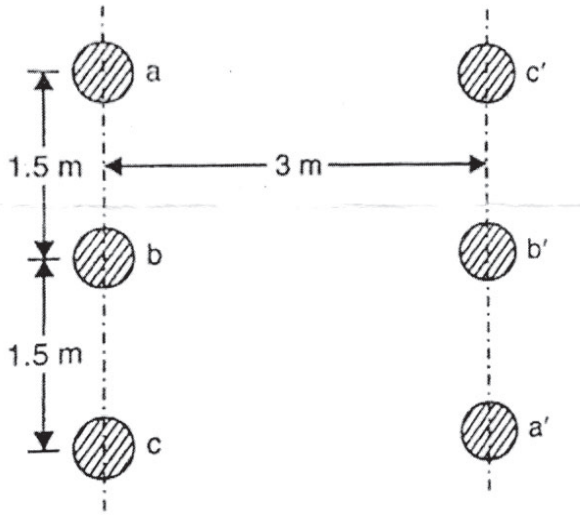
OR

Q6) a) Derive the expression for capcitance of three phase transmission line with unsymmetrical spacing with transposition, hence explain concept of GMD in capacitance calculations. **[8]**

b) 3 phase, 110 kV, 100 km 50 Hz overhead double circuit transmission line conductors are placed in vertical plane as shown in figure. The conductor diameter is 1.5 cm. Assuming complete transposition of the line, calculate **[9]**

i) Capacitance per phase (line to neutral)

ii) Charging current per phase



Q7) a) ABCD constants of a 3 phase 132 kV, 50 Hz transmission line are as follows **[10]**

$A = D = 0.99 \angle 0.18^{o}$, $B = 55 \angle 69^{o}\ \Omega$ and $C = 315 \times 10^{-6} \angle 90^{o}$ S If the line delivers a load of 50 MW at 0.8 lagging power factor at the receiving end, calculate

i) Sending end voltage

ii) Sending end current

iii) Sending end power factor

iv) Line efficiency

v) Line regulation

b) Deduce the relation between sending end and receiving end quantities of a medium transmission line considering nominal 'T' model of the line, draw neat phasor diagram. **[8]**

OR

Q8) a) Justify the following statements. **[6]**

i) Under lagging load condition, receiving end voltage of the line is always less than sending end voltage.

ii) With increase in load power factor, there is increase in efficiency of line.

iii) Nominal 'π' network of transmission line is always symmetrical and reciprocating network.

b) Draw neat sketches of following representations of transmission lines, clearly mention all parameters in it **[6]**

i) Short transmission line

ii) Medium transmission line with Nominal 'T' network

iii) Medium transmission line with Nominal 'π' network

c) Following data refers to 50 Hz, 3 phase transmission line of length 25 km with sending end voltage of 132 kV, Load delivered at receiving end is 120 MW at 0.8 pf lagging. **[6]**

Resistance of conductor = 0.6 Ω/km

Reactance of conductor = 0.75 Ω/km

Calculate

i) Line current

ii) Sending end voltage

iii) Line losses

Total No. of Questions : 8]

SEAT No. :

PB-3607

[Total No. of Pages : 3

[6261]-12
S.E.(Electrical Engineering)
ELECTRICAL MACHINES - I
(2019 Pattern) (Semester - IV) (203146)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of non-programmable calculator is allowed.***
5) ***Assume suitable additional data if necessary.***

Q1) a) State features of wave winding. **[4]**

b) Derive the torque equation of DC motor by usual notations. **[6]**

c) A 6 pole, Lap wound DC shunt motor takes armature current of 110 Ampere at 480 volt. It has armature resistance of 1 Ohm and total 864 armature conductors.The flux per pole is 0.05 Weber. Calculate- **[8]**

i) Mechanical power developed in armature

ii) Gross torque

iii) Speed of the motor

OR

Q2) a) Sate the material used and function of following parts of a DC machine- **[4]**

i) Armature core

ii) Brushes

b) Draw the power flow diagram of DC motor. Write respective expressions of power and power loss for respective blocks. **[6]**

c) What is armature reaction in DC Machines? Explain the effects of armature reaction with suitable diagrams. Suggest the remedial measure on it. **[8]**

P.T.O

Q3) a) Explain why DC Series motor should not be started on - No load condition? **[3]**

b) Sketch & explain the Torque - Armature current characteristics of DC shunt motor. **[6]**

c) Draw the connection diagram of 4 point starter used for DC shunt motor & explain the function of **[8]**

i) Hold on coil &

ii) Over load coil.

OR

Q4) a) What is meant by reactance voltage in case of commutation in DC machines? **[3]**

b) Draw the connection diagram & explain the speed control of DC shunt motor by flux control method. **[6]**

c) A DC series motor is running at 350 rpm at 220V, taking a current of 25Amp. The motor armature plus field resistance is 1 Ohm. Calculate - **[8]**

i) the resistance to be added in series to reduce the speed to 250 rpm at constant torque.

ii) The power wasted in the resistor.

Q5) a) A 4-pole, 3phase induction motor connected to 50 HZ supply. If the machine runs at 3% slip at full-load, determine **[4]**

i) Rotor speed

ii) Frequency of rotor currents

iii) Frequency of rotor currents at stand still

iv) Speed of rotating magnetic field

b) Obtain the torque equation of induction motor under running condition & there of derive the condition of maximum torque under running condition **[6]**

c) Draw torque-slip characteristics of 3-ph induction motor & explain **[8]**

i) Stable and unstable operating region

ii) maximum torque

iii) torque ,when slip is one.

OR

Q6) a) Draw a neat sketch of squirrel cage induction motor, label all the parts and explain its constructional details. **[4]**

b) With suitable phasor diagrams elaborate the concept of rotating magnetic field in case of 3 phase induction motor **[6]**

c) A 4 - pole, 50 Hz, 3 - phase induction motor gives output power of 14710 Watt. It has friction and windage losses of 2% of the output. The full - load slip is 3%. Calculate the **[8]**

i) Rotor cu. loss and

ii) Rotor input

Q7) a) Draw equivalent circuit of 3 Phase induction motor ,name all parameters involved in it. **[3]**

b) With the help of circuit diagram explain procedure to conduct - No load test and blocked rotor test on 3 phase squirrel cage induction motor.**[6]**

c) Draw the connection diagram of star-delta starter & explain the starting and running operation of 3-ph induction motor. **[8]**

OR

Q8) a) Compare star-delta starter and Rotor Resistance starter on any 4 poins. **[8]**

b) Draw the circle diagram & write the procedure to find full load current, p.f, full load slip, locate the points for slip = 0 and slip = 1. Assume rotor Cu loss = stator Cu loss. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3608

[Total No. of Pages : 3

[6261]-13

S.E. (Electrical Engineering)

NETWORK ANALYSIS

(2019 Pattern) (Semester - IV) (203147)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data, if necessary.***

Q1) a) What is the significance of Initial Conditions? Write a note on initial conditions in basic circuits. **[8]**

b) Find current equation when switch is open at t = 0. Refer fig. no. 1. **[9]**

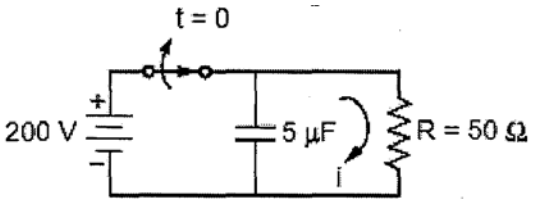


Fig. No. 1

OR

Q2) a) What is time constant? Explain time constant in case of series R-L and series R-C circuit. **[8]**

b) The switch is moved from position 1 to 2 at $t = 0$. Find the voltage $vR(t)$ and $vC(t)$ for $t \geq 0$. Refer fig. no. 2. **[9]**

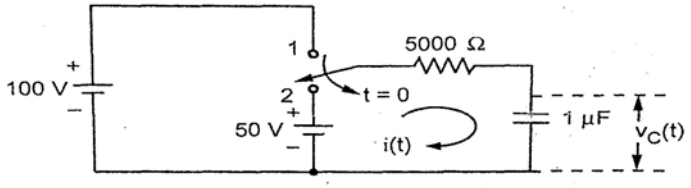


Fig. No. 2

P.T.O.

Q3) a) Explain the properties of Laplace Transform. **[6]**

b) Derive the relationship between unit step function and unit ramp function. **[6]**

c) Find the Laplace transform of cos ωt. **[6]**

OR

Q4) a) State ant six properties of Laplace Transform. **[6]**

b) Find the Laplace transform of the waveform shown in the fig. 3. **[6]**

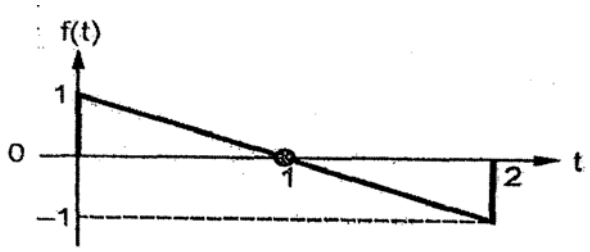


Fig. No. 3

c) Find the Laplace inverse of $\frac{1}{s(s+4)}$ using convolution integral. **[6]**

Q5) a) Express y-parameters in terms of z-parameters. **[8]**

b) Find Y parameters of the network shown in figure no. 4. **[9]**

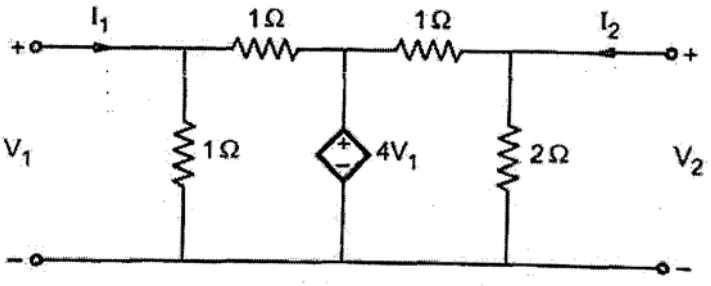


Fig. No. 4

OR

Q6) a) What is high pass filter? Derive the expression for the cut-off frequency of prototype low pass filter in terms of L and C. **[9]**

b) Design a prototype low pass filter sections if design impedance R_0 = 600 ohm and cut-off frequency f_c = 2.5 kHz. **[8]**

Q7) a) State and explain all possible network functions of one port network. **[9]**

b) Find the network functions Z11(s) and Z21(s) for the network shown in fig. No. 5. **[9]**

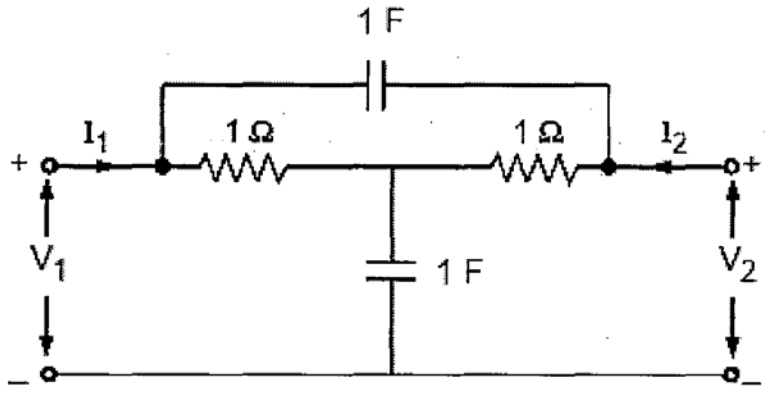


Fig. No. 5

OR

Q8) a) Explain the significance of poles and zeros. **[9]**

b) Define various network functions of a one-port network. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3609

[Total No. of Pages :4

[6261]-14

S.E. (Electrical Engineering)

Numerical Methods and Computer Programming

(2019 Pattern) (Semester- IV) (203148)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Evaluate $f(9)$ using Newton's divided difference interpolation. **[6]**

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

b) Use Sterling's formula to find y(35) from the following table. **[6]**

x	10	20	30	40	50
$y = f(x)$	600	512	439	346	243

c) What is the difference between equally spaced data and unequally spaced data in the case of interpolation? Write examples of each. Hence, mention the methods used for interpolation when the data is equally spaced and unequally spaced. **[6]**

OR

Q2) a) For the following data, calculate the forward difference table and obtain the forward difference polynomical. **[6]**

x	0.1	0.2	0.3	0.4	0.5
$y = f(x)$	1.40	1.56	1.76	2.00	2.28

b) From the given data, find the value of y at $x = 4.5$. **[6]**

x	1	2	3	4	5
$y = f(x)$	2.38	3.65	5.85	9.95	14.85

c) Derive Lagrange's interpolation formula for unequally spaced data. **[6]**

P.T.O.

Q3) a) Use the trapezodial rule with four steps to estimate the following integral.

$$I = \int_0^2 \frac{x}{\sqrt{x^2+1}} dx$$ **[6]**

b) Evaluate the integral using Simpson's 1/3rd rule. Take $h = 0.5$, $k = 0.5$

$$z = \int_0^1 \int_0^1 (x^2 y^2) dx dy$$ **[6]**

c) Derive formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ using Newton's backward difference interpolation formula. **[5]**

OR

Q4) a) Use the Simpson's 1/3rd with step size as $h = 0.5$ to estimate the following integral. $I = \int_1^2 \frac{1}{x^2} dx$ **[6]**

b) Evaluate the integral using the trapezoidal rule. Take $h = 0.5$, $k = 0.5$

$$z = \int_0^1 \int_0^1 (x^2 y^2) dx dy$$ **[6]**

c) Derive formula for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_0$ using Newton's forward difference interpolation formula. **[5]**

Q5) a) Find the inverse of the matrix using the Gauss-Jordan method.

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$ **[6]**

b) Solve the following set of equations using the Gauss-Jacobi method. Solve only 4 interations. Consider $x^{(0)} = y^{(0)} = z^{(0)} = 0$. **[6]**

$$7x + 52y + 13z = 104$$

$$83x + 11y - 4z = 95$$

$$3x + 8y + 29z = 71$$

c) Derive the Gauss elimination method used to solve the linear simultaneous equation. (Derivation is expected. Problem is not expected as the derivation.) **[6]**

OR

Q6) a) Use the Gauss-Jordan method to find the values of x, y, z. **[6]**

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \\ 4 \end{bmatrix}$$

b) Solve the following set of equation using the Gauss-Seidel Method. Solve only 4 iterations. Consider $x^{(0)} = y^{(0)} = z^{(0)} = 0$. **[6]**

$$7x + 52y + 13z = 104$$

$$83x + 11y - 4z = 95$$

$$3x + 8y + 29z = 71$$

c) Enlist the iterative methods used for the solution of the linear simultaneous equation. Explain to anyone in detail. (Derivation is expected. Problem is not expected as the derivation.) **[6]**

Q7) a) Obtain the solution of $y' = 3x + y^2$ using Taylors' series method. Take the initial condition as $y(0) = 1$. Find the value of y for $x = 0.1$. Solve up to the fourth term of derivative. **[6]**

b) Using Euler's method, obtain the solution of $y' = x - y$. Given that $y(0) = 2$ at $x = 0.6$ with the step size as $h = 0.2$. **[6]**

c) Derive the expression of Modified Euler's method used for the solution of the ordinary differential equation. **[5]**

OR

Q8) a) Solve $10y' = x^2 + y^2$ at $x = 0.4$ using the fourth-order Runge Kutta method. The initial conditions are $y(0) = 2$. Take step size as $h = 0.4$. **[6]**

b) Employ the Runge-Kutta method to calculate y for $x = 0.1$ from the equation: $y'' = xy'^2 - y^2$. Given that $y(0) = 1, y' = 0, h = 0.1$. **[6]**

c) Derive the expression of Taylor's series method used for the solution of the ordinary differential equation. **[5]**

Total No. of Questions : 8]

SEAT No. : ____

PB3610

[Total No. of Pages : 2

[6261]-15

S.E. (Electrical Engineering)

FUNDAMENTAL OF MICROCONTROLLER & APPLICATIONS

(2019 Pattern) (Semester - IV) (203149)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Assume suitable data, jf necessary.***

Q1) a) Explain TMOD register with neat diagram. **[6]**

b) Write a program to generate square wave of 2KHz frequency with 50% duty cycle on pin 1.2 Assume XTAL=11.0592MHz & use timer 0 in mode 1. **[6]**

c) Write short note on Data Types in C. **[6]**

OR

Q2) a) Write Steps to program timer in mode 1 **[6]**

b) Draw & explain TCON register. **[6]**

c) Write C Program to all bits of Port 0, 500 times. **[6]**

Q3) a) Write short note on Interrupt enable register. **[6]**

b) Explain the SOC, EOC, & OE pin of ADC 0809. **[6]**

c) Write a program to turn ON & off LED when interrupt 0 occurs, LED is connected to pin of Port 2.4 **[5]**

OR

Q4) a) What is Interrupt & Explain interrupt structure of 8051 microcontroller with its priorities. **[6]**

b) With the help of . diagram explain interfacing of ADC 0809 with 8051 microcontrollers. **[6]**

c) Explain Interrupt Priority Register of 8051 Microcontroller. **[5]**

P.T.O.

Q5) a) Write Short note on SCON register. **[6]**

b) Explain the function of SBUF register, TxD pin & RxD pin for Serial Communication in 8051. **[6]**

c) Write short note AT commands required for GSM. **[6]**

OR

Q6) a) Write program to transfer letter 'T' serially 10 times at baud rate of 4800. Use serial port in mode 1. XTAL= 12MHz. **[6]**

b) Explain Steps to receive Data Serially in 8051 microcontroller. **[6]**

c) Explain Serial port structure of 8051 microcontroller. **[6]**

Q7) a) Explain relay interfacing with 8051 microcontroller. **[6]**

b) Draw & Explain Power measurement using 8051. **[6]**

c) Explain Key interfacing using 8051. **[5]**

OR

Q8) a) With the help of block diagram explain Voltage & current measurement using 8051. **[6]**

b) Draw interfacing diagram of a stepper motor with 8051 and write program to rotate stepper motor. **[6]**

c) Explain LED interfacing with 8051 microcontroller. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3611

[Total No. of Pages : 2

[6261]-16
S.E. (Electrical)
POWER GENERATION TECHNOLOGIES
(2019 Pattern) (Semester - III) (203141)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Explain with neat sketch the construction and working of Pelton wheel turbine used in hydro power plant. **[5]**

b) Draw schematic arrangement of hydroelectric power station and describe energy conversion process of hydro power plant. **[5]**

c) State the functions of the following parts of hydroelectric power station: **[8]**

i) Reservoir
ii) Tailrace
iii) Spillway
iv) Surgetank
v) Forebay
vi) Turbine
vii) Drafttube
viii) Dam

OR

Q2) a) What are the criteria for selection of site for hydroelectric power plant. **[5]**

b) With a neat diagram explain medium head hydro-electric power plants. **[5]**

c) Why surge tanks are used in hydropower plant? Explain their functions. **[8]**

Q3) a) What are the environmental impact of wind turbine? **[5]**

b) What are the types of wind turbine electrical generators? **[5]**

c) Derive the relation of power in wind and explain impact of tower height on power generation in wind energy system. **[7]**

OR

P.T.O.

Q4) a) Wind turbine with 6m dia. Rotor, a coefficient of performance is 0.30 assume air density as 1.2 and wind speed is 11m/s. What is expected power in watt? **[4]**

b) Explain different speed control mechanisms in wind energy system to obtain maximum power. **[6]**

c) Explain how wind pattern affects power generation in wind energy systems. **[7]**

Q5) a) Explain impact of insolation and temperature on I-V curves of PV cells. **[4]**

b) What is a PV system? Describe overview of recent development of PV systems. **[6]**

c) What are the solar energy collectors? Write their types and compare them. **[8]**

OR

Q6) a) Explain the terms **[4]**

i) Solar constant

ii) Cloudy index

b) Explain with neat diagram any one method to measure solar radiations. **[6]**

c) With the help of diagram, describe the PV I-V curve under standard test conditions. **[8]**

Q7) a) What is a fuel cell energy storage technology? **[4]**

b) Explain grid connected renewable systems and their requirements. **[6]**

c) Explain how biomass energy can be converted to electricity. **[7]**

OR

Q8) a) What is a geothermal energy? **[4]**

b) Explain standalone, hybird stand alone and grid connected renewable energy sources. **[6]**

c) Explain the process of municipal solid waste to energy conversion. **[7]**

Total No. of Questions : 8]

SEAT No. :

PB3612

[Total No. of Pages : 2

[6261]-17
S.E. (Electrical Engineering)
MATERIAL SCIENCE
(2019 Pattern) (Semester-III) (203142)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) State the properties of SF6 gas. **[4]**

b) Explain properties of insulating materials which are used In Transformer & Capacitor. **[6]**

c) Write down properties of Paper & Pressboard. **[8]**

OR

Q2) a) Give the applications of Ceramics. **[4]**

b) State the properties and applications of Mica. **[6]**

c) Discuss insulating materials used for line insulators. **[8]**

Q3) a) Define Permeability. Magnetization, Magnetic Susceptibility **[3]**

b) Explain in detail BH curve (hysteresis loop) for ferromagnetic materials. **[6]**

c) Explain Ferromagnetic & Ferrimagnetic materials and their applications. **[8]**

OR

Q4) a) Explain Spontaneous Magnetization. **[3]**

b) Write short note on Ferrites with their properties and application. **[6]**

c) Write short note on Compact Disc & LASER. **[8]**

P.T.O.

Q5) a) Give the properties and application of Copper. **[4]**

b) Write short note on thermocouples. **[6]**

c) A filament of a 200V, 100W lamp is to be manufactured. If filament temperature is 2500° at 100W dissipation & resistivity of the filament material at 20°C is 4.3×10^{-6} ohm-cm and $\alpha_{20} = 0.005/°C$. Calculate the length of the filament at 20°C if its diameter at 20°C is 0.022mm. **[8]**

OR

Q6) a) Give with reasons the material used for making the Filament of lamp. **[4]**

b) Describe properties & applications of Canthal & Bronze. **[6]**

c) Enlist materials with high resistivity. Describe properties and applications of any two materials. **[8]**

Q7) a) Write short note on molecular machine **[3]**

b) With neat diagram, explain energy bands in insulators. **[6]**

c) Explain with neat diagram - BN nanotubes. **[8]**

OR

Q8) a) Write a short note on Single Electron Transistor. **[3]**

b) Write down applications of carbon nano tubes and BN nano tubes. **[6]**

c) Explain nano wires with uses. **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB3613

[6261]-18

[Total No. of Pages :2

S.E. (Electrical Engineering)

ANALOG AND DIGITAL ELECTRONICS

(2019 Pattern) (Semester- III) (203143)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Assume Suitable additional data if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Mention the advantages of PLD's. **[4]**

b) Differentiate between RAM and ROM. **[6]**

c) With neat diagram explain PAL. Mention its advantages and disadvantages. **[8]**

OR

Q2) a) Write a short note on semiconductor memories. **[4]**

b) What is CPLD? Mention the features of CPLD. **[6]**

c) With neat diagram explain the detail architecture of FPGA. **[8]**

Q3) a) Draw the pin diagram of IC 741 and name the pins. **[3]**

b) Explain with neat diagram and output waveforms, Op-Amp as a zero crossing detector. **[6]**

c) Draw and explain V-I converter using operational amplifier. **[8]**

OR

P.T.O.

Q4) a) Mention the applications of instrumentation amplifier. **[3]**

b) With neat diagram explain op-amp as peak detector circuit. **[6]**

c) Explain generation of sine waveform using OPAMP. Draw the required waveforms. **[8]**

Q5) a) Define filter and mention its type. **[4]**

b) Draw and explain the three terminal fixed voltage regulator IC. **[6]**

c) With neat diagram explain astable multivibrator using IC 555. **[8]**

OR

Q6) a) Draw the block diagram of regulated power supply. **[4]**

b) Explain the internal structure of IC 555 with proper diagram. **[6]**

c) With neat diagrams analyze first order low pass filter using Op-Amp. **[8]**

Q7) a) Compare HWR and FWR circuits. **[3]**

b) Explain the working of single-phase full wave centre tapped diode rectifier with pure resistive load. **[6]**

c) With the help of circuit diagram and relevent waveforms, explain the operation of a 3-phase diode bridge rectifier with resistive load. **[8]**

OR

Q8) a) Define following terms. **[3]**

i) Form factor

ii) Ripple factor

iii) TUF

b) With relevant diagrams explain half wave diode rectifier with RL load. **[6]**

c) Explain the working of single-phase full wave diode bridge rectifier with pure resistive load. **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB-3614

[Total No. of Pages : 3

[6261]-19
S.E. (Electrical)
ELECTRICAL MEASUREMENTS & INSTRUMENTATION
(2019 Pattern) (Semester - III) (203144)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) With neat circuit diagram and necessary phasor diagram, prove that in two wattmeter method for measurement of 3 phase power in balanced R-L load, total power, $W_1 + W_2 = \sqrt{3}\ V_L I_L \cos\phi$. **[8]**

b) A circuit takes 10 A at 200 V. The power absorbed is 1000 W. If resistance of current coil is $0.15\,\Omega$ and that of pressure coil is $5000\,\Omega$, calculate the error when **[6]**

i) Pressure coil is connected on supply side of the circuit

ii) Pressure coil is connected on load side of the circuit

c) Write a note on low power factor wattmeter. **[4]**

OR

Q2) a) When the power of 3 phase balanced star connected load is measured by single wattmeter method with current coil in R phase and pressure coil between R phase and neutral, it showed 6 kW. The load current is 30 A at 400 V. What will be the reading of wattmeter if connections of current coil remain same but pressure coil is connected between Y and B phases. **[5]**

b) With neat diagram, derive the torque equation of a single phase electrodynamometer type wattmeter. **[7]**

c) Explain error due to inductance of pressure coil in single phase wattmeter. Hence state significance of multiplying factor. **[6]**

P.T.O.

Q3) a) In a test of 30 min duration with a constant current of 12 A through UPF load, meter registered 1.50 kWh. If the meter is subsequently used on 230 V supply, determine its error and state weather meter is running fast or slow. **[5]**

b) Explain with neat diagram and necessary phasor diagrams, how single-phase energy meter can be calibrated at different power factors using resistive load. **[7]**

c) Write a note on TOD meter **[5]**

OR

Q4) a) A single phase energy meter is supplying power to a unity p.f load at 240 V, 4.4 A for a period of 5 hours. **[7]**

i) If disc makes 2400 revolutions, calculate the meter constant

ii) Calculate the p.f. of the load if the load is operated for 4 hours at 240 V, 5 A and meter making 1500 revolutions.

b) Draw neat diagram of induction type energy meter, label all the parts and explain its construction and working. **[10]**

Q5) a) With neat diagram, explain Pirani gauge for measurement of low pressure **[6]**

b) Draw the representation of lissagious patterns for following frequency ratios **[4]**

i) 2:1 ii) 1:3 iii) 1:1 iv) 2:3

c) Give detailed classification of transducers along with examples of each type. **[8]**

OR

Q6) a) Explain construction and working of cathode ray oscilloscope. **[7]**

b) Explain resistive pressure transducers. **[5]**

c) Define pressure? Explain importance of pressure measurement in electrical systems hence give min five units in which pressure can be measured. **[6]**

Q7) a) With neat diagram, explain capacitive method for level measurement. **[6]**

b) Explain construction and working of bonded and unbonded strain gauge. **[6]**

c) Draw and justify characteristic of LVDT hence give various specifications of LVDT. **[5]**

OR

Q8) a) Explain with neat diagram, construction and working of foil strain gauge **[6]**

b) Explain how level can be measured using hydraulic method. **[7]**

c) Define strain, state importance of displacement measurement in electrical system. **[4]**

Total No. of Questions : 8]

SEAT No. :

PB3615

[Total No. of Pages : 4

[6261]-20
S.E. (Electrical Engineering)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207006)

Time : 2½ Hours] *[Max. Marks : 70*

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.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of logarithmic tables, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Find the fourier transform of $f(x) = \begin{cases} 1 & : |x| < a \\ 0 & : |x| > a \end{cases}$ Hence, find the value of $\int_0^\infty \frac{\sin x}{x} dx.$ **[6]**

b) Solve any one. **[5]**

i) Find z - transform and region of convergence of $f(k) = 3(2^k) - 4(3^k)$, $k \geq 0$.

ii) Find the inverse z transform of the following

$$\frac{10z}{z^2 + 2z - 3}; |z| < 1.$$

c) Solve the difference equation. **[6]**

$6y_{k+2} - y_{k+1} - y_k = 0$, $y(0) = 0$, $y(1) = 1$.

OR

Q2) a) Solve any one. **[5]**

i) Find z-transform and region of convergence of $f(k) = \sin(3k + 2)$, $k \geq 0$.

ii) Find the inverse z-transform of the following

$$\frac{z}{(z-2)(z-3)}; |z| > 3.$$

P.T.O.

b) Find the fourier transform of $f(x) = \begin{cases} 1-x^2 & : |x| < 1 \\ 0 & : |x| > 1 \end{cases}$ **[6]**

c) Find $f(x)$ satisfying the integral equation **[6]**

$$\int_0^\infty f(x).\cos(wx)\,dx = e^{-w}.w \geq 0.$$

Q3) a) If –1, 1, 2 & 4 be the moments of a distribution about 5, find the moments about mean, and coefficients of Skewness & Kurtosis. **[6]**

b) The two regression equations of the variables x and y are **[6]**

$x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$

Find

i) Mean of x,

ii) Mean of y

iii) The correlation coefficient between x and y.

c) If on an average one ship in every ten is wrecked, find the probability that out of 5 ships expected to arrive, 4 at least will arrive safely. **[6]**

OR

Q4) a) The following regression equations were obtained from a correlation table **[6]**

$y = 0.516\,x + 33.73$, $x = 0.512\,y + 32.52$

Find the value of

i) the correlation coefficient

ii) the mean of x & y

b) A manufacturer knows that the rezor blades he makes contain on an average 0.5% of defectives. He packs them in packets of 5. What is the probability that a packet picked at random will contain 3 or more faulty blades? **[6]**

c) The life of army shoes is normally distributed with mean 8 months and standard deviation 2 months. If 5000 pairs are issued how many pairs would be expected to need replacement after 12 months? **[6]**

[Given that $p(z \geq 2) = 0.0228$]

Q5) a) Find directional derivative of $\phi = x^2y + xyz + z^3$ at (1, 1, 1) along the normal to the surface $x^2y^3 = 4xy + y^2z$ at the point (1, 2, 0). **[6]**

b) Show that $\bar{F} = \left(ye^{xy}\cos z\right)\bar{i} + (xe^{xy}\cos z)\bar{j} - e^{xy}\sin z\bar{k}$ *is* irrotational. Find corresponding scalar ϕ such that $\bar{F} = \nabla\phi$. **[6]**

c) Evaluate line integral $\int_C \bar{F}.d\bar{r}$ *for* $\bar{F} = (2y+3)\bar{i} + xz\bar{j} + (yz - x)\bar{k}$ along $x = 2t^2, y = t, z = t^3$ from t = 0 to t = 1. **[5]**

OR

Q6) a) Find the constants a&b so that the surface. **[6]**

$ax^2 - byz = (a + 2)x$ will be orthogonal to the surface.

$4x^2y + z^3 = 4$ at the point (1, –1, 2).

b) With usual notations prove (any one) **[5]**

i) For a solenoidal vector field $\bar{E}$ show that curl curl curl curl $\bar{E} = \nabla^4\bar{E}$.

ii) $\nabla^2\left[\nabla.\frac{\bar{r}}{r^2}\right] = \frac{2}{r^4}$

c) Evaluate $\int_S\int\left(x^3\bar{i} + y^3\bar{j} + z^3\bar{k}\right).d\bar{S}$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 9$. **[6]**

Q7) a) Determine the analytic function F(z) = $u + iv$ if $u = 2x - 2xy$, also find Harmonic conjugate of u. **[6]**

b) Evaluate $\int_C \frac{\sin\pi z^2 + 6z}{(z-1)(z+2)}dz$ where c is the circle $|z| = 4$. **[6]**

c) Find the bilinear transformation that maps the points $z = 1, i, -1$ into the points $w = i, o, -i$ **[6]**

OR

Q8) a) Determine the analytic function $F(z) = u + iv$ if $u - v = x^3 + 3x^2y - 3xy^2 - y^3$.

[6]

b) Evaluate $\oint_C \frac{2z^2 + z + 5}{\left(z - 3/2\right)^2} dz$: where C is the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$. **[6]**

c) Show that under the transformation $w = \frac{i - z}{i + z}$, x-axis in z-plane is mapped onto the circle $|w| = 1$. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3616

[Total No. of Pages : 3

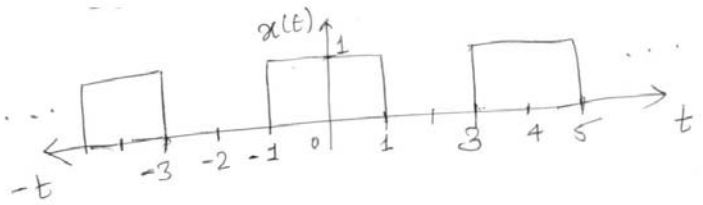
[6261]-21
S. E. (Electronics / E&Tc/E&CE)
SIGNALS AND SYSTEMS
(2019 Pattern) (Semester - IV) (204191)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Figures to the right indicate full marks.***
3) ***Draw neat figures wherever necessary.***
4) ***Assume sutiable data if necessary.***
5) ***Use of scientific calculator is allowed.***

Q1) a) Find the Trignometric Fourier series for a given signal $x(t)$ **[8]**



b) State and explain physical significance of fourier series properties given below. **[6]**

i) Time scaling

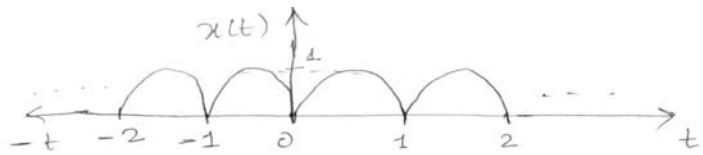
ii) Time Differentiation

iii) Time Reversal

c) Explain Gibb's Phenomenon **[4]**

OR

Q2) a) Determine exponential Fourier Series for the signal given $x(t)$. **[8]**



b) Check whether cos(wt) and cos(2 wt) are orthogonal to each other. **[6]**

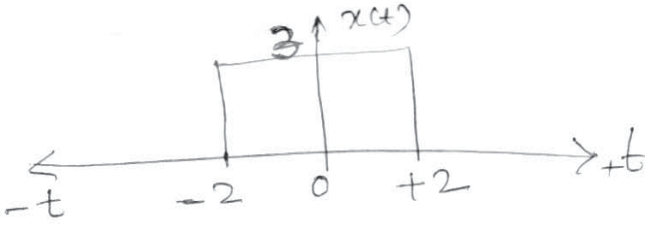
c) State Dirichlet conditions for the existence of Fourier series. **[4]**

P.T.O.

Q3) a) Determine the fourier Transform of $x(t) = e^{-3t}.\ u(t)$. Also, plot magnitude and phase spectrum. **[8]**

b) Define Frequency shifting property of CTFT and find the Fourier Transform of $x(t) = \cos(w_o t).\ u(t)$. **[6]**

c) Determine the Fourier Transform of the signal given below. **[3]**



OR

Q4) a) Find the Fourier Transform of signum(t). **[8]**

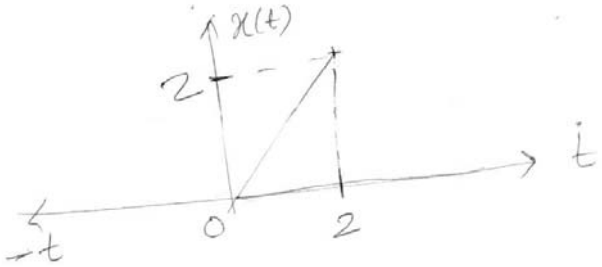
b) Find the Fourier Transform of following signals using properties of CTFT

i) $\delta(t - 3)$

ii) $3\delta(t) + 2e^{-dt}u(t)$ **[6]**

c) Explain magnitude and phase response. **[3]**

Q5) a) Determine the Laplace Transform of the signal given below. Sketch ROC. **[8]**



b) Define ROC. List the properties of ROC. **[6]**

c) Find the Laplace transform of following signals using properties **[4]**

i) $x(t) = u(t - 4)$

ii) $x(t) = r(2t)$

OR

Q6) a) Determine the Inverse Laplace Transform **[8]**

$$X(s) = \frac{2}{S(S+1)(S+2)} \text{ with}$$

ROC specified $-1 < \sigma < 0$

(σ = sigma)

b) Find the initial and final values of given function **[6]**

$$x(s) = \frac{2s+3}{s^2+5s+6}.$$

c) Compare Fourier Transform and Laplace Transform. **[3]**

Q7) a) State the properties of PDF. **[9]**

For a given CDF,

$$F_X(x) = \begin{cases} 0 & x \le 0 \\ K x^2 & 0 < x \le 10 \\ 100K & for\ x > 10 \end{cases}$$

Find K, P(X ≤ 5) and P(5 < X ≤ 7) plot the corresponding PDF.

b) Define probability. A box contains 4 white, 5 Red and 7 black balls. A ball is drawn randomly from a box. Find the probability that **[9]**

i) a ball is Red,

ii) a ball is not white

iii) a ball is back or white.

OR

Q8) a) PDF of a random variable is as given below **[9]**

$$f_X(x) = \frac{1}{2\pi} \quad 0 \le x \le 2\pi$$

$$0 \quad \text{otherwise}$$

Calculate:

i) Mean Value

ii) Mean Square Value

iii) Variance

iv) Standard Deviation

b) A coin is torsed three times. Write the sample space which gives all possible outcomes. Random variable X, Represents the number of heads on any trippletors. **[8]**

Calculate and draw CDF and PDF.

Total No. of Questions : 8]

SEAT No. : ____

PB-3617

[Total No. of Pages : 2

[6261]-22
S.E.(Electronics & Telecommunication)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (204192)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Using Routh's & Hurwitz's criteria, comment on the stability if characteristic equation is: $S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2$. **[8]**

b) Sketch root locus of the unity feedback system with open loop transfer function $G(s)=\frac{K}{s(s+1)(s+4)}$. **[10]**

OR

Q2) a) A feedback control system has open loop gain $G(s)H(s)=\frac{k(s+2)}{s(s+1)(s^2+2s+5)}$. Determine the value of 'k' for which the system is stable as well as critically stable. **[8]**

b) A unity feedback system has the loop transfer function, $G(s)=\frac{k}{s(s+1)(s+3)(s+4)}$ Determine: Breakaway points, intersection with imaginary axis. Plot root locus. **[10]**

Q3) a) For an unity feedback system with open loop transfer function $G(s)=\frac{4}{s(s+2)}$. Determine Damping factor, Undamped natural frequency, resonant peak, and resonant frequency. **[9]**

b) The open loop transfer function of a unity feedback system is given by $G(s)=\frac{1}{s(s+1)(s+2)}$ Sketch the polar plot and determine the gain margin. Also comment on the stability. **[9]**

P.T.O

OR

Q4) a) The open loop transfer function of the system $G(s)H(s)=\frac{10}{(s+2)(s+4)}$

Determine the system stability using Nyquist plot. **[9]**

b) For the unity feedback system with open loop transfer function $G(s)=\frac{12}{s(s+2)(s+6)}$ sketch the bode plot. Determine gain crossover frequency, phase crossover frequency, gain margin and phase margin. Also investigate the stability. **[9]**

Q5) a) Obtain the expression for state transition matrix and state any four properties of state transition matrix. **[9]**

b) Find Controllability and Observability of the system given by state model. **[9]**

$$A=\begin{bmatrix}1 & 1 & 5\\ 1 & -2 & 2\\ 5 & 2 & -8\end{bmatrix},\ B=\begin{bmatrix}5\\ 1\\ 10\end{bmatrix},\ C=\begin{bmatrix}10 & 15 & 11\end{bmatrix},\ D=\begin{bmatrix}0\end{bmatrix}$$

OR

Q6) a) Obtain the state model for the system with transfer function $\frac{Y(s)}{U(s)}=\frac{3S+4}{S2+5S+6}$. **[9]**

b) Determine the transition matrix of state equation $\dot{X}=\begin{bmatrix}0 & -3\\ 1 & -4\end{bmatrix}x(t)$. **[9]**

Q7) a) Explain Proportional mode, Integral Mode and Derivative Mode. **[8]**

b) What do you mean by Industrial Automation? What are its types? Explain the architecture of an automation. **[8]**

OR

Q8) a) Explain the Ziegler–Nichols tuning method of a PID controller. **[8]**

b) Explain what do you mean by Offset in controller. Which method is used to eliminate this problem? **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB3618

[Total No. of Pages : 2

[6261]-23

S.E. (E & TC/Electronics & Computer Engineering)

PRINCIPLES OF COMMUNICATION SYSTEMS

(2019 Pattern) (Semester - IV) (204193)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume Suitable data if necessary.***

Q1) a) Draw & Explain Armstrong method of FM generation. **[6]**

b) State significance of pre-emphasis and de-emphasis in FM. **[6]**

c) FM wave is represented by following equation **[6]**

$V(E) = 12\text{Cos}\,[6 \times 10^8 t + 5\sin 1250t]$ calculate

i) Carrier frequency

ii) Modulating frequency

iii) Modulation index

iv) Maximum Deviation

v) Power dissipated by FM wave in 1052 resister

OR

Q2) a) Explain FM detection using PLL. **[6]**

b) Draw and explain block diagram of super heterodyne FM receiver. **[6]**

c) The maximum deviation allowed in FM broadcast system is 75kHz. It modulating signal is single tone sinusoid of 8kHz, determine the bandwith of FM signal. What will be the bandwidth when modulating signal frequency is doubled. **[6]**

P.T.O.

Q3) a) Explain types of sampling with waveform. **[6]**

b) Explain with block diagram and waveform, generation of PAM. **[6]**

c) What is aliasing? How to reduce it. **[5]**

OR

Q4) a) Compare PAM, PWM and PPM with waveform. **[6]**

b) Explain need of time division multiplexing? Why synchronization is needed in TDM system. **[6]**

c) Find the Nyquist rate and Nyquist interval for following signal, **[5]**

$X(t) = 3\cos(200\pi t) + 5\sin(600\pi t) + 10\cos(1200\pi t)$

Q5) a) Draw and explain block diagram of Delta Modulation. **[6]**

b) Explain need of digital communication. **[6]**

c) Explain types of quantization with neat waveform. **[6]**

OR

Q6) a) Draw and explain block diagram of PCM transmitter. **[6]**

b) Differentiate between A law compander and μ law compander. **[6]**

c) A television signal with bandwidth of 4.2MHz is transmitted using binary PCM. The number of quantization levels is 512 calculate **[6]**

i) signalling rate

ii) transmission band width

Q7) a) Explain various data formats. **[6]**

b) What is inter symbol interference (ISI)? Explain methods to eliminate it. **[6]**

c) Explain need of synchronizer in digital multiplexing. Explain frame synchronization. **[5]**

OR

Q8) a) Explain working principle of scrambling and unscrambling with example. **[6]**

b) Draw and explain AT & T hierarchy multiplexing system. **[6]**

c) What is equalizer? Explain Adaptive equalizer. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3619

[Total No. of Pages :2

[6261]-24

S.E. (Electronics/E & TC) (Electronics & Computer Engineering)

OBJECT ORIENTED PROGRAMMING

(2019 Pattern) (Semester- IV) (204194)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) What is operator overloading? Why it is necessary to overload an operator? **[6]**

b) Write a program to demonstrate friend function in C++. **[6]**

c) What are the rules for overloading operators? **[6]**

OR

Q2) a) Explain friend function with example? **[6]**

b) What are the rules for overloading operators? **[6]**

c) Give a programming example that overloads = = operator with its use. **[6]**

Q3) a) Explain virtual base class and virtual function with example. **[6]**

b) Discuss the ways in which inheritance promotes software reuse, saves time during program development and helps prevent errors. **[6]**

c) What does inheritance mean in C++? What are different forms of inheritance? Give an example of each. **[5]**

OR

Q4) a) Write a C++ program demonstrating use of the pure virtual function with the use of base and derived classes. **[6]**

b) Discuss the role of access specifiers in inheritance and show their visibility when they are inherited as public, private and protected. **[6]**

c) What is the ambiguity that arisesin multiple inheritance? How it can be overcome? Explain with example. **[5]**

P.T.O.

Q5) a) Explain exception handling mechanism in C++? Write a program in C++ to handle divide by zero exception? **[6]**

b) Explain class template using multiple parameters? Write a program in C++. **[6]**

c) What is stream? Explain types of streams available in C++? **[6]**

OR

Q6) a) Explain Namespace in C++ with example. **[6]**

b) Write a C++ program using function template to find the product of two integer or floating-point type of data. **[6]**

c) What is a user defined exception? Write down the scenario where we require user defined exceptions. **[6]**

Q7) a) Write a program using the open(), eof(), and getline() member function to open and read a file content line by line. **[6]**

b) Explain the role of seekg(), seekp(), tellg(), tllp(), function in the process of random access in a file. **[5]**

c) What is file mode? Explain any four file modes supported by C++. **[6]**

OR

Q8) a) Write a program using put() to write characters to a file until user enters a dollar sign. **[6]**

b) Waht is the difference between opening a file with constructor function and opening a file with open () function? **[5]**

c) Explain erroe handling during file operation. **[6]**

Total No. of Questions : 9]

SEAT No. : ____

PB3620

[Total No. of Pages : 5

[6261]-25

S.E. (Electronics/E&TC)/(Electronics & Computer Engineering)

ENGINEERING MATHEMATICS-III

(2019 Pattern) (Semester-III) (207005)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***
7) ***Write numerical calculations correct upto four decimal places.***

Q1) Write the correct options for the following multiple choice questions. **[2]**

a) For $f(x) = x^2$, $h=2$, second forward difference $\Delta^2 f(x)$ is given by

i) 6 ii) 12

iii) 4 iv) 8

b) Unit vector in the direction normal to the surface $x^2 + y^2 + z^2 = 9$ at (1,2,2) is _____ **[2]**

i) $\frac{1}{3}\left(\bar{i} + 2\bar{j} + 2\bar{k}\right)$ ii) $\frac{1}{3}\left(\bar{i} - 2\bar{j} - 2\bar{k}\right)$

iii) $\frac{1}{3}\left(\bar{i} + \bar{j} + \bar{k}\right)$ iv) $\frac{1}{9}\left(\bar{i} + 2\bar{j} + 2\bar{k}\right)$

c) The value of $\oint_C \frac{4z^2 + z}{(z-1)} dz$ where C is $|z| = 2$ **[2]**

i) $5\pi i$ ii) $10\pi i$

iii) $-10\pi i$ iv) $-5\pi i$

P.T.O.

d) For $\bar{F} = x^2\bar{i} + xy\bar{j}$ the value of $\oint_C \bar{F}.dr$ for the curve $y^2 = x$ joining the points (0,0) and (1,1) is **[2]**

i) $\frac{1}{2}$ ii) $\frac{7}{12}$

iii) $\frac{5}{12}$ iv) $\frac{2}{3}$

e) The Cauchy integral formula for analytic function f (z) is **[1]**

i) $\oint_c \frac{f(z)}{(z-a)}dz$ ii) $\oint_c \frac{f(z)}{(z+a)}dz$

iii) $\oint_c \frac{f(z)}{(z-a)^2}dz$ iv) $\frac{1}{2\pi i}\oint_c \frac{f(z)}{(z-a)}dz$

f) Given equation is $\frac{dy}{dx} = f(x, y)$ with initial condition $x = x_0$, $y = y_0$ and h is step size. Euler's formula to calculate y_1 at $x = x_0 + h$, is given by **[1]**

i) $y_1 = y_0 + h\, f(x_0, y_0)$ ii) $y_1 = y_0 + hf(x_1, y_1)$

iii) $y_1 = y_1 + h\, f(x_0, y_0)$ iv) $y_1 = hf(x_0, y_0)$

Q2) a) Find value of y for x=0.5 using newton's forward difference formula for following data **[5]**

x	0	1	2	3	4
y	1	5	25	100	250

b) By using simpson's $\left(\frac{3}{8}\right)^{th}$ rule, find the value of $\int_1^7 f(t)dt$ for following data **[5]**

t	1	2	3	4	5	6	7
f(t)	81	75	80	83	78	70	60

c) Given $\frac{dy}{dx} = x^2 + y, y(0) = 1.$ Determine y(0.02) by using modified Euler's method, take h=0.02 **[5]**

OR

Q3) a) Find longrange's interpolation polynomial for following data. **[5]**

x	0	1	2
y	7	–1	–7

b) By trapezoidal Rule, find the value of $\int_0^1 \frac{1}{1+x^2} dx$ by taking h=0.25 **[5]**

c) Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} = x^2 + y^2, y(1) = 1.5$ in the interval (1,1.5) with h=0.1 **[5]**

Q4) a) Find the directional derivative of the function $\phi = x^2y + xyz + z^3$ at (1,2,–1) in the direction $-8\bar{i} - 8\bar{j} + 4\bar{k}$ **[5]**

b) Show that

$\bar{F} = (2xz^3 + 6y)\bar{i} + (6x - 2yz)\bar{j} + (3x^2z^2 - y^2)\bar{k}$ is irrotational. Find scalar potential ϕ such that $\bar{F} = \nabla\phi$. **[5]**

c) If $\bar{r} \times \frac{d\bar{r}}{dt} = 0$,them show that $\bar{r}$ has a constant direction. **[5]**

OR

Q5) a) Find the directional derivative of the function $\phi = 4xz^3 - 3x^2y^2z$ at (2,–1,2) in the direction $2\bar{i} - 3\bar{j} + 6\bar{k}$ **[5]**

b) Prove that $\bar{F} = \frac{x\bar{i} + y\bar{j}}{x^2 + y^2}$ is solenoidal **[5]**

c) Prove that $\nabla \cdot \left[r\nabla\left(\frac{1}{r^n}\right)\right] = \frac{n(n-2)}{r^{n+1}}$ **[5]**

Q6) a) Find the work done in moving a particle once round the ellipse x=5 cosθ,y=4 sinθ, z=0 under the field of force.

$\bar{F} = (2x - y + z)i + (x + y - z)j + (3x^2 - 2y^2 + z^2)K$ **[5]**

b) Evaluate $\iint_s \bar{r}.\hat{n}\,ds$ over the surface of a sphere of radius 4 with centre at origin. **[5]**

c) Apply stoke's theorem to evaluate $\int_C (yi + zj + xk).d\bar{r}$ where C is the circle given by $x^2 + y^2 + z^2 = 4$, $x + z = 2$ **[5]**

OR

Q7) a) Evaluate $\int_C \bar{F}.d\bar{r}$ for

$\bar{F} = 3x^2 i + (2xz - y)j + zk$ along the straight line joining O(0,0,0) and A (1,1,1). **[5]**

b) Apply stoke's theorem to evaluate $\int_C 4ydx + 2zdy + 6ydz$ where C is the circle $x^2 + y^2 + z^2 - 6z = 0$, $x - z + 3 = 0$ **[5]**

c) Use divergence theorem to evaluate $\iint_s (xi + yj + z^2 k).d\bar{s}$ where S is the surface of the cylinder $x^2 + y^2 = 4$ bounded by the planes $z = 0$ and $z = 2$**[5]**

Q8) a) If $f(z)$ is analytic function of z, and $f(z)$ = u + iv prove that

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\left|\text{Re } f(z)\right|^2 = 2\left|f'(z)\right|^2$$ **[5]**

b) Evaluate $\oint_c \log z$ dz where C is the circle |Z|=1 **[5]**

c) Find the bilinear transformation which maps the points 0,–1, i of the z-plane onto the points $2, \infty, \frac{1}{2}(5+i)$ of w-plane **[5]**

OR

Q9) a) Determine K such that the function. $f(z)=\frac{1}{2}\log(x^2+y^2)+i\tan^{-1}\left(\frac{ky}{x}\right)$ is analytic. **[5]**

b) Evaluate $\oint_C \cot z\,dz$ where C is circle |z|=4 by residue theorem. **[5]**

c) Show that under transformation $w=\frac{i-z}{i+z}$, x–axis in z-plane is mapped on to the circle |w|=1 **[5]**

● ● ●

Total No. of Questions : 8]

SEAT No. :

PB3621

[Total No. of Pages : 2

[6261]-26
S.E. (Electronics /E&TC)
ELECTRONIC CIRCUITS
(2019 Pattern) (Semester-III) (204181)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Define Voltage regulation. Explain the any three performance parameters of voltage regulator. **[6]**

b) IC Voltage Regulator using IC 317, Calculate values of R2 for the output voltage l0v to 20v, assume R1= 240 Ω and Iadj = l00μA. **[6]**

c) Compare Linear power supply and Switch Mode Power Supply (SMPS). **[6]**

OR

Q2) a) Draw and explain the block diagram of Power Supply. **[6]**

b) IC Voltage Regulator using IC 317, Calculate values of R2 for the output voltage 5v to l0v, assume R1= 240 Ω and Iadj = l00μA. **[6]**

c) Write a Short note on "Low drop out Voltage regulator". **[6]**

Q3) a) Draw Block diagram of OP - AMP. and explain the function of each block. **[5]**

b) Define the following Characteristics of OPAMP **[6]**

i) Input offset voltage

ii) Slew Rate

iii) CMRR (Common Mode Rejection Ratio)

c) Compare Concept of Voltage Series and Voltage Shunt in OP AMP. **[6]**

OR

P.T.O.

Q4) a) List types of differential amplifiers. Draw dual input balanced output differential amplifier. **[5]**

b) State Ideal and Typical values of OP AMP parameters (IC 741). **[6]**

c) Explain with circuit diagram necessity of level shifting in OP AMP. **[6]**

Q5) a) Draw and explain Inverting amplifier. Draw its input and output waveforms. **[6]**

b) Design a Practical differentiator circuit for the input signal having maximum frequency of operation 250 Hz. **[6]**

c) Draw and explain Inverting Schmitt trigger circuit using OP AMP. **[6]**

OR

Q6) a) Compare Inverting and Non-Inverting amplifier in OP AMP. **[6]**

b) Design a Practical Integrator circuit to operate at f=4 KHz and gain equal to 4. **[6]**

c) Draw and explain square wave Generator using OP AMP. **[6]**

Q7) a) Draw and explain V to I Converter using grounded load using OP AMP. **[5]**

b) Draw and explain the circuit of R/2R DAC using OP AMP. **[6]**

c) With the help of neat block diagram explain operation of PLL. **[6]**

OR

Q8) a) Draw and explain I to V Converter using OP AMP. **[5]**

b) Draw and explain the circuit of binary weighted resistor DAC using OP AMP. **[6]**

c) Define the following specifications of ADC **[6]**

i) Resolution

ii) Accuracy

iii) Conversion time

Total No. of Questions : 8]

SEAT No. :

PB3622

[Total No. of Pages : 2

[6261]-27

S.E. (E & TC/Electronics/Computer Engineering)

DIGITAL CIRCUITS

(2019 Pattern) (Semester - III) (204182)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q. No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 and Q.No.7 or Q.No.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) Explain implementation of full adder using 8 : 1 MUX. **[6]**

b) Explain 3-bit parity checker circuit. **[6]**

c) Implement 1 : 16 demux using 1 : 4 demux. **[6]**

OR

Q2) a) Implement the given logic function using a 4 : 1 multiplexer. **[6]**

f (A, B, C) = $\sum m(0, 1, 2, 4, 7)$

b) Implement 3-bit parity generator circuit. **[6]**

c) Explain the working of a half-subtractor? Draw its logic diagram. **[6]**

Q3) a) Design a circuit to generate the following sequence using D FFs 1011. **[8]**

b) Explain with neat diagram the types of shift register. **[9]**

OR

Q4) a) Design a 3- Bit asynchronous counter using JK FF. **[9]**

b) Convert SR flip - flop into JK flip flop. **[8]**

Q5) a) Write short note on state diagram and state table with suitable example. **[6]**

b) Write short note on Principal Component of an ASM Chart. **[6]**

c) Draw the state diagram of SR flip flop and JK flip flop. **[6]**

OR

P.T.O.

Q6) a) Draw ASM chart for 2 bit binary counter having enable line E Such that : E = 1, Count Enable and E = 0, Count Disable. **[9]**

b) Compare Mealy and Moore machine. **[9]**

Q7) a) Classify and explain the characteristics of memories. **[9]**

b) Implement 3-bit binary to Gray code converter using PROM. **[8]**

OR

Q8) a) Design and implement 2-bit comparator using PAL? **[9]**

b) Explain CPLD architecture. **[8]**

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. :

PB-3623

[Total No. of Pages : 3

[6261]-28
S.E. (E&TC Engineering)
ELECTRICAL CIRCUITS
(2019 Pattern) (Semester - III) (204183)

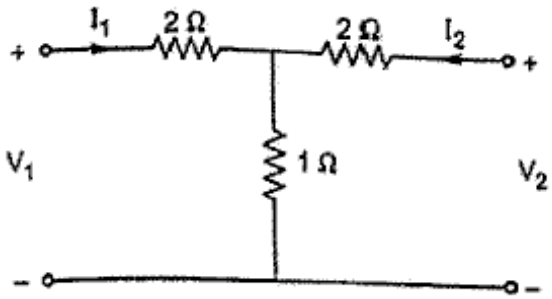
Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) Define Z parameters. Why Z parameters are called open circuit parameters. **[6]**

b) Obtain the Z parameters of the network shown below **[6]**



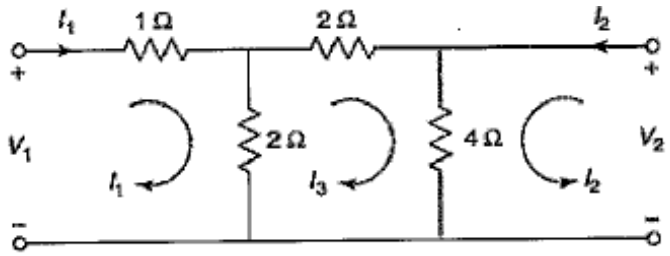
c) What do you mean by the reciprocal network? Derive the condition for reciprocity for Y parameters. **[6]**

OR

Q2) a) Define basic h- parameters and give the significance of each parameter.**[6]**

P.T.O.

b) Find the h parameters for the network given below **[6]**



c) What do you mean by symmetrical network? Derive the condition of symmetry for Z parameters. **[6]**

Q3) a) Draw and explain the various characteristics of DC shunt motor. **[5]**

b) Derive the torque equation of DC motor. **[6]**

c) Which are the different methods of speed control of DC shunt motor explain any one method. **[6]**

OR

Q4) a) Explain the function of no volt coil and overload release used in three point starter. **[5]**

b) Explain the construction and working of permanent magnet DC motor. **[6]**

c) Sketch the neat constructional diagram of DC machine. List the various parts stating the function of each part. **[6]**

Q5) a) Explain the working principle of three phase induction motor with neat diagrams. **[6]**

b) Explain the v/f method of controlling the speed of three phase induction motor. **[6]**

c) Describe the working principle of operation of single phase induction motor using capacitor. Draw the circuit and phasor diagram. **[6]**

OR

Q6) a) Derive the torque equation for three phase induction motor. **[6]**

b) Sketch and explain the torque – slip characteristics for three phase induction motor and explain the effect of variation of rotor resistance on it. **[6]**

c) With the help of diagram explain the DOL starter. **[6]**

Q7) a) Explain the working of brushless DC motor with neat diagram. **[6]**

b) Draw and explain the torque-speed characteristics of brushless DC motor. **[6]**

c) What is step angle in the stepper motor State the expression for it. **[5]**

OR

Q8) a) Explain the block diagram of electric vehicle. State its advantages and limitations. **[6]**

b) Explain the operation of variable reluctance stepper motor. **[6]**

c) Compare variable reluctance motor with permanent magnet stepper motor. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3624

[Total No. of Pages :3

[6261]-29
S.E. (E & TC)
DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester-III) (204184)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Use of Calculator is followed.***
5) ***Assume suitable data if necessary.***

Q1) a) Compare Stack and Queue. What are the advantages of circular queue over liner queue? **[6]**

b) Write a function PUSH and POP in 'C' for stack using linked list. **[6]**

c) What are the applications of Queue? Explain two applications in detail. **[5]**

OR

Q2) a) Write a short note on circular queue. Compare it with linear queue. **[5]**

b) Convert the following prefix expression into infix form. Show all the steps and stack contents: **[6]**

*-A/BC-/AKL

c) Write ADD and DETETE function in 'C' for Queue using array **[6]**

Q3) a) Compare array and linked list. **[5]**

b) Write a 'C' function to delete a number from singly linked list. **[6]**

c) Explain doubly linked list (DLL). What are the advantages of DLL over SLL. **[6]**

OR

P.T.O.

Q4) a) Draw and explain circular linked list. State the limitations of single linked list. **[5]**

b) Write 'C' function to insert a number at end in to the single linked list. **[6]**

c) Differentiate singly linked list and doubly linked list. **[6]**

Q5) a) Construct Binary search tree of the following. **[6]**

MAR, OCT, JAN, APR, NOV, FEB, MAY, DEC, JUN, AUG, JUL, SEP

b) Write a pseudo code to search an element in binary search tree using arrays. **[6]**

c) Explain with suitable example how binary tree can be represented using: **[6]**

i) Array

ii) Linked List

OR

Q6) a) Define BST? Create a BST for the following data: **[6]**

14,15,4,9,7,18,3,5,7.

b) Define binary tree. Name and explain with suitable example the following terms **[6]**

i) Root node

ii) Left sub tree and right sub tree

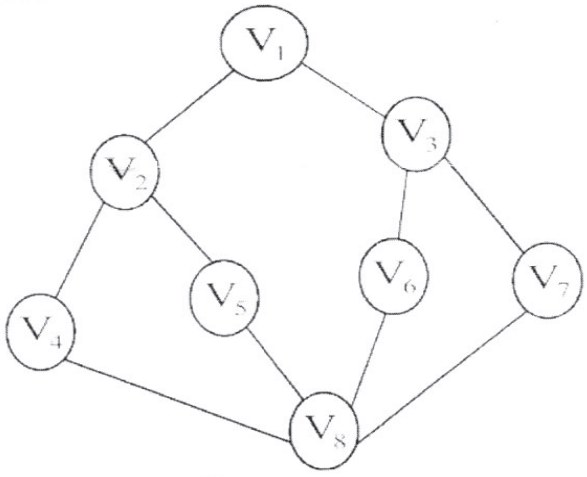
iii) Depth of tree

c) Construct the binary search tree from the following elements: **[6]**

15,4,16,8,2,18,14

Also show preorder, inorder and postorder traversal for the same

Q7) a) Draw adjacency list and adjacency matrix for the following graph: **[6]**

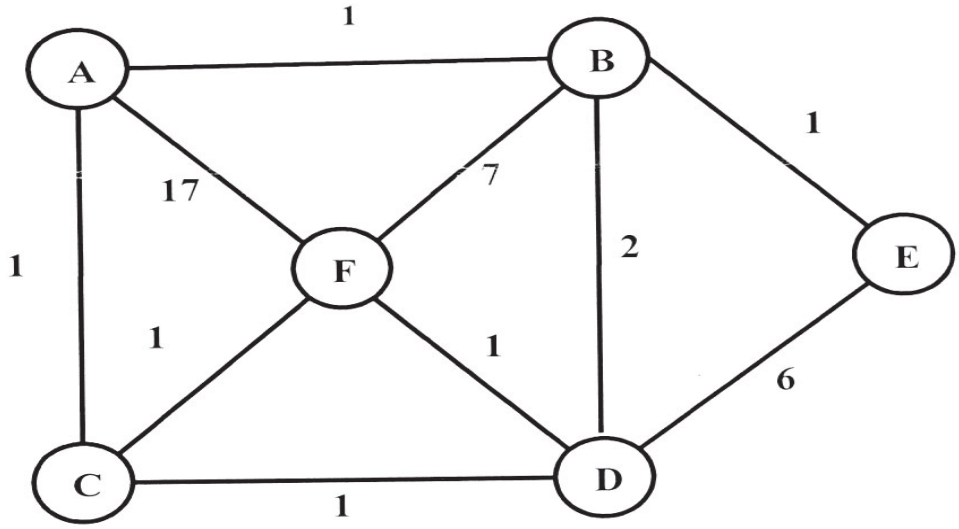


b) What is MST? Explain with suitable example Kruskal's Algorithm to find out MST. **[6]**

c) Define DFS and BFS graph with example. **[6]**

OR

Q8) a) Explain Kruskal algorithm? Find the minimum spanning tree for below figure Using Kruskal's Algorithm. **[6]**



b) Explain Dijkstra's algorithm with example. **[6]**

c) Explain with suitable example the techniques to represent a graph. **[6]**

Note: consider graph of minimum 6 vertices

Total No. of Questions : 8]

SEAT No. :

PB-3625

[Total No. of Pages : 2

[6261]-30

S.E. (Electronics & Computer Engineering)

PRINCIPLES OF PROGRAMMING LANGUAGE

(2019 Pattern) (Semester - IV) (204206)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Explain in detail general structure of C language file. **[8]**

b) Explain in detail about following programming languages **[10]**

i) Functional Programming

ii) Logic and rule based programming

OR

Q2) a) Explain the concept of encapsulation in detail with example. **[8]**

b) Explain in detail about **[10]**

i) Abstraction

ii) Modularity

Q3) a) Write a program in Java to print numbers from 1 to 5. **[8]**

b) Explain about different Java string class methods. **[9]**

OR

Q4) a) Explain about Java virtual machine in detail. **[8]**

b) Explain concept of array in Java with programming example for multi-dimensional array. **[9]**

P.T.O

Q5) a) How to define class in java, explain with syntax and example. **[8]**

b) Explain concept of method overloading in Java with suitable example. **[10]**

OR

Q6) a) Explain about instance of operator in Java with suitable example. **[8]**

b) Explain in detail about packages in Java with suitable example. **[10]**

Q7) a) Write about **[8]**

i) Byte streams

ii) Character strems in Java

b) Explain in detail about applet skeleton in Java. **[9]**

OR

Q8) a) Explain about different exceptions types in Java. **[8]**

b) Explain use of try and catch block in Java with suitable example. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3626

[Total No. of Pages : 2

[6261]-31

S.E. (Electronics and Computer Engineering)

SYSTEM PROGRAMMING AND OPERATING SYSTEMS

(2019 Pattern) (Semester - IV) (204207)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) In the following example, there are five processes named as P1, P2, P3, P4 and P5. Their arrival time and burst time are given in the table below. Calculate average waiting time and average turnaround time for SJF (Non-preemptive) scheduling algorithm. **[6]**

Process	Arrival time	Burst time
P1	02	06
P2	05	02
P3	01	08
P4	00	03
P5	04	04

b) Draw and explain architecture of Batch Operating Systems. **[6]**

c) Draw and explain Microkernel Kernel Operating System. Differentiate between. Microkernel and Monolithic Kernel. **[8]**

OR

Q2) a) Draw and explain architecture of Multitasking Operating Systems. **[6]**

b) Consider the following processes arrival time and burst time are as shown. Calculate average waiting time and average turnaround time using FCFS scheduling algorithm. **[6]**

Process	Arrival time	Burst time
P1	02	02
P2	00	01
P3	02	03
P4	03	05
P5	04	05

c) Define Process. Draw process state transition diagram in operating system and explain different process states in detail. **[8]**

P.T.O.

Q3) a) What is dead lock in operating system? What are the three ways to handle deadlock explain it with example. **[8]**

b) What is Mutual Exclusion? Explain any three mutual exclusion techniques in detail. **[8]**

OR

Q4) a) Explain any two Classical Problems of Synchronization in detail. **[8]**

b) What is semaphore? Explain different types of Semaphore. State the advantages of Semaphore. **[8]**

Q5) a) i) Explain concept of paging with suitable diagram. **[8]**

ii) Calculate the number of page faults and page hits for the page replacement policies FIFO for the given reference string 1, 3, 0, 3, 5, 6, 3 with 3 page frames.

b) What is Fragmentation? Explain Internal fragmentation and External fragmentation and differentiate between them. **[8]**

OR

Q6) a) Explain the concept of Paging and Segmentation. Differentiate between Paging and Segmentation. **[8]**

b) Explain the terms Shared Memory and Message passing for IPC. Give the difference between shared memory and message passing. **[8]**

Q7) a) Explain the following Directory structure in OS **[6]**

i) Single-level directory

ii) Two-level directory

b) Consider the following disk request sequence for a disk with 200 tracks Request sequence ={176,79,34,60,92, 11,41, 114} **[6]**

Head pointer is starting at 50 and moving in left direction. Find the number of head movements (total seek length) in cylinders using FCFS scheduling.

c) Explain file management concept. What are the functions of file management in operating system? **[6]**

OR

Q8) a) Differentiate between Programmed I/O and Interrupt Driven I/O. **[6]**

b) What is I/O buffering? Explain different types of I/O buffering. **[6]**

c) Explain the following File allocation methods **[6]**

i) Contiguous File allocation

ii) Linked File Allocation

Total No. of Questions : 8]

SEAT No. :

PB3627

[Total No. of Pages : 3

[6261]-32
S.E. (Electronics & Computer Engineering)
ELECTRONIC CIRCUITS
(2019 Pattern) (Semester-III) (204202)

Time : 2½ Hours] *[Max. Marks : 70*

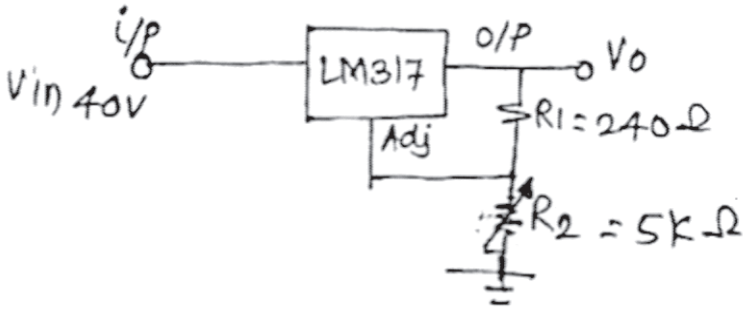
Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicates full marks.***
3) ***Draw neat diagram wherever necessary.***
4) ***Assume suitable data if necessary.***

Q1) a) Write short note on current boosting regulator. **[6]**

b) Draw the detailed block diagram of SMPS and explain its operation. **[6]**

c) For the circuit diagram as shown in the Fig. (3) calculate range of O/P voltage. (Assume ladj = 50 μA) **[6]**



OR

Q2) a) Compare Linear Voltage regulators with SMPS **[6]**

b) Write a short note on Low Dropout Regulator (LDO) **[6]**

c) Design an adjustable voltage regulator using LM 317 for output voltage from 10 to 20 V and draw the typical connection diagram. Assume: R1 = 240 Ω and ladj. 100 μA. **[6]**

P.T.O.

Q3) a) Explain the following Op Amp parameters and state their ideal value **[6]**

i) CMRR

ii) Slew rate

b) Draw circuit diagram of current mirror circuit and explain in detail. **[5]**

c) A Dual input balanced output differential amplifier has the following specifications : **[6]**

VCC = ± 10 V, RC1 = RC2 = 3.7 k Ω and RE = 4.2 k Ω, βac = βdc = 100 & VBE = 0.7 V. $r'_e = 25.3\Omega$

Calculate : i) Voltage Gain (Ad)

ii) Input Resistance (Ri)

iii) Output Resistance (Ro)

OR

Q4) a) Draw the block diagram of Op Amp and explain in detail. **[6]**

b) Write a short note on Level Shifter circuits. **[5]**

c) Draw the circuit diagram of Dual input balanced output differential amplifier and write down the expressions for **[6]**

i) Voltage Gain (Ad)

ii) Input Resistance (Ri)

iii) Output Resistance (Ro)

Q5) a) Draw circuit diagram of practical differentiator and its frequency response. Explain it over ideal differentiator **[6]**

b) Draw neat circuit diagram of: **[6]**

i) Non-inverting amplifier

ii) Inverting summing amplifier

c) Draw circuit diagram of precision full wave rectifier with showing input and output waveform. **[6]**

OR

Q6) a) Explain in detail working of square wave generator with neat circuit diagram. Draw waveform of output voltage and capacitor voltage. **[6]**

b) Draw neat circuit diagram of three Op-amp Instrumentation amplifier. Enlist the advantages of Instrumentation amplifier. **[6]**

c) Draw circuit diagram of inverting symmetrical Schmitt trigger and plot hysteresis and explain in short. **[6]**

Q7) a) Draw and explain successive approximation A/D converter. **[5]**

b) Explain PLL with its block diagram. **[6]**

c) Calculate output frequency 'f 0', Lock range 'Δf L' , Capture range 'Δf C' of a PLL, If RT = 1 kΩ, CT = 0.1 μf, filter capacitor C = 10 μf and internal resistance = 3.6 kΩ. Asuurne $\pm$ V = 10V **[6]**

OR

Q8) a) Draw the circuit diagram of R-2R ladder DAC. State the advantages over binary weighted DAC. **[5]**

b) Define the term Free running frequency, Lock range and Capture range in PLL. **[6]**

c) Draw circuit diagram of frequency multiplier using PLL and explain in detail. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB-3628

[Total No. of Pages : 4

[6261]-33

S.E. (Electronics and Computer Engineering)

DATA STRUCTURES AND ALGORITHMS

(2019 Pattern) (Semester - III) (204184)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***

2) ***Figures to the right side indicate full marks.***

3) ***Assume suitable data, if necessary.***

Q1) a) Define Queue. Explain its implementation using any one method. **[6]**

b) Compare stack with queue. **[6]**

c) Give an algorithm for reversing a queue. **[6]**

OR

Q2) a) Define Stack and Queue. Explain any one application of queue. **[6]**

b) Identify the expressions and convert them into remaining two **[6]**

i) a*b/c*d-e/f

ii) (a+b)/(c+d)

c) Explain Stack operation PUSH and POP with example. **[6]**

Q3) a) Write short notes on **[6]**

i) Circular Linked List.

ii) Doubly Link List.

b) What is the need of linked list? Explain any one application of doubly linked list with suitable example. **[5]**

c) Write a structure of doubly linked list. Differentiate between Array and Linked list. **[6]**

P.T.O.

OR

Q4) a) Write 'C' function to delete node from singly linked list. **[6]**

b) Differentiate between SLL and DLL. **[6]**

c) A doubly linked list with numbers to be created. Write algorithm to create the list. **[5]**

Q5) a) Define Binary Tree. What are its types? Explain with suitable figures. **[6]**

b) Write inorder, preorder, Postorder traversal for the following tree. (Fig.1). **[6]**

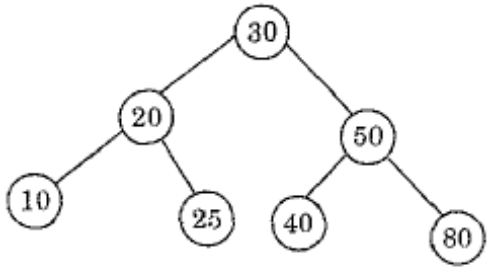


Figure .1

c) Explain the different cases to delete the element in binary search tree. **[5]**

OR

Q6) a) Define the following terms: **[6]**

a) Root

b) Subtree

c) Level of Node

d) Depth of Tree

e) Siblings

f) Height of tree

b) Explain traversing of binary tree? **[6]**

c) Construct the binary search tree (BST) from the following elements:

10, 60, 40, 28, 14, 50, 5 **[5]**

Q7) a) Give the adjacency matrix and adjacency list as shown in figure (1). **[6]**

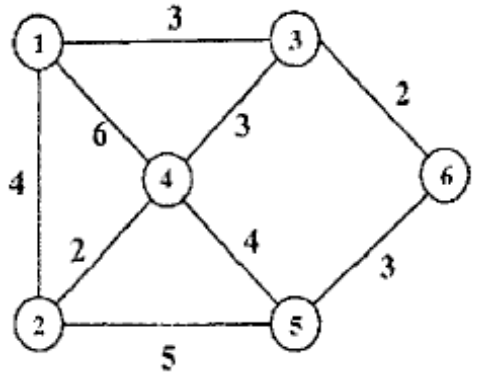
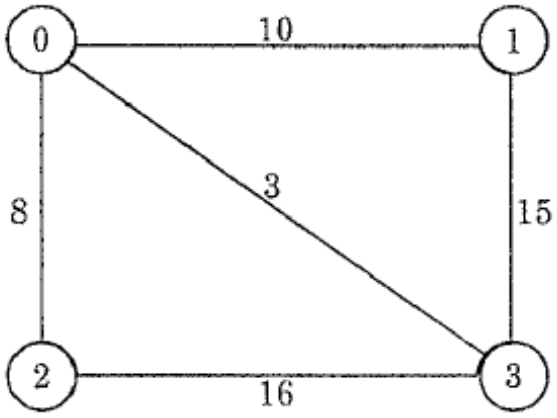


Fig. 1

b) Explain Dijkstar's algorithm with example. **[6]**

c) What do you mean by spanning free of a graph? Find minimal spanning tree of the following graph using Kruskal's algorithm. **[6]**



OR

Q8) a) Define Graph. Differentiate between DFS & BFS. **[6]**

b) Find out the minimum spanning tree of the following graph figure 2 using: **[6]**

a) Prim's Algorithm

b) Kruskal's Algorithm.

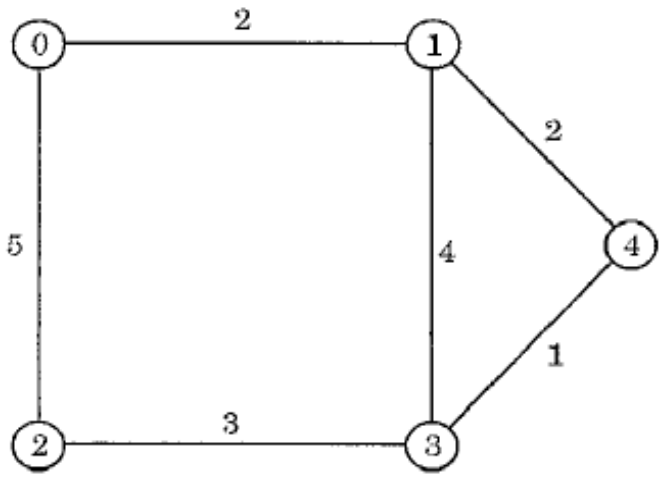


Fig. 2

c) Explain different types of graph with appropriate diagrams. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3629

[6261]-34

[Total No. of Pages :2

S.E. (Electronics & Computer Engineering)

COMPUTER ORGANIZATION

(2019 Pattern) (Semester- III) (204203)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Compare memory mapped I/O with I/O mapped I/O. **[5]**

b) Explain in detail Direct Memory Access (DMA). **[6]**

c) What are the evolutionary steps of I/O channel? Explain types of I/O channel? **[6]**

OR

Q2) a) Differentiate between programmed I/O and Interrupt driven I/O. **[5]**

b) What is the use of DMA? Explain cycle stealing in DMA. **[6]**

c) Discuss the following I/O mechanisms for transferring data with a neat flowchart: Programmed I/O and Interrupt Driven I/O. **[6]**

Q3) a) Explain different addressing modes with example. Discuss drawback of relative addressing mode. **[5]**

b) Explain the following addressing modes with one example such: **[6]**

i) Immediate

ii) Register Indirect

iii) Direct

c) What is displacement addressing? Explain its types with calculation of effective address. **[6]**

OR

P.T.O.

Q4) a) What is machine instruction? Explain any three types of operations. **[5]**

b) List the features of 8086 microprocessors. **[6]**

c) Explain the following addressing modes along with suitable example: **[6]**

i) Direct addressing

ii) Indirect addressing

iii) Displacement addressing mode

Q5) a) Explain with example working of multistage pipeline. **[5]**

b) What are various hazards in instruction pipelining? Explain with example. **[6]**

c) Explain the instruction cycle in detail. **[7]**

OR

Q6) a) List and explain various ways in which an instruction pipeline can deal with conditional branch instructions. **[5]**

b) What is register organization? What are different types of registers? Explain in detail. **[6]**

c) Write a short note on superscalear execution and superscalar implementation. **[7]**

Q7) a) Write control sequence for execution of the instruction Add (R3), R1. **[5]**

b) Explain the design of multiplier control unit using Delay Element method. **[6]**

c) What is microprogrammed control unit design? Draw and explain basic structure of micro-programmed control unit. **[7]**

OR

Q8) a) Compare hardwired control and microprogrammed control unit. **[5]**

b) Write a control sequence for the following instruciton for single bus organization: SUB (R3), R1. **[6]**

c) Explain in detail microinstruction sequencing organization. **[7]**

Total No. of Questions : 9]

SEAT No. :

PB3630

[6261]-35

[Total No. of Pages : 5

S.E. (Computer/I.T./Computer Science & Design Engineering/AI & ML)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - IV) (207003)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Write the correct option for the following multiple choice questions.

a) The first three moments of a distribution about the value 5 are 2,20 and 40. Third moment about the mean is **[2]**

i) – 64 ii) 64

iii) 32 iv) – 32

b) If probability density function $f(x)$ of a continuous random variable x is defined by $f(x) = \begin{cases} \frac{1}{4}, -2 \le x \le 2 \\ 0, \text{otherwise} \end{cases}$ **[2]**

then $P(x \le 1)$ is

i) $\frac{1}{4}$ ii) $\frac{1}{2}$

iii) $\frac{1}{3}$ iv) $\frac{3}{4}$

c) Using secant method, the first approximation to the root x_2 of the equation $x^3 - 5x - 7 = 0$, if the initial approximations are given as $x_0 = 2.5$ and $x_1 = 3$ is **[2]**

i) 2.7183 ii) 3

iii) 2 iv) 0

P.T.O.

d) If Lagrange's polynomial passes through **[2]**

x	0	1
y	–4	–4

then $\frac{dy}{dx}$ at $x = 1$ is given by

i) 0 ii) 2

iii) 1 iv) $\frac{1}{2}$

e) To compare the variability of two or more than two series, coefficient of variation is obtained using ($\overline{x}$ is arithmetic mean and σ is standard deviation) **[1]**

i) $\frac{\overline{x}}{\sigma} \times 100$ ii) $\frac{\sigma}{\overline{x}} \times 100$

iii) $\sigma \times \overline{x} \times 100$ iv) $\frac{\overline{x}}{\sigma^2} \times 100$

f) If x_0 is initial approximation to the root of the equation $f(x) = 0$ by Newton - Raphson method, first approximation x_1 is given by **[1]**

i) $x_0 = \frac{x_0 + x_1}{2}$ ii) $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}$

iii) $x_1 = x_0 + \frac{f(x_0)}{f'(x_0)}$ iv) $x_1 = x_0 + \frac{f'(x_0)}{f(x_0)}$

Q2) a) Find arithmetic mean and coefficient of variation for x if the data is,

$$\begin{vmatrix} x & 1 & 2 & 3 & 4 \\ f & 9 & 6 & 5 & 3 \end{vmatrix}$$ **[5]**

b) Fit a straight line of the form y = ax + b for the data $\begin{vmatrix} x & -2 & -1 & 0 & 1 & 2 \\ y & 5 & 3 & 1 & -1 & -3 \end{vmatrix}$. **[5]**

c) Given the information: $\overline{x} = 8.2, \overline{y} = 12.4,\ \sigma_x = 6.2, \sigma_y = 20\ \gamma(x, y) = 0.9.$ Find line of regression of x on y. Estimate x for $y = 10$ **[5]**

OR

Q3) a) The first four moments of a distribution about the value 2 are 2, 10 , 20 and 25. Find first four moments about mean, coefficient of skewness and kurtosis. **[5]**

b) Fit a parabola of the type $y = ax^2 + bx + c$ for the data $\begin{vmatrix} x & -1 & 0 & 1 & 2 \\ y & 3 & 1 & 3 & 9 \end{vmatrix}$ **[5]**

c) Find the coefficient of correlation for following distribution,

$$\begin{vmatrix} x & 5 & 7 & 9 & 11 & 13 \\ y & 9 & 6 & 12 & 3 & 15 \end{vmatrix}$$ **[5]**

Q4) a) A box contains 6 red balls, 4 white balls and 5 blue balls. Three balls are drawn successively from the box. Find the probability that they are drawn in the order red, white and blue if each ball is not replaced. **[5]**

b) A coin is so biased that appearence of head is twice likely as that of tail. If a throw is made 6 times, using Binomial distribution, find the probalility that at least two heads will appear. **[5]**

c) In a distribution, exactly normal, 7% of the items are under 35 and 89% are under 63. Find the mean and standard deviation of the distribution. [Given A(z = 1.48) = 0.43, A(z = 1.23) = 0.39] **[5]**

OR

Q5) a) The average number of misprints per page of a book is 1.5. Assuming the distribution of number of misprints to be poisson, find the number of pages containing more than one misprint if the book contains 900 pages. **[5]**

b) A random sample of 200 screws is drawn from a population which represents the size of screws. If a sample is distributed normally with mean 3.15 cm and standard deviation 0.025cm, find expected number of screws whose size falls between 3.12 cm and 3.2 cm. **[5]**

[Given A(z = 1.2) = 0.3849, A(z = 2) = 0.4772]

c) A nationalised bank utilizes four teller windows to render fast service to the customers. On a particular day, 800 customers were observed. They were given service at the different windows as follows. **[5]**

Window number	Expected no.of customers
1	150
2	250
3	170
4	230

Test whether the customers are uniformly distributed over the windows at 5% level of significance.

[Given $\chi^2_{3,0.05} = 7.815$]

Q6) a) Using the Bisection method up to fifth iteration, find a real root of the equation $x^3 - 4x - 9 = 0$. **[5]**

b) Find the real root of the equation $2x^3 - 2x - 5 = 0$ by applying Newton - Raphson method at the end of fourth iteration. **[5]**

c) Solve by Gauss - Seidel method, the system of equations: **[5]**

$45x_1 + 2x_2 + 3x_3 = 58$

$-3x_1 + 22x_2 + 2x_3 = 47$

$5x_1 + x_2 + 20x_3 = 67$

OR

Q7) a) Solve the following system by Cholesky's method: **[5]**

$4x_1 + 2x_2 + 14x_3 = 14$

$2x_1 + 17x_2 - 5x_3 = -101$

$14x_1 - 5x_2 + 83x_3 = 155$

b) Solve the following system by Gauss elimination method: **[5]**

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

$x_1 + 2x_2 - x_3 = 3$

$3x_1 - x_2 + 2x_3 = 1$

c) Use method of false position to find the fourth root of 32 correct to three decimal places. **[5]**

Q8) a) Using Newton's forward interpolation formula, find the polynomial satisfying the data. **[5]**

x	0	1	2	3	4
y	–4	–4	0	14	44

b) Use simpson's $\frac{1}{3}$ rd rule to obtain $\int_1^2 \frac{1}{x}\,dx$ dividing the interval into four parts. **[5]**

c) Use Euler's method to solve $\frac{dy}{dx} = \frac{x-y}{2}, y(0) = 1$. Tabulate values of y for $x = 0$ to $x = 2$. Take h =0.5. **[5]**

OR

Q9) a) Use Runge - Kutta method of fourth order to solve $\frac{dy}{dx} = x^2 + y^2;\ x_0 = 1,\ y_0 = 1.5$ to find y at $x = 1.1$ taking h = 0.1 **[5]**

b) Using modified Euler's method, find y(0.1) given that $\frac{dy}{dx} = 1 + xy;$ y(0) = 1 and h = 0.1. Consider accuracy to four decimal places. **[5]**

c) Using Newton's backward interpolation formula, find the polynomial satisfying the data. Also, find y when $x = 4.5$. **[5]**

x	1	2	3	4	5
y	14	30	62	116	198

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Total No. of Questions : 8]

SEAT No. :

PB-4462

[Total No. of Pages : 3

[6261]-36

S.E. (Computer Engineering/Artificial Intelligence & Data Science Engineering)

DATA STRUCTURES AND ALGORITHMS

(2019 Pattern) (Semester - IV) (210252)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer to the questions 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.***
2) ***Draw neat labelled diagrams wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Elaborate following terminologies : **[6]**

i) Graph

ii) Adjacency List

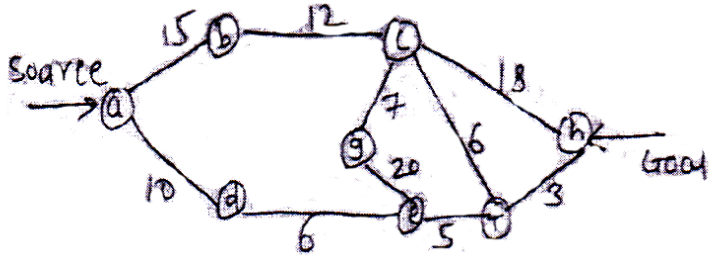
iii) Adjacency Matrix

b) Differentiate between tree and graph. **[6]**

c) Write pseudo code for Floyd-Warshall algorithm. **[6]**

OR

Q2) a) Find the shortest path using Dijkstra's algorithm. Write all the sequence of steps used in algorithms. **[6]**



b) Write Prim's algorithm to find minimum spanning tree. **[6]**

c) Write the applications of : **[6]**

i) Graph

ii) BFS

iii) DFS

P.T.O.

Q3) a) Explain following terms w.r.t. symbol table : **[6]**

i) Insert & lookup operations

ii) Advantages

iii) Disadvantages

b) Construct an AVL tree having the following elements : **[6]**

H, I, J, B, A, E, C, F, D, G

c) Insert 15, 10, 17, 7 in splay tree. **[6]**

OR

Q4) a) What is the need of AA tree? List the five invariants that AA tree must satisfy. **[6]**

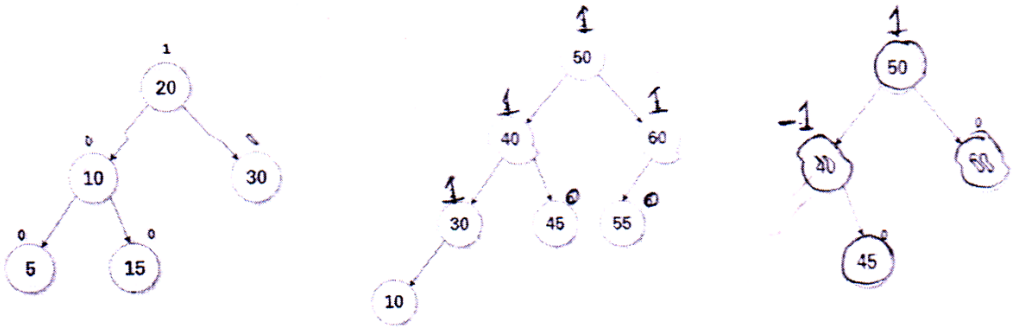
b) Who developed K-D tree? What is the purpose of K-O tree? Insert step by step (7, 8), (12, 3), (14, 1), (4, 12), (9, 1), (2, 7) and (10, 19) into K-D tree. **[6]**

c) Show the balanced AVL tree after deletion of mentioned node : **[6]**

i) Delete 30

ii) Delete 55

iii) Delete 60



Q5) a) What is indexing? What are the advantages of indexing? Discuss clustering index with example. **[6]**

b) Construct a B-Tree of order 3 for following data : **[6]**

50, 30, 21, 90, 10, 13, 20, 70, 25, 92, 80.

c) Why B+ tree? List its properties and advantages. **[5]**

OR

Q6) a) Explain with example trie tree. Give properties and advantages of trie tree. **[6]**

b) Build B+ tree of order 3 for the following : **[6]**

F, S, Q, K, C, L, H, T, V, W, M, R

c) What is difference between B and B+ tree? **[5]**

Q7) a) Explain Index Sequential file and discuss their advantages and disadvantages. **[6]**

b) List & explain two possible ways of representing records. **[6]**

c) Differentiate between indexed sequential file and direct access file. **[5]**

OR

Q8) a) Explain Sequential file organization and discuss their advantages and disadvantages. **[6]**

b) What is coral rings? Describe inverted files w.r.t linked organization. **[6]**

c) Explain Direct Access file. **[5]**

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Total No. of Questions : 8]

SEAT No. : ____

PB4397

[6261]-37

[Total No. of Pages :2

S.E. (Computer Engineering) (AI & DS)
SOFTWARE ENGINEERING
(2019 Pattern) (Semester- IV) (210253)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) What is project scheduling? Explain in brief about the basic principles guiding the s/w project scheduling. **[6]**

b) What is the need of project Estimation? What are the steps while estimation of software? **[6]**

c) How are LOC and FP used during Project Estimation? Explain any one with suitable example. **[6]**

OR

Q2) a) What is the difference between COCOMO and COCOMO II Model? **[6]**

b) What is the necessity of Estimation? How estimation with Use-cases is performed? **[6]**

c) What is the need for defining a software scope? What are the categories of software engineering resources (Project Resources)? **[6]**

Q3) a) Explain the following design concepts: **[6]**

i) Abstraction
ii) Patterns
iii) Modularity

b) What is meant by coupling and cohesion. Explain these terms in relation with good software design. **[6]**

c) What is the importance of software design? What are types of design classes? **[5]**

OR

P.T.O.

Q4) a) Explain in detail the Architectural design and Component level design elements. **[6]**

b) What is software Architecture? What is architectural context diagram? **[6]**

c) Write short note on 'Interface analysis and design models'. **[5]**

Q5) a) Briefly explain the steps involved in risk planning in project development. **[6]**

b) Describe with an example how the effect of risk on project schedule is evaluated using PERT. **[6]**

c) Explain Version Control and Change Control Layer in Software Configuration Management in detail. **[6]**

OR

Q6) a) Discuss Software Configuration Management in detail. **[6]**

b) Define Software Risk in detail. What are different types of Software Risk? **[6]**

c) Discuss the RMMM plan in detail. **[6]**

Q7) a) What are the guidelines those lead to a successful software testing strategy? **[6]**

b) What is meant by integration testing? Explain top down and bottom up integration testing. **[6]**

c) What is the difference between verification and validation? **[5]**

OR

Q8) a) Differentiate between black box testing and white box testing. **[6]**

b) Explain how Object oriented software testing is different from conventional software testing. **[6]**

c) Explain Unit Testing and Integration Testing with respect to the Object Oriented Context. **[5]**

Total No. of Questions : 8]

SEAT No. : ____

PB3631

[Total No. of Pages :2

[6261]-38

S.E. (Computer)

MICROPROCESSOR

(2019 Pattern) (Semester- IV) (210254)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Draw & Explain the general descriptor format available in various descriptor tables. **[6]**

b) Explain the use of following Instructions in detail: **[6]**

i) LGDT

ii) SGDT

iii) SIDT

c) Explain the segment Translation process of 80386. **[6]**

OR

Q2) a) With the necessary Diagram, Explain the complete Address Translation process in 80386. **[6]**

b) Enlist various types of system & non-system descriptors in 80386. Explain their use in brief. **[6]**

c) Draw & Explain the General Selector Format. **[6]**

Q3) a) Explain various Aspects of Protection Mechanism of Paging unit. **[6]**

b) What is CPL, EPL, IOPL? Explain in Brief. **[6]**

c) Explain the need of Protection Mechanism in 80386. **[5]**

OR

Q4) a) Explain how control transfer Instructions are executed using the call gate in the system. **[6]**

b) List & Explain various Privilege Instructions. **[6]**

c) Elaborate the concept of combining segment Protection & Page level protection in 80386. **[5]**

P.T.O.

Q5) a) Explain the structure of a V86 Task in detail. How is protection provided within the V86 task? **[6]**

b) Draw & Explain the Task state segment of 80386. **[6]**

c) With the necessary diagram, Explain entering & leaving the virtual mode of 80386. **[6]**

OR

Q6) a) Explain the TSS descriptor & its role in multitasking. **[6]**

b) List & Explain various features of virtual 8086 Mode. **[6]**

c) Define Task switching & Explain the steps involved in task switching operation. **[6]**

Q7) a) With the help of neat diagram Explain the Process of handling Interrupts in Protected mode. **[6]**

b) Explain the different types of exceptions in 80386 with suitable example. **[6]**

c) With the help of neat diagram explain the architecture of typical Microcontroller. **[5]**

OR

Q8) a) Explain various Descriptors present in IDT of 80386. **[6]**

b) Explain the following exceptions in brief. **[6]**

i) Divide Error

ii) Invalid op code

iii) Overflow

c) Explain various features of the 8051 Microcontroller. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3632

[6261]-39

[Total No. of Pages :2

S.E. (Computer Engineering)

PRINCIPLES OF PROGRAMMING LANGUAGES

(2019 Pattern) (Semester- IV) (210255)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain why Java is secured, portable and Dynamic? Which of the concept in Java ensures these? **[8]**

b) What are strings in java? Explain following operations of class strings in java with example. **[9]**

i) To find length of string

ii) To compare strings

iii) Extraction of characters from string

iv) To search a substring

OR

Q2) a) What is constructor? Show with exmaple the use and overloading default, parameterized and copy constructor? **[8]**

b) What do you mean by method overloading? Demonstrate through a program in Java how method overloading is used to add two integers and three integers respectively. **[9]**

Q3) a) What is inheritance? What are advantages of using inheritance? Show by example the simple inheritance in Java? **[9]**

b) Explain with example how the access protection is provided for packages in java? **[9]**

OR

P.T.O.

Q4) a) What are uncaught exceptions? Illustrate with example the use of try( ), catch( ) and throw( ) methods in exception handling? **[9]**

b) Differentiate between character streams and byte streams with examples. **[9]**

Q5) a) Differentiate between process and thread. What are various stages of thread lifecycle? **[8]**

b) Write a JavaScript program to develop a simple web application? **[9]**

OR

Q6) a) Explain is Alive( ) and join( ) methods in multithreading. **[8]**

b) Explain features of AngularJS and ReactJS? **[9]**

Q7) a) What is recursion? Write a lisp function to calculate power of a number using recursion and iteration. **[9]**

b) Explain with example how to use structures in prolog? **[9]**

OR

Q8) a) What is predicate in LISP? Explain any 5 predicates with example. **[9]**

b) What is clause in prolog? Explain types of clauses with example. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3633

[Total No. of Pages :4

[6261]-40

S.E. (Computer Engg.) (Artificial Intelligence & Data Science Engg.) (Computer Science & Design Engg.)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester - III) (210241)

Time : 2½ Hours] *[Max. Marks : 70*

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 whenever necessary.***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) From a group of 7 men and 6 women, five persons are to be selected to from a committee so that at least 3 men are there on the committee. In how many ways can it be done? **[6]**

b) How many 3-digit numbers can be formed from the digits 2,3,5,6,7 and 9, which are divisible by 5 and none of the digits is repeated? **[6]**

c) How many 6-digit odd numbers greater than 6,00,000 can be formed from the digits 5,6,7,8,9, and 0 **[6]**

i) If repetition is allowed.

ii) If repitition is not allowed

OR

Q2) a) In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together **[6]**

b) If a committee has eight members. **[6]**

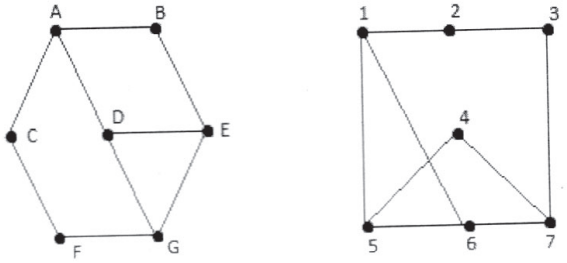
i) How many way can the committee members be seated in a row?

ii) How many way can the committee select a president, vice-precident and secretary

c) In a certain country, the car number plate is formed by 4 digits from the digits 1,2,3,4,5,6,7,8 and 9 followed by 3 letters from the alphabet. How many number plates can be formed if neither the digits nor the letters are repeated? **[6]**

P.T.O.

Q3) a) Show that the following graphs are isomorphic **[7]**

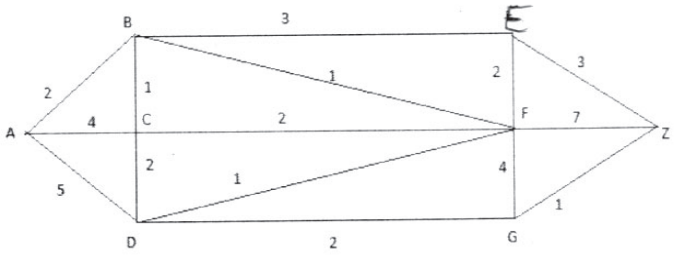


b) List and explain the necessary and sufficient conditions for Hamiltonian and eulerian path with suitable examples. **[5]**

c) Define the graph K_n and K_{mn} **[5]**

OR

Q4) a) Use dijkstras algorithm to find the shortes path between A and Z in figure. **[7]**



b) Draw a complete bipartite graph on 2 and 4 vertices K2,4 and 2 and 3 vertices K2,3. **[5]**

c) Under What condition $K_{m,n}$ will have eulerian circuit **[5]**

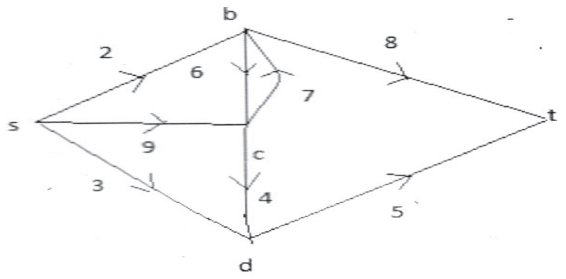
Q5) a) Define following terms **[6]**

i) Level of a tree

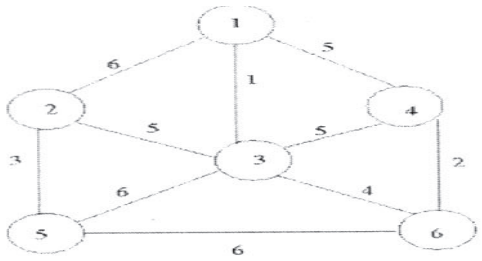
ii) Height of a tree

iii) Fundamental circuit

b) Use labeling procedure to find a maximum flow in the transport network given in the following figure. Determine the corresponding minimum cut. **[6]**



c) Construct Minimal spanning tree for the following graphs using prims algorithm **[6]**



OR

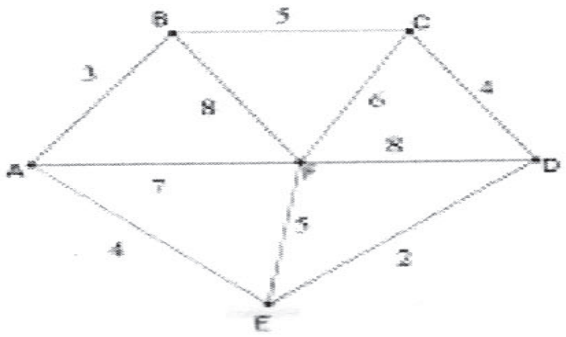
Q6) a) Define following terms **[6]**

i) Forest

ii) Fundamental cutsets

iii) Game tree

b) Construct Minimal spanning tree of the following graphs using kruskals algorithm **[6]**



c) Construct an optimal tree for 10,11,14,21,16,18 using Huffman conding **[6]**

Q7) a) Define: **[6]**

i) Cyclic group

ii) Abelian group

iii) Cosets

b) Let $Z_n = \{0,1,2,....n-1\}$. Constract the multiplication table for n=6. Is $(Z_n,*)$ an abelian group. Where* is a binary operation on Z_n such that a*b = remainder of a*b divided by n **[6]**

c) Let (A,*) be a group, show that (A,*) is an abelian group iff $a^2 * b^2 = (a*b)^2$ **[5]**

OR

Q8) a) Define: **[6]**

i) Group codes

ii) Subgroup

iii) Integral domain

b) Let (A,*) be an algebraic system where * is a binary operation such that for any a,b, belongs to A, a*b=a **[6]**

i) Show that * is an associated operation

ii) Can * ever be a communtative operation?

c) Prove that the set Z of all integers with binary operation * defined by a* b = a+b+1 such that for all a,b belonging to Z is an abelian group**[5]**

Total No. of Questions : 8]

SEAT No. :

PB3634

[Total No. of Pages : 2

[6261]-41

S.E. (Computer Engineering) (Artificial Intelligence & Data Science)
FUNDAMENTALS OF DATA STRUCTURES
(2019 Pattern) (Semester-III) (210242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt question Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Sort given array by using bubble sort method: 64, 34, 25, 12, 22, 11, 90. Show step by step execution for all the passes highlighting "swap" and "No Swap" situations. How many passes are required to sort an array of N elements using bubble sort? **[9]**

b) Write an algorithm to search an element in array A using binary search technique. Show stepwise search of Key 10 in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11. Is there any pre-processing of data required before starting binary search or what is its precursor requirement? **[9]**

OR

Q2) a) Enlist different searching methods. Write short note on **[9]**

i) Fibonacci Search

ii) Index Sequential Search

b) Sort given array by using selection sort method 50, 23, 03, 18, 9, 01, 70, 21, 20, 6, 40, 04. Show step by step execution of all passes. What is the best and worst case time complexity of selection sort? **[9]**

Q3) a) Write pseudo code for following function using Doubly Linked List of integer numbers **[9]**

i) Insert given value as last value in the list. Draw diagram of operation.

ii) Delete first node from the list. Draw diagram of operation.

iii) Delete last node from the list. Draw diagram of operation.

b) Write and explain node structure of **[9]**

i) Generalized linked list.

ii) Circularly Singly Linked List.

Draw and explain insertion of value in Circularly Singly Linked List with example.

OR

P.T.O.

Q4) a) Write pseudocode to perform merging of two sorted singly linked lists of integers into third list. Write complexity of it. **[9]**

b) Write and explain node structure of Generalized linked list for representing multiple variable polynomial. Represent given polynomial graphically using Generalized Linked List: $5x^7 + 7xy^6 + 11xz$. **[9]**

Q5) a) Write rules to convert given infix expression to postfix expression using stack. Convert expression (A* B – (C + D * E) ˆ (F * G / H)) stepwise using above rules.

Where ˆ is - exponential operator. **[8]**

b) Explain with example three different types of recursion. **[9]**

OR

Q6) a) What is infix, prefix and postfix expression? Give example of each. Explain evaluation of postfix expression with suitable example expression and assume values for variables used to solve it. **[8]**

b) Write pseudo-C/C++ code to implement stack using array with overflow and underflow conditions. **[9]**

Q7) a) What are advantages of Circular Queue over Linear Queue using static memory allocation? Write pseudocode to add and remove element from Circular Queue along with Queue Full and Empty condition. **[8]**

b) Draw and explain implementation of Linear Queue using Singly Linked List. Explain Add, Remove, Queue Full and Queue Empty operations. **[9]**

OR

Q8) a) What is Doubly Ended Queue? Draw Diagram with labelling four basic operations at appropriate places. Which two data structures are combined in it and how? **[6]**

b) Draw and explain Priority Queue? State any real life application. **[6]**

c) Write pseudocode for Linear Queue Implementation using array. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3635

[Total No. of Pages : 3

[6261]-42

S.E. (Computer Engineering)/(Computer Science & Design Engineering)/(AI & DS)

OBJECT ORIENTED PROGRAMMING

(2019 Pattern) (Semester - III) (210243)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Draw Neat and Clean Diagram.***
3) ***Assume Suitable data, if necessary.***
4) ***Figures of the rights indicate full marks.***

Q1) a) Explain need of operator overloading. What are the rules to be followed when overloading an operator in C++? **[5]**

b) How virtual functions are implemented in C++? Explain with help of a program. **[6]**

c) Define a class string and use binary overloaded operator (= =) to compare two strings. **[6]**

OR

Q2) a) What is abstract base class in C++ polymorphism? Explain with program. **[5]**

b) Explain Virtual destructor with the help of a program. **[6]**

c) Write C++ program to demonstrate use of unary operator (- -) overloading using member function and unary operator overloading (++) using friend function. **[6]**

Q3) a) Explain the errror handling in file I/O. **[5]**

b) Explain the two ways in which files can be opened, open () and Using constructor with a program. **[6]**

c) What is stream? Explain types of stream available in C++ i.e istream, ostream, ifstream and ofstream. **[7]**

OR

P.T.O.

Q4) a) List and Explain different Mode bits used in open () function, while opening a file. (Any five) **[5]**

b) Explain the command line argument in C++ Write a program to explain the same. **[6]**

c) Which header file do we use for file handling? Explain the following file handling functions **[7]**

i) seekg ( )

ii) tellg ( )

iii) seekp ( )

iv) tellp ( )

Q5) a) What is exception in C++? Explain each keyword to handle exception in C++. **[5]**

b) What is template function? Explain with suitable example. **[6]**

c) Explain class template. Write a program to demonstrate class templeate in C++. **[6]**

OR

Q6) a) What do you mean by rethrowing exceptions. Write a program for the same. **[5]**

b) What is generic programming? How it is implemented in C++. **[6]**

c) Write a program in C++ to demonstrate class type exception handling in C++. **[6]**

Q7) a) What are the various algorithms available in STL? Explain any one with C++ program. **[5]**

b) Write a program to implement map in C++. **[6]**

c) What is a container? What are various types of containers? Explain any two containers in details. **[7]**

OR

Q8) a) What is the algorithm in STL? Explain sort function with example. **[5]**

b) What is a sequential container? List various sequential containers. Compare arrays and vectors. **[6]**

c) What is iterator? Write a program in C++ to demonstrate the use iterator. **[7]**

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. :

PB-3636

[Total No. of Pages : 2

[6261]-43

S.E. (Computer Engineering) (AI & DS) (Computer Science & Design Engg.)

Computer Graphics

(2019 Pattern) (Semester - III) (210244)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagram must be drawn wherever necessary***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Differentiate between Parallel projection and Perspective Projection **[4]**

b) What is transformation and write transformation matrix for : **[4]**

i) 2-D reflection with respect to line Y=X

ii) 3-D rotation about Y-axis.

c) A triangle is defined by $\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$ Find transformed coordinates after the following transformation **[8]**

i) 90° rotation about the origin.

ii) Reflection about line X = Y

OR

Q2) a) What are the types of projection and write in brief about each type of projections **[4]**

b) Derive 3D transformation matrix for rotation about a principal axis. **[4]**

c) Perform 45° rotation of a triangle A(0, 0), B(1, 1) and C(5, 2). Find transformed coordinates after rotation, (i) About origin, (ii) About P(–. 1, 1). **[8]**

P.T.O.

Q3) a) Write short note on Warnock's Algorithm **[6]**

b) Explain Halftone shading **[5]**

c) Compare Gauraud shading and Phong Shading **[6]**

OR

Q4) a) Explain Backface Detection and removal. **[6]**

b) Explain and compare point source and diffuse illumination. **[5]**

c) Explain the following terms with examples: **[6]**

i) Color gamut

ii) Specular Reflection

iii) Diffuse reflection

Q5) a) Explain, the Bezier curve. List its properties. **[4]**

b) Explain Blending function for B-spline curve **[7]**

c) What are fractals? Explain Triadic Koch in detail **[7]**

OR

Q6) a) Write a short note on interpolation and approximation **[4]**

b) Explain Hilbert's curve with an example. **[7]**

c) With suitable example write short note on the fractal line **[7]**

Q7) a) Explain deletion of segment with suitable example **[7]**

b) Define Morphing and write the applications of Morphing **[3]**

c) Explain renaming of a segment with suitable example **[7]**

OR

Q8) a) Write a short note on motion specification methods based on **[7]**

i) Geometric and kinematics information.

ii) Specification methods based on physical information

b) Write any three important features of NVIDIA gaming platform **[3]**

c) Explain architecture of 1860 **[7]**

Total No. of Questions : 8]

SEAT No. :

PB4531

[Total No. of Pages :3

[6261]-44
S.E.(Computer Engineering)
DIGITAL ELECTRONICS AND LOGIC DESIGN
(2019 Pattern) (Semester - III) (210245)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answers 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 draw wherever necessary.***
3) ***Assume Suitable data if necessary.***

Q1) a) What are the applications of Flip-Flop? Explain shift register. **[6]**

b) Design a sequence generator to generate the sequence. **[6]**
.....1, 3, 5, 7, 1.....

c) Desgin the 2-bit synchronous UP counter using T - F/F. **[6]**

OR

Q2) a) Explain S-R Flip-Flop and J-K Flip Flop using NOR gate. **[6]**

b) Convert the following Flip Flops **[6]**
i) D to T
ii) Jk to D

c) Draw and explain 4 bit Ripple down Counter. **[6]**

Q3) a) Implement the following Boolem function using PAL. **[6]**
$F1 = \sum m(0,3,5,7,9,10,11,14,15)$
$F2 = \sum m(2,3,12,14)$

b) Draw block diagram of PLA device and explain in detail. **[6]**

c) What is ASM chart? Design ASM chart for 3-Bit gray code sequence with up-down conditions. **[5]**

OR

P.T.O.

Q4) a) Implement gray to binary code using PLA. **[6]**

b) Implement the following Boolean functions using PAL **[6]**

$X1(A, B, C, D) = \sum m(0,2,6,7,8,9,12,13)$

$X2(A, B, C, D) = \sum m(3,6,7,11,14,15)$

c) What is ASM Chart? State & Explain basic components of ASM chart. Also explain the salient features of ASM chart **[5]**

Q5) a) Draw and explain the operation of TTL NAND gate using 2-bit input. **[6]**

b) Explain with a neat diagram CMOS NAND gate **[6]**

c) Define the following terms and mention its standard value for TTL logic family. **[6]**

i) Noise immunity
ii) Power Dissipation
iii) Figure of Merit

OR

Q6) a) Draw and explain CMOS invertor. **[6]**

b) Explain TTL open collector. **[6]**

c) Compare CMOS and TTL logic family. **[6]**

Q7) a) For memory operations draw digital circuits using ALU and shift registes. **[6]**

b) What is Microprocessor? List different applications of Microprocessor. **[6]**

c) What are the different types of buses used in Microprocessor? **[5]**

OR

Q8) a) Explain in brief basic arithmetic operations using ALU IC 74181. **[6]**

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

i) Address Bus

ii) Data Bus

iii) Control Bus

c) Write a short note on Memory organization of Microprocessor. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3637

[Total No. of Pages : 4

[6261]-45

S.E. (Artificial Intelligence and Data Science)

STATISTICS

(2019 Pattern) (Semester - IV) (217528)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Make suitable assumption wherever necessary.***

Q1) a) For the following distribution, find (1) first 4 moments about any arbitrary point (2) Four Central Moments. **[9]**

X	2	2.5	3	3.5	4	4.5	5
F	5	38	65	92	70	40	10

b) The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$. The value of variance of x is 9. Find : **[9]**

i) The mean values of x and y.

ii) The correlation x and y and

iii) The standard deviation of y.

OR

Q2) a) The first four moments about the working mean 30.2 of distribution are 0.255, 6.222, 30.211 and 400.25. Calculate the first four moments about the mean. Also evaluate β_1, β_2 and comment upon the skewness and kurtosis of the distribution. **[9]**

b) Obtain the regression lines y on x and x on y for the data : **[9]**

x	5	1	10	3	9
y	10	11	5	10	6

P.T.O.

Q3) a) A Dice is thrown 10 times. If getting an odd number is a success. What is the probability of getting (i) 8 successes (ii) at least 6 success. **[6]**

b) If the probability that an individual suffers a bad reaction from certain injection is 0.001. Determine the probability out of 2000 people, by using Poisson's distribution (i) Exactly 3 (ii) More than 1 will suffer a bad reaction. **[5]**

c) For a normal distribution when mean = 2, standard deviation = 4, find the probabilities of the following intervals. **[6]**

i) $4.43 \leq x \leq 7.29$

ii) $-0.43 \leq x \leq 5.39$

[Given : A (z = 0.61) = 0.2291, A (z = 1.32) = 0.4066, A (z = 0.85) = 0.3023]

OR

Q4) a) A Random variable X with following probability distribution **[5]**

X	0	1	2	3	4
P(X)	0.1	k	$2k$	$2k$	k

Find :

i) k

ii) P($x < 2$)

iii) P($x \geq 3$)

iv) P($1 \leq x \leq 3$)

b) In a continuous distribution density function. **[6]**

$f(x) = kx\ (2 - x)$, $0 < x < 2$

Find the value of

i) k

ii) Mean

iii) Variance

c) MNC company conducted 1000 candidates aptitude test. The average score is 45 and the standard deviation of score is 25. Assuming normal distribution for the result. **[6]**

Find :

i) The number of candidates whose score exceed 60.

ii) The number of candidates whose score lies between 30 & 60.

[Given : A (z = 0.6) = 0.2257]

Q5) a) The table below gives the number of customers visit the certain company on various days of week. **[6]**

Days	Sun	Mon	Tue	Wed	Thurs	Fri	Sat
Number of Customers	6	4	9	7	8	10	12

Test at 5% of level of significance whether customer visits are uniformly distributed over the days.

[Given $\chi^2_{6,0.05} = 15.592$]

b) In a Batch of 500 articles, produced by a machine, 16 articles are found defective. After overhauling the machine, it is found that 3 articles are defective in a batch of 100.Has the machine improved? **[6]**

[Given $Z_\alpha = 1.96$]

c) In two independent samples of size 8 and 10 the sum of squares deviations of the sample values from the respective sample means were 84.4 and 102.6. Test whether the difference of variances of the population is significance or not. **[6]**

[Given $F_{t,0.05} = 3.29$]

OR

Q6) a) In an experiment on pea breeding, the following frequencies of seeds were obtained. **[6]**

Round and Green	Wrinkled and Green	Round and Yellow	Wrinkled and Yellow	Total
222	120	32	150	524

Theory Predicts that the frequencies should be in Proportion 8:2:2:1. Examine the correspondence between theory and experiment.

[Given $\chi^2_{3,0.05} = 7.815$]

b) For sample I : $n_1 = 1000, \Sigma x = 49000, \Sigma(x-\bar{x})^2 = 7,84,000,$

For sample II : $n_2 = 1500, \Sigma x = 70500, \Sigma(x-\bar{x})^2 = 24,00,000.$

Discuss the significance difference between mean score.

[Given $Z_\alpha = 1.96$] **[6]**

c) Samples of size 10 and 14 were taken from two normal populations with standard deviation 3.5 and 5.2. The sample means were found to be 20.3 and 18.6. The whether the means of the two populations are at the same level. **[6]**

[Given $t_{22,0.05} = 2.07$]

Q7) a) State & prove Neyman-Pearson Fundamental Lemma. **[9]**

b) Let P be the probability that a coin will fall head in a single toss in order to test $H_0 : P = \frac{1}{2}$ against $P = \frac{3}{4}$. The coin is tossed 5 times and H_0 is rejected if more than 3 heads are obtained. Find the probability of type I error and power of the test. **[8]**

OR

Q8) a) Show that the likelihood ratio test for testing the equality of variances of two normal distribution is the usual F-test. **[9]**

b) Write short note on : **[8]**

i) Population and sample

ii) Type I and Type II Error

iii) Critical Region

iv) Power of test

Total No. of Questions : 8]

SEAT No. :

PB3638

[Total No. of Pages :2

[6261]-46

S.E. (AI & DS)

INTERNET OF THINGS

(2019 Pattern) (Semester- IV) (217529)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Draw Neat and Clean Diagram.***
3) ***Assume suitable data if necessary.***

Q1) a) Explain Request Response model, Publish Subscribe model and Push/ Pull Model? **[9]**

b) Justify how Retail Sector impacting on end to end user by integrating IOT technology. **[9]**

OR

Q2) a) Explain in brief Telematics and Telemetry model? **[10]**

b) How is security a big concern in IOT? What kind of development is there in market to make IoT more secure? **[8]**

Q3) a) Explain SNMP and NETCONF in detail. **[8]**

b) Explain the IOT system working block with the help of Control units, Communication Modules and Sensors? **[9]**

OR

Q4) a) Draw IOT protocol structure and explain IPv4, 6LoWPAN in detail?**[9]**

b) How information is exchanged in real time without human intervention?**[8]**

P.T.O.

Q5) a) Explain how you will design an energy management system in a commercial building using IoT. **[10]**

b) Elaborate on how you will use IoT for remote healthcare. **[8]**

OR

Q6) a) What is the Web of things (WOT)? Draw and explain the cloud of things architecture. **[10]**

b) What is Industrial IoT? How is it different from Conventional IoT? **[8]**

Q7) a) Explain Smart home and Smart city applications in view of IoT. **[10]**

b) How will IoT be used to protect environmental loss? **[7]**

OR

Q8) a) Explain use of IoT in the agriculture field. Explain it with a case study. **[10]**

b) Write a note on Industrial IoT. **[7]**

Total No. of Questions : 8]

SEAT No. :

PB3639

[6261]-47

[Total No. of Pages :2

S.E. (Artificial Intelligence and Data Science)

MANAGEMENT INFORMATION SYSTEMS

(2019 Pattern) (Semester- IV) (217530)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain how MIS is helpful to Management in their operations. **[8]**

b) Explain how to Secure information systems with system vulnerability. Explain the value of security and control in Business. **[9]**

OR

Q2) a) What is Business Intelligence? Explain its foundations database and Information management. **[9]**

b) Discuss management Issues. Explain Hardware and software platform trends. **[8]**

Q3) a) Define Enterprise Application and explain with examples. **[9]**

b) Explain importance of project Management and how to manage project risk. **[8]**

OR

Q4) a) Write a note on managing global systems. Explain technology issues and opportunities for global value chain. **[8]**

b) How to enhance decision making and building information systems? **[9]**

P.T.O.

Q5) a) Elaborate Customer Relationship Management in detail with a suitable case study. **[9]**

b) Describe e-commerce system with its functions, applications and issues. Take a case study of Amazon/Flipkart. **[9]**

OR

Q6) a) Elaborate Supply chain Management in detail with suitable case study. **[9]**

b) Explain decision support system in businesses with its different components and role of OLTP systems under DSS. **[9]**

Q7) a) Write short note on **[9]**

i) Neural Network

ii) Virtual Reality

iii) Expert System

b) Explain in detail Predictive Analytics with a case study of an insurance company. **[9]**

OR

Q8) a) Write short note on **[9]**

i) Business Intelligence

ii) Genetic Algorithms

iii) Fuzzy Logic

b) How MIS helps in decision making process? Elaborate all the phases in the process of decision making. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3640

[6261]-48

[Total No. of Pages :2

S.E. (Artificial Intelligence and Data Science)

OPERATING SYSTEMS

(2019 Pattern) (Semester- III) (217521)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Assume suitable data if necessary.***

Q1) a) What is a deadlock? State and explain the conditions for deadlock to occur. **[6]**

b) Write the structure of Producer-Consumer problem in bounded buffer using semaphore. Discuss how critical section requirements are fulfilled? **[6]**

c) What is semaphore? Explain the concept of binary semaphore. **[5]**

OR

Q2) a) State and explain in brief different methods of handling deadlock. **[6]**

b) What is Readers-Writers problem? How Reader and Writer processes synchronize? **[6]**

c) What is monitor? Explain the concept of monitor with example. **[5]**

Q3) a) Explain segmentation with suitable diagram. **[6]**

b) How sharing and protection is provided in a paging system? Explain with suitable diagram. **[6]**

c) Explain with example first-fit, best-fit and worst-fit memory allocation techniques. **[6]**

OR

P.T.O.

Q4) a) Explain paging with suitable diagram. **[6]**

b) Write a short note on swapping. **[6]**

c) What are the advantages and disadvantages of fixed and dynamic partitioning of memory? When there is a need of compaction? **[6]**

Q5) a) Which are different file organization techniques? Describe any one in brief. **[6]**

b) What is an I/O buffer? What is its use? **[6]**

c) Describe any one disk scheduling policy with an example. **[5]**

OR

Q6) a) What are the file access methods? Explain them in detail. **[6]**

b) Describe working of FIFO and C-SCAN algorithms with suitable diagrams. **[6]**

c) Write a note on free space management. **[5]**

Q7) a) How process and threads are implemented in Linux? Explain. **[6]**

b) How process scheduling is performed in Linux? **[6]**

c) What are goals of Linux? Also interfaces to linux. **[6]**

OR

Q8) a) Explain process management system calls in Linux. **[6]**

b) Write a short note on kernel structure. **[6]**

c) Define the components of LINUX system with diagram. What is the responsibility of kernel in LINUX operating system? **[6]**

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

PB-3641

[6261]-49
S.E.(Computer Science and Design)
DATA STRUCTURES AND FILES
(2019 Pattern) (Semester - IV) (218253)

Time : 2½ Hours] ***[Max. Marks : 70***

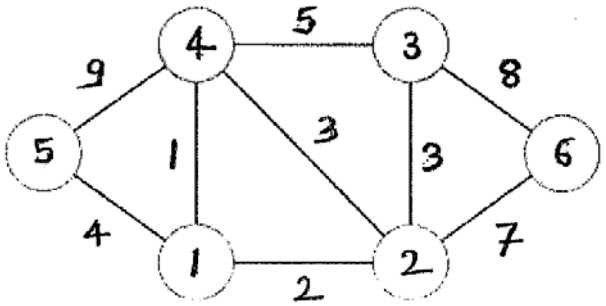
Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***

Q1) a) Draw any directed graph with minimum 6 nodes and represent Graph using adjacency matrix, adjacency list, and inverse adjacency list. **[6]**

b) Write non-recursive pseudo for Breadth First Search (BFS). **[6]**

c) Find MST of the following graph using kruskals Algorithm **[6]**



OR

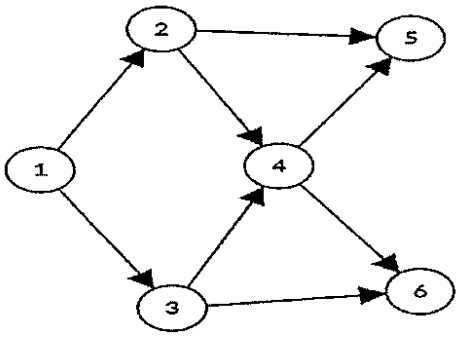
Q2) a) Consider the graph represented by the following adjacency matrix: **[6]**

	A	B	C	D	E
A	0	5	0	6	4
B	5	0	8	0	7
C	0	8	0	0	9
D	6	0	0	0	5
E	4	7	9	5	0

Find minimum spanning tree of this graph using prim's Algorithm

P.T.O

b) Write a short note on topological sorting? Apply topological sorting for the following graph: **[6]**



c) Write non-recursive pseudo for Depth First Search (DFS). **[6]**

Q3) a) Explain AVL tree rotations with example. **[6]**

b) Construct AVL tree for following data by inserting each data item one at time 15, 20, 24, 10, 13, 7, 30, 36, 25. **[6]**

c) List and explain techniques of splay Tree **[5]**

OR

Q4) a) Explain with example **[6]**

i) Red - Black Tree

ii) K - dimensional Tree

b) Construct AVL tree for following sequence of keys **[6]**

10, 20, 15, 12, 25, 30, 14, 22, 35, 40.

c) Explain Static and dynamic tree tables with suitable example. **[5]**

Q5) a) Construct B-tree of order 3 by inserting the following data one at a time.

5, 3, 21, 9, 1, 13, 2, 7, 10, 12, 4, 8. **[6]**

b) Create Min heap for Data 25, 12, 27, 30, 5, 10, 17, 29, 40, 3. **[6]**

c) What is Max Heap? Explain Basic operations of Max heap with example **[6]**

OR

Q6) a) Create Max heap for Data 15,19,10,7,17,16. After Construction max heap delete element 17 and rebuild heap. **[6]**

b) Construct a B+ tree of order 5 for following data one at a time 30, 31, 23, 32, 22, 28, 24, 29, 15, 26, 27, 34, 39, 36. **[6]**

c) Explain with example Trie tree. Give advantage and applications of Trie tree. **[6]**

Q7) a) Define sequential file organization. Give its advantages and disadvantages. **[6]**

b) Explain any two Types of Indices with example. **[6]**

c) Explain K-way merge algorithm. **[5]**

OR

Q8) a) Explain Different operations of sequential file organization with Example. **[6]**

b) What is file? List different file opening modes in C++. **[6]**

c) Explain concept of inverted files with example. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3642

[Total No. of Pages : 2

[6261]-50

S.E. (Computer Science and Design Engineering)

OPERATING SYSTEMS

(2019 Pattern) (Semester - IV) (218254)

Time : 2½ Hours] *[Max. Marks : 70*

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.***

Q1) a) Define mutual exclusion? How mutual exclusion achieve? **[6]**

b) What is deadlock? List the conditions that lead to deadlock. How deadlock can be prevented. **[6]**

c) Solve producer-consumer problem with monitor? **[5]**

OR

Q2) a) Define the following **[6]**

i) critical section

ii) waiting time

iii) race condition

b) Write note on: memory management requirement. **[6]**

c) Explain IPC problem- reader and writer problem. **[5]**

Q3) a) Explain paging and translation look aside buffer with its diagram. **[6]**

b) What is virtual memory? Explain demand paging with example. **[6]**

c) Write a short note on buddy system with its advantages and disadvantages. **[6]**

OR

P.T.O.

Q4) a) Explain segmentation with suitable example in briefs. **[6]**

b) Difference between segmentation and paging. **[6]**

c) Discusses the given memory management techniques with diagram: partition allocation Method **[6]**

Q5) a) Explain various methods for free space management. **[6]**

b) Discuss various issues involve in selecting appropriate disc scheduling algorithm. **[6]**

c) Explain the index allocation of disk space. **[5]**

OR

Q6) a) How to provide protection to file system? Explain. **[6]**

b) Explain in details allocation method. **[6]**

c) Compare and explain LIFO FIFO & STTP. **[5]**

Q7) a) Describe step by step booting process in Linux. **[6]**

b) What is system call? Explain the various types of system call provided by OS. **[6]**

c) What is kernel structure in Linux? **[6]**

OR

Q8) a) What is utility program & what are its function. **[6]**

b) Explain implementation of process and threads in Linux. **[6]**

c) What are the different types of shells in Linux. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3643

[6261]-51

[Total No. of Pages :2

S.E. (Computer Science and Design)

COMPUTER NETWORKS

(2019 Pattern) (Semester- IV) (218255)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain roles of Network Layer. **[5]**

b) 17.63.110.114/24 for this given IP address find out **[6]**

i) Subnet mask

ii) What is first IP address for address block?

iii) What is last IP address for address block?

c) What is difference between classful and classless IP addressing? Which addressing is currently used in the internet? **[6]**

OR

Q2) a) Explain Mobile IP with suitable diagram. **[5]**

b) Differentiate between DVR and Link state Routing Algorithm. **[6]**

c) Find the sub-network address and the host id for the following. **[6]**

IP Address	Mask
120.14.22.17	255.255.128.0
140.11.36.23	255.255.255.0
141.181.14.16	255.255.224.0

Q3) a) What causes silly window syndrome? How is avoided? Explain. **[7]**

b) Explain UDP Header? Below is an Hexadecimal dump of an UDP datagram captured. **[7]**

03 61 10 1A 10 4C Y2 42

i) What is source port number?

ii) What is destination port number?

iii) What is the length of the data?

iv) Is packet directed from a client to server or vice versa?

v) What is the client process?

c) Explain SCTP in detail. **[4]**

OR

P.T.O.

Q4) a) Differentiate between TCP and UDP protocol. **[7]**

b) What is Socket explain different types of sockets? List various socket primitives. **[7]**

c) Explain QoS parameters in Computer Network. **[4]**

Q5) a) Compare SMTP and HTTP protocols. **[4]**

b) Explain working of SMTP and POP3/IMAP protocols in Email systems. **[6]**

c) Why HTTP is called as stateless protocol? Explain HTTP request and response messages. **[8]**

OR

Q6) a) Differentiate between Persistent and Non persistent HTTP. **[4]**

b) Explain working of DNS with diagram. **[6]**

c) Why do we need DHCP? Explain different components of DHCP? What are the advantages of DHCP? **[8]**

Q7) a) Explain Model of Network Security. **[4]**

b) Explain the working of IPSec with the different security services offered by IPSec? **[6]**

c) Write short note on following. **[7]**

i) Symmetric Key

ii) Asymmetric key encryption techiniques.

OR

Q8) a) Write short note on SSL. **[4]**

b) Explain intrusion detection with merits and demerits. **[6]**

c) Explain firewalls with its types. **[7]**

Total No. of Questions : 8]

SEAT No. :

PB3644

[Total No. of Pages : 2

[6261]-52

S.E. (Computer Science and Design Engineering)

DESIGN THINKING

(2019 Pattern) (Semester - IV) (218256)

Time : 2½ Hours] *[Max. Marks : 70*

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

Q1) a) What is sketching in design thinking? How can you use sketching as a ideation method? **[5]**

b) How to evaluate and select an idea? **[6]**

c) What is brainstorming? What are different variants of brainstorming. **[6]**

OR

Q2) a) When do designers think in preposition and colours? Explain with example. **[5]**

b) How humours can be used in designs? Design a poster in an humours way that shows Sport requires accurate vision to achieve a high level of performance. **[6]**

c) How to use story telling in design process? What are the elements of good story telling? How to reach the users through story? **[6]**

Q3) a) What are the principles and benefits of lean startup method. **[7]**

b) Why Visualization techniques are useful for design Thinking? Elaborate on any three visualization techniques. **[7]**

c) Write a short note on quick and dirty prototype. **[4]**

OR

Q4) a) Explain the importance of presentation technique in design thinking process. Explain the different presentation types. **[7]**

b) What is story boarding? Why it is important? Give example. **[7]**

c) What is a mock up in design thinking? Give example. **[4]**

P.T.O.

Q5) a) How to use customer's feedback in product development? **[4]**

b) What is prototype testing? What are the characteristics of prototype testing? **[6]**

c) Compare usability and desirability testing.Compare usability and desirability testing. **[8]**

OR

Q6) a) What is testing? When to conduct user testing? **[4]**

b) Why is testing integral to the design thinking process? What are the types of testing in design thinking? **[6]**

c) Explain Kano model of Testing. **[8]**

Q7) a) How design thinking helps in innovation? **[4]**

b) Explain different Test phase- techniques of interviews and surveys. **[6]**

c) What is the importance of design activism? Explain types of activism. **[7]**

OR

Q8) a) What is the new social contract for a new era? **[4]**

b) What is innovation portfolio? How do you create an innovation portfolio. **[6]**

c) How to introduce design thinking into your organization? **[7]**

Total No. of Questions : 8]

SEAT No. :

PB3645 **[6261]-53** [Total No. of Pages : 2

S.E. (Computer Science & Design)
DATA STRUCTURE & ALGORITHMS
(2019 Pattern) (Semester-III) (218242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Explain insertion sort algorithm and sort the given list using insertion sort: 7, 4, 10, 6, 3, 12, 1, 8, 2, 15, 9, 5 **[5]**

b) Explain merge sort algorithm using divide and conquer strategy with an example. State its time complexity and space complexity. **[6]**

c) Write pseudo code for radix sort. **[6]**

OR

Q2) a) Explain Merge sort using the following example: **[5]**

18, 13, 12, 22, 15, 24, 10, 16, 19, 14, 30

b) Explain sequential search and binary search with appropriate example. Comment on their data organization, time complexity and space complexity **[6]**

c) Write an algorithm for searching an element using binary search. Discuss the time complexity of algorithm in best case and worst case **[6]**

Q3) a) Write pseudo code to represent Singly linked list as an ADT. **[7]**

b) Write a code to delete alternate elements from Linked List **[7]**

c) Compare SSL and DLL **[4]**

OR

P.T.O.

Q4) a) Write a pseudo code to Represent Doubly Link list as an ADT **[7]**

b) Define Link List & explain following types with suitable Example **[7]**

i) Singly Linked List

ii) Doubly Linked List

iii) Circular Linked List

c) Explain Generalised linked list with suitable Example. **[4]**

Q5) a) What is recursion? Explain use of stack for recursion. **[4]**

b) Explain evaluation of prefix expression using stack with Suitable example. **[6]**

c) Convert following infix expression to postfix expression **[8]**

((A+B) – C * (D/E)) + F

Use stack & show step by step conversion.

OR

Q6) a) What is backtracking? Explain the use of stack in backtracking **[4]**

b) Explain process of conversion of an infix expression to postfix expression using stack: **[6]**

A* (B – C)/E ^ F + G

c) Explain evaluation of postfix expression using stack with suitable example? List Different Applications of Stack. **[8]**

Q7) a) Define the following terms with example: **[4]**

i) Dequeue

ii) Circular queue

b) Write pseudo code to perform insert and delete operation on linear queue. **[6]**

c) What is Priority queue? Describe the operations on priority queue and explain its applications. **[7]**

OR

Q8) a) Write algorithm to delete intermediate node from Doubly Link List **[4]**

b) Write pseudo code to implement a circular queue using arrays. **[6]**

c) Explain Dequeue with the insert and delete operations performed on it. **[7]**

Total No. of Questions : 8]

SEAT No. : ____

PB3646

[6261]-54

[Total No. of Pages :2

S.E. (Computer Science & Design Engg.)

LOGIC DESIGN AND COMPUTER ARCHITECTURE

(2019 Pattern) (Semester- III) (218245)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Total number of questions are 8.***
2) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
3) ***Assume Suitable data if necessary.***
4) ***Neat sketches must be drawn wherever necessary.***

Q1) a) Explain Combinational Circuit with Suitable two examples. **[5]**

b) Explain SR Latch. **[5]**

c) Explain JK Flipflop with neat diagram and also explain Truth Table and Excitation Table. **[7]**

OR

Q2) a) Design Mod 20 Counter using IC 7490. **[7]**

b) Convert T to D Flipflop. **[5]**

c) Design 3 Bit Synchronous counter using T flipflop. **[5]**

Q3) a) Explain Von Neumann Computer Architecture with neat diagram. **[7]**

b) With Neat diagram explain Instruction Cycle. **[5]**

c) Explain Control Signals. **[5]**

OR

Q4) a) Explain Address Register, Data Register and Flag register. **[7]**

b) Explain BUS organization with neat Diagram. **[5]**

c) Explain Micro operations. **[5]**

P.T.O.

Q5) a) Write a key features of RISC. **[4]**

b) List down Addressing Modes with an example. **[8]**

c) Explain 0-1-2-3 address instruction. **[6]**

OR

Q6) a) Write a key features of CISC. **[6]**

b) Explain features multicore intel corei7 processor. **[8]**

c) Explain Interrupt handling. **[4]**

Q7) a) With neat diagram explain write Cycle. **[4]**

b) Compare salient features of SRAM and DRAM. **[6]**

c) Explain with neat block diagarm DMA Controller. **[8]**

OR

Q8) a) With neat diagram explain read Cycle. **[4]**

b) Explain Cache coherence. **[6]**

c) Explain Interrupt Driven I/O and Module Programmed I/O. **[8]**

Total No. of Questions : 8] **SEAT No. :**

PB-3647

[Total No. of Pages : 2

[6261]-55
S.E. (Information Technology)
Processor Architecture
(2019 Pattern) (Semester - IV) (214451)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Discuss the steps in executing interrupts in PIC 18 microcontroller. **[7]**

b) Draw an interfacing diagram for 4×4 matrix keyboard with PICI8F microcontroller and explain it. **[8]**

c) Explain function of following LCD pins: **[3]**

i) RS ii) RW iii) EN

OR

Q2) a) Explain PIR (Peripheral Interrupt Request Register) IPR (Peripheral Interrupt Priority Register). **[8]**

b) Draw and explain the interfacing of relay and buzzer with PIC 18Fxxx microcontroller. **[7]**

c) What are peripheral interrupts, IVT and ISR? **[3]**

Q3) a) Explain RS232 standard with suitable diagram. **[6]**

b) Explain operation of compare mode of PIC18FXX microcontroller with diagram **[6]**

c) Compare SPI and I2C bus protocols **[5]**

P.T.O.

OR

Q4) a) Explain the function CCP1CON SFR along with its format **[6]**

b) Distinguish between synchronous and asynchronous serial communication. **[5]**

c) Explain the UART operation in PIC 18FXX with example. **[6]**

Q5) a) Write steps in programming A to D conversion in PIC 18F microcontroller **[6]**

b) Explain function of any 4 pins of RTC DS1306 **[8]**

c) List out the steps necessary for reading from EEPROM of PIC l8 **[4]**

OR

Q6) a) Draw and explain the interfacing diagram of DAC0808 with PIC 18FXXX. **[7]**

b) Explain in detail the functions of ADCON0 SFR of PIC 18FXX microcontroller. **[6]**

c) Explain interfacing of LM35 temperature sensor with PIC I8FXX microcontroller **[5]**

Q7) a) Describe the ARM BUS Technology **[6]**

b) How ARM instruction set differs from pure RISC definition? **[5]**

c) Explain ARM core dataflow Model with suitable diagram. **[6]**

OR

Q8) a) Describe the major Design Rules of RISC philosophy. List the features of RISC Processor accepted by ARM processor. **[5]**

b) Write significance of special registers R13, R14 and R15 in ARM 7 **[6]**

c) What are the different operating modes of ARM7? **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PB3648

[Total No. of Pages : 3

[6261]-56

S.E. (Information Technology)

DATABASE MANAGEMENT SYSTEMS

(2019 Pattern) (Semester - IV) (214452)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***Neat diagram must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***
5) ***Use of Scientific Calculator is permitted.***

Q1) a) Write a note on : **[8]**

i) Database Modification using SQL

ii) Set Operation

b) Consider the following relation: **[6]**

Customer(cid,cname,caddress,city,state)

Order(oid,odate,aamount)

Customer and order are related with one to many relationship. solve the following queries.

i) List the name of customer who belong to Maharashtra state, sorted on city.

ii) What are the name of all customer who placed the order between 01/01/2010 to 31/03/2011?

iii) Define constraint on order amount such that it should be always greater than zero.

c) Explain the concept of Dynamic and Embedded SQL. **[4]**

OR

P.T.O.

Q2) a) Explain in detail with syntax Stored, procedure and Trigger 3-54 **[8]**

b) Write the syntax for following SQL command : **[6]**

i) Create Table

ii) Alter table

iii) Drop table

iv) Insert

v) Update

vi) Delete

c) What is view? List two major problem with processing update operations expressed in terms of views. **[4]**

Q3) a) Compute the closure of the following set F of functional dependencies for relation schema R = (A, B, C, D, E). **[7]**

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

List the candidate keys for R.

b) State and explain armstrong's axioms and its properties. **[6]**

c) Explain Difference between 4NF & BCNF. **[4]**

OR

Q4) a) Describe the concept of transitive dependency. Explain how this concept is use to define 3NF. **[7]**

b) Explain with example Materialized evaluation and pipelining. **[6]**

c) Suppose that we decompose the schema R = (A, B, C, D, E) into **[4]**

(A, B, C)

(A, D, E).

Show that this decomposition is a lossless-join decomposition if the following set F of functional dependencies holds.

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

Q5) a) Explain : **[8]**

i) ACID properties

ii) Explain Timestamp Based Concurrency Control

b) What is the need of Serializability? **[6]**

c) Check whether given schedule is view serializable? **[4]**

T1	T2	T3
Read(Q)		
	Write(Q)	
Write(Q)		
		Write(Q)

OR

Q6) a) What is Log Based Recovery? Explain Deferred Database Modification and Immediate Database Modification. **[12]**

b) Write a note on “Shadow Paging”. **[6]**

Q7) a) Explain the following : **[12]**

Internet Databases

Mobile Databases

Cloud Databases

SQLite Databases

b) Explain XQuery FLWOR Expressions. **[5]**

OR

Q8) a) With a proper diagram, explain the architecture of Distributed Databases. **[9]**

b) With a suitable diagram, explain Centralized and Client-Server Architectures. **[8]**

Total No. of Questions : 8]

SEAT No. :

PB3649

[6261]-57

[Total No. of Pages :2

S.E. (Information Technology)
COMPUTER GRAPHICS
(2019 Pattern) (Semester- IV) (214453)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Show that the Transformation matrix of reflection about line y = x is equivalent to reflection relative to x-axis followed by anticlockwise rotation of 90 degree. **[6]**

b) Explain with diagram, Perspective vanishing points as 1 point, 2 point and 3 point. **[6]**

c) Explain the basic transformation techniques in 3D Graphics. **[6]**

i) Scaling

ii) Rotation

iii) Translation

OR

Q2) a) Explain 3D reflection about XY, YZ and XZ plane. **[6]**

b) Let ABCD be the rectangle window with A (10,20), B (100,20), C (100,90), D (10,90). Find the region code for endpoints and use Cohen Sutherland algorithm to clip the lines P1-P2 with P1 (5,30) and P2 (70,100) and Q1-Q2 with Q1 (50,70) and Q2 (80,30). **[6]**

c) Explain with diagram parallel and perspective projection. **[6]**

Q3) a) Explain with diagram Phong shading algorithm in detail. **[6]**

b) What is segment? Explain the concept of segment table and display file. **[6]**

c) Explain different types of light sources. Also explain specular reflection. **[5]**

OR

P.T.O.

Q4) a) What is Shading. Explain with diagram Constant intensity shading method. **[6]**

b) Define color gamut. Explain with diagram CIE Chromaticity Diagram. **[6]**

c) Explain RGB, CYM color models. **[5]**

Q5) a) Write a short note on Interpolation and approximation. **[6]**

b) Explain Bezier curve. List its properties. **[6]**

c) What are the methods of controlling animation? **[6]**

OR

Q6) a) Explain Koch curve and its application in detail. **[6]**

b) Write short notes on **[6]**

i) Morphing

ii) Design of animation sequence

c) What is fractal? Explain Hilbert curve in detail. **[6]**

Q7) a) What is the different usage of Virtual Reality? Explain in detail. **[6]**

b) What is Haptics Rendering Pipeline Modeling in Virtual Reality? **[6]**

c) What is kinematic modeling in a Virtual Reality? **[5]**

OR

Q8) a) What is graphics rendering pipeline in a Virtual Reality system? **[6]**

b) Explain gesture interfaces in Virtual Reality. **[6]**

c) Explain 3D position trackers. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3650

[Total No. of Pages :2

[6261]-58

S.E. (Information Technology)

SOFTWARE ENGINEERING

(2019 Pattern) (Semester- IV) (214454)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) What is a component? Explain An Object-Oriented View of components with suitable example. **[9]**

b) What is an architectural style? Explain different architectural style with suitable example. **[9]**

OR

Q2) a) What are the characteristics of a good design? Explain Software Quality Guidelines and Attributes of software design. **[9]**

b) Explain design evaluation cycle. What are design issues we have to consider which designing user interface? **[9]**

Q3) a) What do you meant by Work Breakdown Structure? Explain representations of WBS with suitable examples. List advantages of WBS. **[8]**

b) What is Critical Path Method (CPM)? Explain the components of CPM. Explain key steps in Critical Path Mehod using suitable example. **[9]**

OR

Q4) a) What is Project Management Spectrum? Explain the W5HH Principle.**[8]**

b) What do you meant by Software measurement? Explain size & function-oriented metrics with suitable examples. **[9]**

P.T.O.

Q5) a) Define quality. What is Cost of Quality? Explain types of Cost of Quality in details. **[9]**

b) What is software testing? Why it is important? Explain Principles of Software Testing. **[9]**

OR

Q6) a) Compare Software Quality Assurance, Software Quality Control and Software testing. **[9]**

b) Explain defect management. Explain various stages of defect management process. **[9]**

Q7) a) What do meant by Software configuration? Define baseline. What is Software Configuration Objects? **[9]**

b) Explain test-driven development with neat diagram. **[8]**

OR

Q8) a) What is CASE workbench? Explain types of CASE workbenches. **[9]**

b) Explain software reuse. What are approaches of Reuse-based software engineering? What are benefits of software reuse? **[8]**

Total No. of Questions : 8]

SEAT No. :

PB3651

[Total No. of Pages : 3

[6261]-59
S.E. (Information Technology Engg.)
DISCRETE MATHEMATICS
(2019 Pattern) (Semester - III) (214441)

Time : 2½ Hours] *[Max. Marks : 70*

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 diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

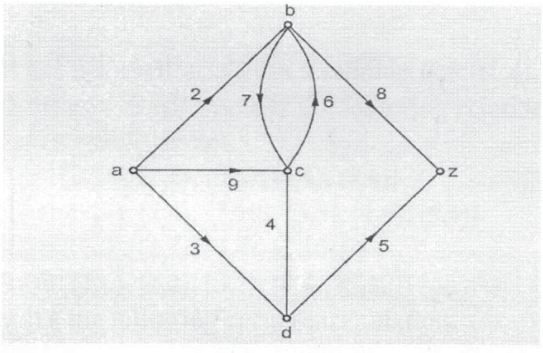
Q1) a) Give an example of the following graphs **[6]**

i) Eulerian but not Hamiltonian

ii) Hamiltonian but not Eulerian

iii) Eulerian as well as Hamiltonian

b) Using the labeling procedure, find the maximum flow in the following transport network. **[6]**



c) What is the Prefix Code? Which of the following codes are prefix codes? Justify your answer. **[6]**

i) a: 101, e: 11, t: 001, s: 011, n: 010

ii) a: 010, e: 11, t: 011, s: 1011, n: 1001, i: 10101

OR

Q2) a) A connected planar graph has nine vertices with degree **[6]**

2, 2, 2, 3, 3, 3, 4, 4, 5

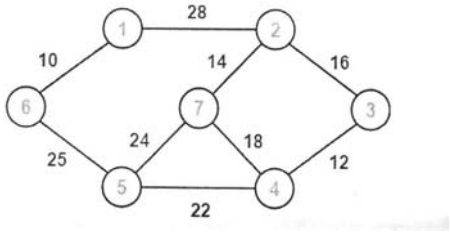
i) Find number of edges

ii) Find number of faces

iii) Construct such a graph

P.T.O.

b) Find the minimum spanning tree and weight of it for the given graph using Prim's algorithm. **[6]**



c) Suppose that someone starts a chain letter. Each person who receives the letter is asked to send it on to four other people. Some people do this, but others do not send any letters. How many people have seen the letter, including the first person, if no one receives more than one letter and if the chain letter ends after there have been 100 people who read it but did not send it out? How many people sent out the letter? **[6]**

Q3) a) What is Function? Given a relation R = {(1,4), (2,2), (3,10), (4,8), (5,6)} and check whether the following relations R1, R2, R3 & R4 are functions or not. **[6]**

R1 = {(1,4), (2,4), (3,4), (4,4), (5,4)}

R2 = {(1,2), (2,4), (2,10), (3,8), (4,6), (5,4)}

R3 = {(1,6), (2,2), (4,4), (5,10)}

R4 = {(1,6), (2,2), (3,2), (4,4), (5,10)}

b) Solve the following recurrence relation. **[6]**

$a_n = 5a_{n-1} - 6a_{n-2}$ where $a_0 = 2$ and $a_1 = 5$

c) Find the minimum number of students in a class such that five of them are born in the same month? (Use PigeonHole Principle). **[5]**

OR

Q4) a) Find the transitive closure by using Warshall's algorithm for the given relation as: **[6]**

R = {(1,1), (1,4), (2,1), (2,2), (3,3,), (4,4)}

b) Define POSET. Draw Hasse Diagram for relation R defined over set A. A = {1, 2, 3, 4, 6, 8, 12} R = {(x,y)| x divides y}. **[6]**

c) Given f(x) = 2x + 3 and g(x) = 3x – 2. Find f(7), gof(x) and fog(x). **[5]**

Q5) a) Which of the following congruences is true? Justify your answer. **[6]**

i) $5127 \equiv 1297 \pmod{20}$

ii) $577 \equiv 7188 \pmod{11}$

iii) $1492 \equiv 717 \pmod{31}$

b) Compute GCD of the following numbers using Euclidean Algorithm **[6]**

i) GCD(745, 1250)

ii) GCD(485, 1551)

c) Using Chinese Remainder Theorem, find the value of P using following data **[6]**

$P \equiv 4 \pmod{5}$

$P \equiv 5 \pmod{7}$

OR

Q6) a) Find multiplicative inverse of 5 mod 31 using Extended Euclidean Algorithm. **[6]**

b) Find totient function of the following numbers **[6]**

i) 77

ii) 75

iii) 50

c) What is a Mersenne prime number? Which of the following numbers is the Mersenne Prime number? 19, 31, 1023, 63,7. **[6]**

Q7) a) Let S{1,2,3,6,12}, where a*b is defined as LCM (a,b) over set S. Determine whether it is a semigroup, group, or Abelian Group or neither. **[6]**

b) Consider the set A={1,3,5,7,9.....} i.e. a set of odd positive integers. Determine whether A is closed under: **[6]**

i) a*b = a + b

ii) a*b = 2a – b

iii) a*b = a.b (Multiplication)

iv) a*b = power (a,b)

v) a*b = max(a,b)

vi) a*b = GCD(a,b)

c) Prove that Z={1,5,7,11} is an Abelian group under multiplication mod 12. **[5]**

OR

Q8) a) Show that the set of all positive rational numbers forms an abelian group under the composition * defined by a * b = (ab)/2. **[6]**

b) Explain Field with an example. **[6]**

c) Prove that Hamming Distance d(x,y) = 0 iff x = y where x and y are codewords. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3652

[Total No. of Pages :2

[6261]-60
S.E. (I.T.)
LOGIC DESIGN & COMPUTER ORGANIZATION
(2019 Pattern) (Semester-III) (214442)

Time : 2½ Hours] *[Max. Marks : 70*

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 indicates full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Differentiate between combinational Circuit and Sequential Circuit. **[6]**

b) Explain in detail the Conversion of D flip-flop to T flip-flop. **[6]**

c) Define Register. Explain various types of shift registers. **[5]**

OR

Q2) a) Draw the pin Configuration of IC 7476 and explain the function of Present and Clear pins. **[6]**

b) What is meant by race around condition? How race around condition can be eliminated? **[6]**

c) Define Modulus of Counter. Design MOD-81 counter using Decade Counter IC 7490. **[5]**

Q3) a) Explain following terms in brief i) ALU Signals ii) ALU Functions iii) ALU Types. **[6]**

b) What are the uses of Registers in a CPU? List typical Registers in a CPU. Write a short note on Flag register. **[6]**

c) What are interrupts? Explain with diagram what steps are carried out when they are present. **[6]**

OR

Q4) a) Write in brief about the Fetch cycle with operations and microinstructions carried out? **[6]**

b) Explain and Design basic structure of Von Neumann architecture. Write the difference between Harvard and Von Neumann architecture. **[6]**

c) Write a short note on following - Address Bus, Data Bus, Control Bus. **[6]**

P.T.O.

Q5) a) What is mean by Machine Instruction? Explain basic format of Machine instruction? What are the basic types of machine instructions? **[6]**

b) What is meant by Multicore architecture? List the typical features of multicore intel core i7. **[6]**

c) What is purpose of Interrupt? What are various types of Interrupts? **[5]**

OR

Q6) a) Explain interrupt handling. **[6]**

b) Give the Taxonomy of Parallel Processor Architectures, with one line explanation of each type. **[6]**

c) Identify the addressing mode in following instructions: **[5]**

i) MOV R1, #0A2DH

ii) MOV R1,R2

` iii) MOV R1, [R2]

Q7) a) Along with suitable diagram explain direct cache mapping technique. **[6]**

b) What is DMA? Along with suitable diagram explain how DMA is used for data transfer. **[6]**

c) Explain memory read cycle with timing diagram. **[6]**

OR

Q8) a) Compare : SRAM and DRAM. **[6]**

b) Explain Cache Coherence. **[6]**

c) Whta is Principle of Locality? Explain two types of Localities. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3653

[Total No. of Pages : 4

[6261]-61
S.E. (I.T.)
DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester - III) (214443)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Imagine we have two empty stacks of integers, S1 and S2. Draw a picture of each stack after the following operations: **[6]**

i) S1. Push (3);
ii) S1. Push (5);
iii) S1. Push (7);
iv) S1. Push (9);
v) S1. Push (11);
vi) S1. Push (13);
vii) while (! Emptystack (S1))
{
X = S1. Pop ();
X = S1. Pop ();
S2. Push (X);
}

b) Clearly indicate the content of stack during conversion of given infix expression to prefix.

A^B*C–D+E/F/(G+H) **[6]**

c) Write a C++ pseudocode algorithm for the following operation of simple queue using linked representation. **[6]**

i) enqueue ()
ii) dequeue()
iii) print_Queue()

OR

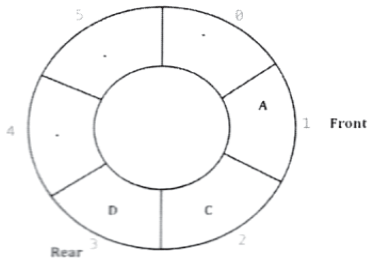
P.T.O.

Q2) a) If the values of A, B, C, and D are 2, 3, 4, and 5 respectively. Calculate the value of the following prefix expression and clearly indicate the content of stack. **(Consider '_' as a minus sign)** **[6]**

i) + – * A B C D

ii) – * A + B C D

b) Consider the following **circular queue of characters of size 6.** "_" denotes an empty queue location. Initial queue configuration is Front = 1, Rear = 3 and having letters as shown below. **[6]**



i) F is added to the queue

ii) Two letters are deleted

iii) K, L, M are added to the queue

iv) R is added to the queue

v) Two letters are deleted

vi) S is added to the queue

vii) Two letters are deleted

Show the queue content of queue with Front and Rear as the above options take place.

c) What is double ended queue? Mention Types of double ended queue. Explain enqueue and dequeue operations of double ended queue. **[6]**

Q3) a) Create a binary tree from given preorder and inorder traversal. **Show all intermediate steps.** **[6]**

Preorder : G B Q A C K F P D E R H

Inorder : Q B K C F A G P E D H R

b) Write the C++ pseudocode algorithm for creating expression tree from postfix expression. **[6]**

c) Construct an inorder threaded binary search tree for the following set of elements. **[5]**

100, 50, 200, 300, 20, 150, 70, 180, 120, 30

Show all steps.

OR

Q4) a) Write C++ pseudocode algorithm for preorder traversal of threaded binary tree. **[6]**

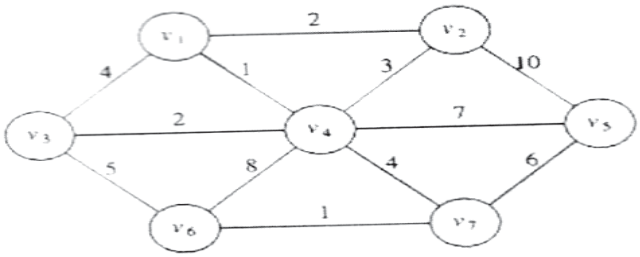
b) Draw the expression tree for the given postfix expression. Clearly indicate the content of stack. Write the inorder and preorder traversal of the concern tree. **[6]**

A B C * + E * F +

c) Explain the following terms with respect to tree. **[5]**

i) Root
ii) Leaf node
iii) Siblings
iv) Degree of a node
v) Degree of tree

Q5) a) Find the minimum spanning tree using Prim's algorithm for the following graph. **[6]**



b) Obtain an AVL tree by inserting one data element at a time in the following sequence: **[7]**

50, 55, 60, 15, 10, 40, 20, 45, 30, 70, 80.

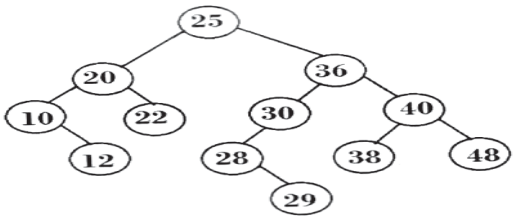
Label the rotations appropriately at each stage

c) Write short note on OBST **[5]**

OR

Q6) a) Write an application of Topological sorting with suitable example. **[6]**

b) For a given tree, Identify whether it is AVL tree or not? If it is not an AVL tree, convert it into balanced AVL tree. After conversion, insert node 15 in the tree. Delete node 20 from the tree. After insertion and deletion operation, if the tree is imbalanced, make it balanced AVL tree. **[7]**



c) Construct Heap to Sort given values in ascending order using MAXheap sort, 5, 3, 17, 10, 84, 19, 22. **[5]**

(Note : Make a use of Heapify)

Q7) a) Differentiate between sequential file and direct access file. **[6]**

b) Write a pseudo code to perform the following operations on Sequential file : **[6]**

i) Insert record

ii) Delete record

c) What are the characteristics of good hash function? List different techniques to resolve collision in hash table and explain any one with suitable example. **[5]**

OR

Q8) a) Explain the Index sequential file organization with advantages and disadvantage. **[6]**

b) Explain Linear probing with and without replacement with suitable examples. **[6]**

c) What is File? Differentiate between text file and binary file. **[5]**

* * *

Total No. of Questions : 8]

SEAT No. :

PB-3654

[Total No. of Pages : 2

[6261]-62
S.E. (I.T.)
Object Oriented Programming
(2019 Pattern) (Semester - III) (214444)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagram must be drawn wherever necessary***
2) ***Figures to the right side indicate full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Write a short note on 'Symbolic Constants' in Java. **[9]**

b) Discuss Constructor Overloading with suitable code. **[9]**

OR

Q2) a) How are objects initialized dynamically? Explain with an example. **[9]**

b) What is garbage collection in OOP? Explain finalize() method in Java. **[9]**

Q3) a) Define a class 'shape' with abstract method compute_area(). Derive the classes 'circle' and 'rectangle' from 'shape' class. Calculate the area of circle and rectangle using Dynamic Binding. Use appropriate instance variables and methods whenever necessary. **[9]**

b) Discuss diamond problem in detail? How it can be solved? **[8]**

OR

Q4) a) Design a class 'person1' with instance variables 'name' and 'age'. Derive a class 'person2' from 'person1' class with instance variable 'gender'.Derive a class 'employee' from 'person2' class with instance variable 'address'. Create a database of the 3 employees. Use the appropriate methods to accept and display the data. **[9]**

b) Define Polymorphism? Differentiate between Compile Time Polymorphism and Run Time Polymorphism with an example. **[8]**

P.T.O.

Q5) a) Can we throw an exception explicitly or manually? If 'yes', justify your answer with an example. **[9]**

b) What is Generic Programming? Discuss any four methods of LinkedList class with their syntax. **[9]**

OR

Q6) a) Differentiate between an array and ArrayList class. Explain following methods of ArrayList class. **[9]**

i) add()

ii) get()

iii) remove()

b) Implement a program which handle Arraylndex Out of Bound Exception **[9]**

Q7) a) What is a Design Pattern? Write a short note on 'Iterator' design pattern. **[9]**

b) How do you write to a file and read from a file using FileWriter and FileReader class, respectively? **[8]**

OR

Q8) a) How are input/output exceptions handled in File Handling? Explain with an example **[9]**

b) Is it possible to concatenate two or more files and save them in a different file? If 'yes', justify' your answer with an example. **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB3655

[Total No. of Pages :2

[6261]-63

S.E. (Information Technology)

BASICS OF COMPUTER NETWORK

(2019 Pattern) (Semester- III) (214445)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain FDMA, TDMA & CDMA with neat diagram. **[9]**

b) Draw and Explain MAC Frame Format of 802.3. **[9]**

OR

Q2) a) Discuss CSMA/CA random access technique. How collision avoidance is achieved in the same? **[9]**

b) Write short note on IEEE 802.4(Token Bus) and IEEE 802.5(Token Ring). **[9]**

Q3) a) Discuss Network Layer Services. Illustrate IPv4 addresses with respect to classess. **[9]**

b) Explain Classful and Classless Addressing with example. **[8]**

OR

Q4) a) Describe Subnetting and Supernetting with example. **[9]**

b) Explain in detail fragmentation in terms of IPv4. **[8]**

P.T.O.

Q5) a) Discuss Distance Vector Routing protocol in detail. **[9]**

b) Explain EIGRP protocol in detail. **[9]**

OR

Q6) a) Discuss OSPF protocol in detail. **[9]**

b) Explain Link State Routing protocol in detail. **[9]**

Q7) a) What is congestion Control? Explain leaky bucket algorithm. **[9]**

b) Explain the use of different timers in TCP. **[8]**

OR

Q8) a) Explain various socket primitives used in connection oriented client server approach. **[9]**

b) Discuss with neat diagram TCP header format. **[8]**

Total No. of Questions : 8] **SEAT No. :**

PB-3656

[Total No. of Pages : 3

[6261]-64
S.E.-(Artificial Intelligence and Machine Learning)
Operating Systems
(2019 Pattern) (Semester - IV) (218552)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) What is busy waiting with respect to process synchronization? Explain how semaphore reduces severity of this problem. Also define with example: **[9]**

i) General semaphores ii) Binary semaphores

b) Consider the following snapshot of system for banker's algorithm. **[9]**

Process no	Allocation				Max				Available				Need			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	0	1	2	0	0	1	2	5	2	0					
P1	1	0	0	0	1	7	5	0								
P2	1	3	5	4	2	3	5	6								
P3	0	6	3	2	0	6	5	2								
P4	0	0	1	4	0	6	5	6								

Calculate the need? Is the system safe? Justify, If yes, give safe sequence.

OR

P.T.O.

Q2) a) Write structure of reader and writer process where writers have priority. **[9]**

b) Explain working of banker's algorithm for deadlock avoidance with suitable example. **[9]**

Q3) a) Explain Belady's anomaly and the measures to prevent it **[8]**

b) Consider the page reference string with 3 frames. **[9]**

A ,B, C,D,E,C,D,A,F,G,H,G,H,I,G,H,I,E,D,E,D,B

Calculate the no of page faults for following page replacement algorithm.

i) FIFO ii) Optimal iii) LRU

OR

Q4) a) Consider the following page reference string: **[9]**

7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1

Calculate the no of page faults for following page replacement algorithm. Consider no of frames'3.

i) FIFO ii) Optimal iii) LRU

b) Explain the address translation mechanism in paging and segmentation.**[8]**

Q5) a) We assume a disk with 200 tracks and disk request queue has random requests in it.The requested disks in the order are 55, 58, 39, 18, 90, 160, 150, 38, 184 starting with a track 100. **[9]**

Find the no of tracks traversed and average seek length if

i) FCFS ii) SSTF iii) SCAN iv) C-SCAN.

b) Explain different file organization techniques. **[9]**

OR

Q6) a) Suppose that a disk drive has 5000 cylinders numbered 0 to 4999. The drive is currentlyservicing a request at cylinder 143 and the previous request was at cylinder l25.The queue of pending requests in fifo order is 86,1470,913,1774,948,1509,1022,1750,130. **[9]**

Starting from the current head position what is the total distance in cylinders that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithm.

i) FCFS ii) SSTF iii) SCAN iv) C-SCAN

b) Describe 3 methods of record blocking with the help of neat diagrams.**[9]**

Q7) a) Explain simple Assembly Scheme and pass structure of Assemblers. **[9]**

b) Explain the concepts relocation and linking. **[8]**

OR

Q8) a) Explain General Loader Scheme. **[9]**

b) Explain all elements of Assembly Language Programming. **[8]**

Total No. of Questions : 8]

SEAT No. :

PB3657

[Total No. of Pages : 2

[6261]-65

S.E. (AI & ML)

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(2019 Pattern) (Semester - IV) (218553)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary.***

Q1) a) What is uncertainty? State the causes of uncertainty. Justify need of probabilistic reasoning in AI. **[6]**

b) Write short note on First Order Logic. **[6]**

c) State the techniques of knowledge representation. Explain Logical representation with its advantages and disadvantages. **[6]**

OR

Q2) a) Explain the various levels of knowledge based agent. **[6]**

b) Differentiate between Inductive and Deductive reasoning. **[6]**

c) What are the approaches to design Knowledge base agent? What are the requirements of Knowledge Representation System? **[6]**

Q3) a) Explain various learning Type in machine learning? **[9]**

b) Explain the role of training data set, testing data set and validation data set with suitable example. **[8]**

OR

Q4) a) Explain the Cross-validation with diagram. **[9]**

b) Enlist all the machine learning application and explain any 2 in details. **[8]**

P.T.O.

Q5) a) What is Learning in Machine Learning? Explain different types of learning in Machine Learning. **[9]**

b) What is the need of dimensionality reduction? Explain subset selection method. **[9]**

OR

Q6) a) Write a note on Principal Component Analysis. **[6]**

b) Explain with example forward and backward selection method for subset selection. **[6]**

c) Compare Supervised, Unsupervised and Semi-Supervised Learning with examples. **[6]**

Q7) a) What is Binary classification and Multi-class classification, explain with suitable example. **[6]**

b) What is linear Regression? When is it suitable to use linear regression over classification? **[4]**

c) What is confusion matrix? Define the terms True Positive (TP), False Positive (FP), True Negative (TN), False Negative (FN). **[7]**

Consider the following two class confusion matrix. Calculate Precision, Recall, Accuracy and Fl-score.

	Actual Values		
		+ve	–ve
Predicted values	+ve	9	2
	–ve	1	8

OR

Q8) a) Explain One-Vs-Rest construction method of multiclass classifier with suitable example. **[6]**

b) Differentiate between Underfitting Vs Overfitting. **[4]**

c) What is univariate and multivariate regression? Explain any two measures of evaluation of performance of Regression Model. **[7]**

Total No. of Questions : 10]

SEAT No. :

PB3658

[Total No. of Pages :3

[6261]-66

S.E. (Artificial Intelligence & Machine Learning Engg.)

DATABASE MANAGEMENT SYSTEM

(2019 Pattern) (Semester- IV) (218554)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
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 different DDL and DML commands with example. **[6]**

b) Explain join operations with example. **[6]**

c) Consider the following database

Student (Roll_No, Name, Address)

Subject (Sub_code, Sub_name)

Marks (Roll_No, Sub_code, Marks)

Write following queries in SQL.

Find average marks of each student, along with the name of student. **[2]**

OR

Q2) a) Explain the concept of view along with its operations. **[6]**

b) What is cursor? Explain types of cursors with example. **[6]**

c) Consider the schema:

student_fees_detail(name,total_fees_deposited,till_date)

Answer the following:

Write SQL query to display the total fees deposited by students whose minimum 3 character name starts with aj. **[2]**

Q3) a) Explain insertion, deletion and modification anomalies with example. **[5]**

b) State the need of normalization? Explain 1NF, 2NF and 3NF with example. **[8]**

OR

P.T.O.

Q4) a) What is the difference between 3NF and BCNF? **[5]**

b) Define Query processing. What are the steps involved in query processing? **[8]**

Q5) a) What is transaction? Explain ACID properties of transaction. **[6]**

b) What is deadlock? Explain how deadlock detection and prevention is done. **[8]**

OR

Q6) a) What is serializable schedule? Explain with suitable example the types of serializable schedules. **[6]**

b) What is concurrency control? Explain time stamp based concurrency control. **[8]**

Q7) a) Explain Architecture of Parallel & Distributed Databases. **[5]**

b) What is XML Schema?

Give XML Schema for the following banking system:

account (account_number, branch_name, balance)

Customer(customer_number, customer_street, customer_city),

Depositor(customer_number, account_number) **[8]**

OR

Q8) a) Explain the following terms in XML with examples : **[5]**

i) Documents

ii) Elements

iii) Nested/sub elements

iv) Attributes

v) Namespace

vi) DTD

vii) Schema

b) Explain different parallel database architectures. **[8]**

Q9) Write short note on : **[16]**

a) Embedded SQL

b) Functional dependencies

c) Two phase locking protocol

d) SQLite Database

OR

Q10) Write short note on : **[16]**

a) Trigger

b) Query optimization

c) Shadow paging

d) Mobile Database

Total No. of Questions : 8]

SEAT No. : ____

PB3659

[Total No. of Pages : 2

[6261]-67

S.E. (Artificial Intelligence and Machine Learning)

COMPUTER GRAPHICS

(2019 Pattern) (Semester - IV) (218555)

Time : 2½ Hours] ***[Max. Marks : 70***

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 side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Explain with diagram Cohen Sutherland line clipping algorithm. **[6]**

b) What is the concept of vanishing point in perspective projection? Explain with diagram. **[6]**

c) Explain rotation about arbitrary axis in 3D transformation. **[6]**

OR

Q2) a) Explain the following term with example. **[6]**

i) Windowing

ii) Clipping

iii) Viewport

b) Find the normalization transformation window to viewport, with window, lower left corner at (1, 1) and upper right corner at (3,5) onto a viewport, for entire normalized device screen. **[6]**

c) Explain with diagram, Perspective vanishing points as 1 point, 2 point and 3 point. **[6]**

Q3) a) Explain with diagram Gourand shading algorithm in detail. **[6]**

b) What is a segment? How do we create it? Why do we need segments? **[6]**

c) Explain CMY and HSV color models. **[5]**

OR

P.T.O.

Q4) a) What is Shading? What steps are required to shade an object using Phong shading algorithm? **[6]**

b) What are various color models? Explain with diagram RGB and HLS color model. **[6]**

c) Define color gamut. Explain with diagram CIE Chromaticity Diagram. **[5]**

Q5) a) Explain Bezier curve. List its properties. **[6]**

b) Write short notes on: **[6]**

i) Koch curve

ii) Frame-by-frame Animation techniques

c) What is fractal? Explain Hilbert curve in detail. **[6]**

OR

Q6) a) Write short notes on : **[6]**

i) B-spline curve

ii) Blending function of Bezier curve

b) What are the methods of controlling animation? **[6]**

c) Explain various types of animation languages. **[6]**

Q7) a) Explain the physical modeling in Virtual Reality. **[6]**

b) Explain haptic feedback in Virtual Reality system. **[6]**

c) Differentiate HMD and CAVE in Virtual Reality. **[5]**

OR

Q8) a) Explain the behavior modeling in Virtual Reality. **[6]**

b) What is geometric modeling in a Virtual Reality? **[6]**

c) Explain gesture interfaces in Virtual Reality. **[5]**

Total No. of Questions : 8]

SEAT No. : ____

PB3660

[6261]-68

[Total No. of Pages :4

S.E. (Artificial Intelligence and Machine Learning)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester- III) (218541)

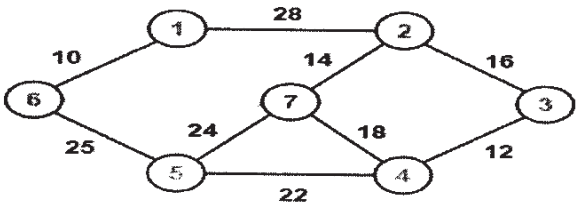
Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) What is a planar graph? Suppose that a connected planar graph has eight vertices, each of degree three. Into how many regions is the plane divided by a planar representation of this graph? **[6]**

b) Build a minimum spanning tree for the following graph using Kruskal's algorithm. **[6]**



c) Define Prefix Code. Which of the following codes are prefix codes? Justify your answer. **[6]**

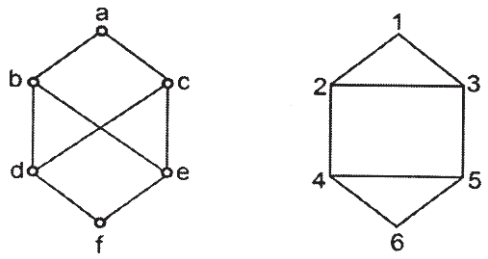
i) a:11, e:01, t:10, s:00

ii) a:0, e:1, t:10, s:00

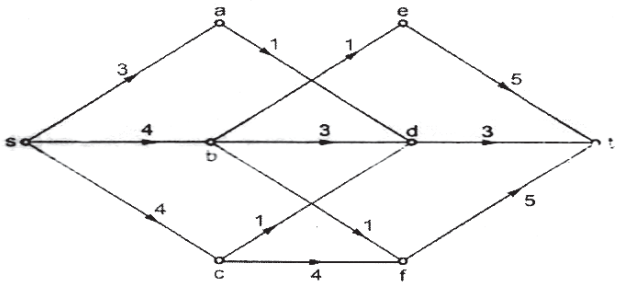
OR

P.T.O.

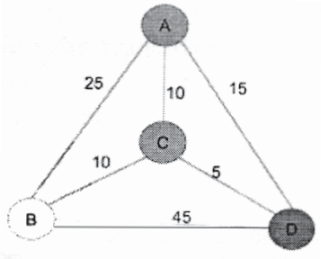
Q2) a) Determine whether the following graphs are isomorphic to each other. Justify your answer. **[6]**



b) Using the labeling procedure, find the maximum flow in the following transport network. **[6]**



c) Use the nearest Neighborhood method to solve the Traveling Salesperson problem starting with vertex A. Find the cost of the tour. **[6]**



Q3) a) Consider these relations on the set of integers: **[6]**

R1 = {(a,b) | a ≤ b},

R2 = {(a,b) | a > b}

R3 = {(a,b) | a = b}

R4 = {(a,b) | a = 1 + b}

R5 = {(a,b) | a = b or a = –b}

R6 = {(a,b) | a + b ≤ 3}

Which of these relations contain each of the pairs (1,1), (1,2), (2,1), (1,–1), and (2,2)?

b) Solve the following recurrence relation. **[6]**

$a_n = 6a_{n-1} - 9a_{n-2}$ where $a_0 = 1$ and $a_1 = 6$

c) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D, and F? **[5]**

OR

Q4) a) What is Injective function? Determine whether each of these functions is a injection from R to R. **[6]**

i) $f(x) = 2x + 1$

ii) $f(x) = x^2 + 1$

iii) $f(x) = x^3$

iv) $f(x) = (x^2 + 1)/(x^2 + 2)$

b) What is POSET? Let A is set of factors of positive integer m and relation is divisibility on A. i.e. R = $\{(x,y) \mid x,y \in A, x \text{ divides } y\}$ for m = 40. Draw Hasse Diagram. **[6]**

c) Find the transitive closure by using Warshall's algorithm for the given relation as: **[5]**

R = {(2,1),(2,3),(3,1),(3,4),(4,1),(4,3)}

Q5) a) Using Binary expansion method solve the following (Show step-wise answer) $7^{51} \bmod 15$. **[6]**

b) Which of the following is true? Justify your answer. **[6]**

i) $556 \equiv 1296 \pmod{10}$

ii) $1655 \equiv 935 \pmod{25}$

iii) $448 \equiv 784 \pmod{23}$

c) Using Chinese Remainder Theorem, find the value of P using following data **[6]**

$P \equiv 3 \pmod{7}$

$P \equiv 6 \pmod{11}$

OR

Q6) a) What is a Mersenne prime number? Which of the following is the Mersenne Prime number? 71, 31, 255, 63, 7 **[6]**

b) Find the Euler's totient function of the following numbers. **[6]**

i) 73

ii) 72

iii) 78

c) Find multiplicative inverse of 15 mod 26 using Extended Euclidean Algorithm. **[6]**

Q7) a) Consider the set A = {1,3,5,7,9, ...} i.e. a set of odd positive integers. Determine whether A is closed under: **[6]**

i) a*b = a + b

ii) a*b = a/b

iii) a*b = a.b (Multiplication)

iv) a*b = LCM (a,b)

v) a*b = 2a + b

vi) a*b = power (a,b)

b) Show that $(Z_7, +)$ is an Abelian Group. **[6]**

c) Prove that Hamming Distance d(x,y) = 0 iff $x = y$ where x and y are codewords. **[5]**

OR

Q8) a) Show that the set of all positive rational numbers forms an abelian group under the composition * defined by a * b = (ab)/2. **[6]**

b) Explain Integral Domain with an example. **[6]**

c) Consider the (2,6) encoding function e. e(00) = 1,10,000,

e(10) = 101000

e(01) = 011110, e(11) = 111001

Find the minimum distance of e. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3661

[Total No. of Pages :5

[6261]-69

S.E. (Artificial Intelligence & Machine Learning Engineering)
DATA STRUCTURES & ALGORITHMS
(2019 Pattern) (Semester-III) (218542)

Time : 2½ Hours] *[Max. Marks : 70*

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 diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Imagine we have two empty stacks of integers, S1 and S2. Draw a picture of each stack after the following operations: **[6]**

i) S1. Push (3);

ii) S1. Push (5);

iii) S1. Push (7);

iv) S1. Push (9);

v) S1. Push (11);

vi) S1. Push (13);

vii) While (! Emptystack (S1))

{

X=S1. Pop ();

X=S1. Pop ();

S2. Push (X);

}

b) Clearly indicate the content of stack during conversion of given infix expression to prefix. **[6]**

A^B*C-D+E/F/(G+H)

c) Write a pseudocodefor the following operation of simple queue using linked representation. **[6]**

i) enqueue ()

ii) dequeue ()

iii) Print_ Queue ()

OR

P.T.O.

Q2) a) If the values of A,B,C and D are 2,3,4, and 5 respectively. Calculate the value of the following prefix expression and clearly indicate the content of stack. (consider '-' as a minus sign). **[6]**

i) + - *A B C D

ii) - * A + B C D

b) Consider the following circular queue of characters of size 6. "-" denotes an empty queue location. Initial queue configuration is Front = 1,

Rear = 3 and having letters as shown below. **[6]**

i) F is added to the queue

ii) Two letters are deleted

iii) K, L, M are added to the queue

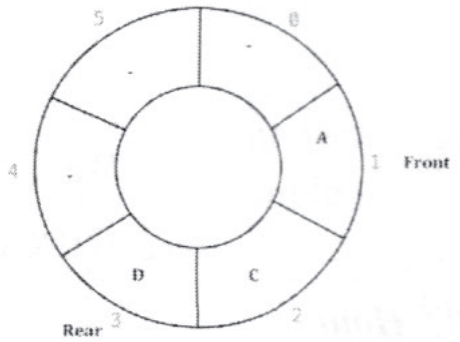
iv) Two letters are deleted

v) R is added to the queue

vi) Two letters are deleted

vii) S is added to the queue

viii) Two letters are deleted



Show the queue content of queue with Front and Rear as the above options take place.

c) What is double ended queue? Mention Types of double ended queue. Explain enqueue and dequeue operations of double ended queue. **[6]**

Q3) a) Create a binary tree from given preorder and inorder traversal. Show all intermediate steps. **[6]**

Preorder : G B Q A C K F P D E R H

Inorder : Q B K C F A G P E D H R

b) Write the algorithm for creating expression tree from postfix expression. **[6]**

c) Construct an inorder threaded binary search tree for the following set of elements.

100, 50, 200, 300, 20, 150, 70, 180, 120, 30

Show all steps. **[5]**

OR

Q4) a) Write C++ code for preorder traversal of threaded binary tree. **[6]**

b) Draw the expression tree for the given postfix expression. Clearly indicate the content of stack. Write the inorder and preorder traversal of the concern tree.

A B C * + E * F + **[6]**

c) Explain the following terms with respect to tree. **[5]**

i) Root

ii) Leaf node

iii) Siblings

iv) Degree of a node

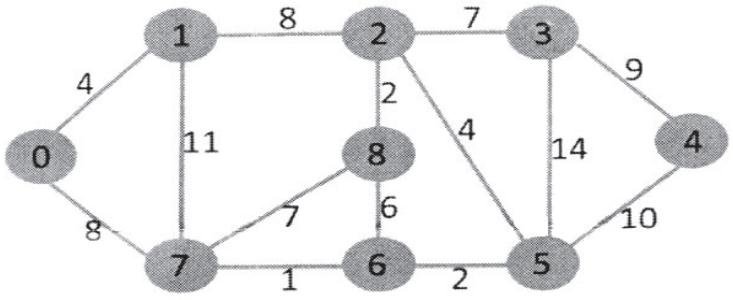
v) Degree of tree

Q5) a) Obtain an AVL tree by inserting one data element at a time in the following sequence: **[6]**

50, 55, 60, 15, 10, 40, 20, 45, 30, 70, 80.

Label the rotations appropriately at each stage

b) Find shortest path from vertex 0 to all other vertices using Dijkstra algorithm for the following graph. **[7]**



c) Write short note on OBST. **[5]**

OR

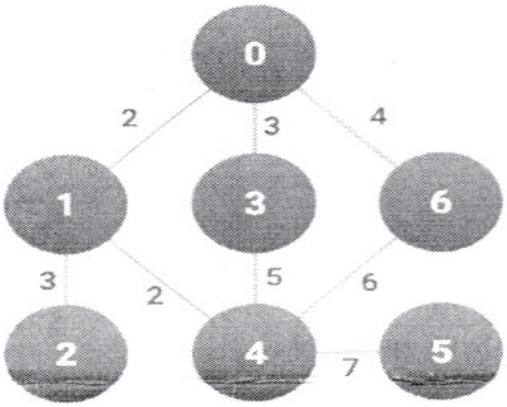
Q6) a) Construct Heap to Sort given values in ascending order using MAX heap sort. **[6]**

5, 3, 17, 10, 84, 19, 22.

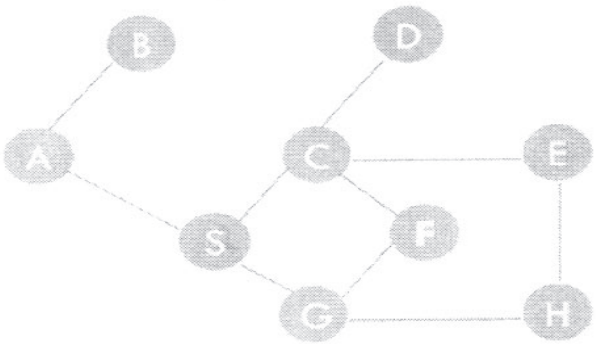
(Note : Make a use of Heapify)

b) Find MST for the below graph using Prim's algorithm. Show each step.

(Minimum Spanning Tree) **[7]**



c) Write a BFS and DFS graph traversal for the below graph. (BFS - Breadth First Search, DFS - Depth First Search) **[5]**



Q7) a) Differentiate between sequential file and direct access file. **[6]**

b) Write a pseudo code to perform the following operations on Sequential file : **[6]**

i) Insert record

ii) Delete record

c) What are the characteristics of good hash function? List different techniques to resolve collision in hash table and explain any one with suitable example. **[5]**

OR

Q8) a) Explain the Index sequential file organization with advantages and disadvantages. **[6]**

b) Explain Linear probing with and without replacement with suitable example. **[6]**

c) What is File? Differentiate between text file and binary file. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3662

[Total No. of Pages : 2

[6261]-70
S.E. (AIML)
COMPUTER NETWORKS
(2019 Pattern) (Semester - III) (218543)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of calculator is allowed.***

Q1) a) What is error correction and error detection? Describe any two error detection techniques with suitable example. **[9]**

b) What is frames in data link layer? Describe in detail the fixed size framing and variable size framing? **[9]**

OR

Q2) a) Explain CSMA/CD random access technique in detail. **[9]**

b) What is noiseless protocols? Describe the two protocols for noiseless channels? **[9]**

Q3) a) How does routing work? Describe in detail OSPF and EIGRP. **[9]**

b) Describe following network layer protocols: **[8]**

i) Address Resolution Protocol (ARP)

ii) Dynamic Host Configuration Protocol (DHCP)

OR

Q4) a) Explain following terms **[9]**

i) Distance Vector Routing

ii) Link State Routing

iii) Path vector Routing

b) Describe Network Address Translation (NAT) in detail. **[8]**

P.T.O.

Q5) a) What is socket? Describe the types of socket with example. **[9]**

b) Explain the three - way handshake algorithm for TCP connection establishment Compare and contrast between TCP and UDP. **[9]**

OR

Q6) a) Explain UDP with its header format. **[9]**

b) What do you mean by Congestion Control in transport layer? Describe the leaky bucket algorithm for congestion control? **[9]**

Q7) a) Describe Domain Name System (DNS) with suitable examples. **[9]**

b) What is MIME? Describe Multipurpose Internet Mail Extension. **[8]**

OR

Q8) a) Describe the functions of the two FTP connections. List the difference between FTP & TFTP. **[8]**

b) Write Short Note on **[9]**

i) SNMP

ii) HTTP

iii) IMAP

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. :

PB-3663

[Total No. of Pages : 3

[6261]-71

S.E. (Artificial Intelligence & Machine Learning Engineering)

OBJECT ORIENTED PROGRAMMING

(2019 Pattern) (Semester - III) (218544)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat must be drawn diagrams wherever necessary***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Consider the definition of 'complex' class as below: **[6]**

```
public class complex
{
private int real, img;
   public complex()
   {
      //constructor 1
   }
public complex(int real, int img)
   {
      //constructor 2
   }
public complex(complex c)
   {
      //constructor 3
   }
}
```

Re-write the class 'complex' as;

i) Define the constructor I so that the private member variables are initialized to 0.

ii) Define the constructor 2 so that the private member variable real and img is initialized according to the value of the parameter.

iii) Define the constructors 3, where copy one object to another.

P.T.O.

b) Enlist the characteristics of Destructor. How is Destructor declared in OOP? Demonstrate with an example. **[6]**

c) What is garbage collection in OOP? Explain finalize() method in detail.**[5]**

OR

Q2) a) With suitable code segments illustrate various uses of 'final' keyword.**[6]**

b) Write a program which demonstrate constructor overloading. **[6]**

c) What is the need of constructor? Enlist the characteristics of Constructor. **[5]**

Q3) a) Define Polymorphism? What are the types of Polymorphism? How can be run time polymorphism achieved in OOP? **[6]**

b) Define a class 'person' with instance variables name and age. Derive a class 'employee' from 'person' class with instance variable address. Create a database of the 3 employees. Use the appropriate methods to accept and display the data. **[6]**

c) Enlist the benefits and costs of Inheritances. **[6]**

OR

Q4) a) Define Inheritance. What are the types of Inheritance? How can you inherit a class in OOP? **[6]**

b) Define a class 'shape' with abstract method compute_area(). Derive the classes 'circle' and 'rectangle' from 'shape' class. Calculate the area of circle and rectangle using dynamic binding. Use appropriate instance variables and methods whenever necessary. **[6]**

c) Discuss diamond problem in detail? How it can be solved? **[6]**

Q5) a) Define Exception. What are its types? Discuss exception handling mechanism in detail. **[6]**

b) Write a generic program using ArrayList class to count the number of elements in a collection that have a specific property as prime number.**[6]**

c) Is there any difference between throw and throws in exception handling in OOP? If 'yes', justify your answer. **[5]**

OR

Q6) a) Differentiate between an array and ArrayList class. Write any four methods of ArrayList class with their syntax. **[6]**

b) Write a program which handles Arithmetic Exception. **[6]**

c) Can a single try block have multiple catch blocks? Which catch block will execute first? Discuss in detail. **[5]**

Q7) a) Explain following File operations using File class: **[8]**

1) Create a File

2) Read from a File

3) Write to a File

4) Close a File

b) How Input/Output exceptions are handled in OOP? **[5]**

c) What is a design pattern? Explain 'singleton' design pattern in detail. **[5]**

OR

Q8) a) How do you write to a file and read from a file using FileWriter and FileReader class, respectively? **[8]**

b) What are the advantages of design patterns? Explain 'adaptor' design pattern in detail. **[5]**

c) Write program to handle primitive data types in file handling. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3664

[Total No. of Pages :2

[6261]-72

S.E. (Artificial Intelligence & Machine Learning)

SOFTWARE ENGINEERING

(2019 Pattern) (Semester- III) (218545)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) Explain the process of Translating the requirements model into the design model with neat diagram. **[9]**

b) Explain Architectural views in detail. **[9]**

OR

Q2) a) What is FURPS in Quality attributes? Explain. **[9]**

b) Discuss Repository architecture style? Enumerate its drawbacks. **[9]**

Q3) a) Explain process of Project Planning. **[9]**

b) Explain four P's (PPPP) of effective software project management. **[8]**

OR

Q4) a) What do you mean by PERT/CPM? Discuss benefits & Limitations of PERT/CPM? **[9]**

b) List and explain basic principles that guide software project scheduling. **[8]**

P.T.O.

Q5) a) What are Quality dimensions? Why are important as per Garvin? **[9]**

b) Write a short note on **[9]**

i) Test plan

ii) Test case

OR

Q6) a) Explain software quality dilemma. Why does it occur and how to remove it? **[9]**

b) What is software testing? Explain seven principles in software testing. **[9]**

Q7) a) Why Risk Management is Important? Explain. **[9]**

b) Write a short note on "Software reuse". **[8]**

OR

Q8) a) Explain technical risk and business risk in detail. **[9]**

b) What is test driven development? Explain in detail. **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB3665

[Total No. of Pages : 2

[6261]-73
S.E. (Biotechnology)
BIOCHEMISTRY - II
(2019 Pattern) (Semester - IV) (215470)

Time : 2½ Hours] ***[Max. Marks : 70***

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.***

Q1) Answer the following.

a) Enlist the enzymes involved in glycolysis. **[9]**

b) Differentiate between preparatory phase and payoff phase of glycolysis. **[9]**

OR

Q2) Answer the following

a) Write in detail about non oxidative section of the pentose phosphate pathway. **[9]**

b) Differentiate between non oxidative and oxidative phase of pentose phosphate pathway. **[9]**

Q3) Write in detail about

a) What are the steps of glycogen metabolism? Describe any one in detail. **[9]**

b) Describe the role of glycogen synthase in glycogen synthesis. **[8]**

OR

Q4) Answer the following

a) Write in detail about glycogenin **[9]**

b) Describe the reaction catalyzed by branching enzyme in glycogen synthesis. **[8]**

Q5) Answer the following

a) Write in short about dialysis and polyacrylamide gel electrophoresis. **[9]**

b) Draw the urea cycle with all enzymes, coenzymes and cofactor involved in it. **[9]**

OR

P.T.O.

Q6) Answer the following

a) Write a short note on gel filtration chromatography. Draw a suitable diagram for the same. **[9]**

b) What are the causes and consequences of ammonia toxicity. **[9]**

Q7) Answer the following.

a) Explain the process of oxidation of saturated fatty acids. **[9]**

b) Differentiate between oxidation of saturated fatty acid and polyunsaturated fatty acid. **[8]**

OR

Q8) Answer the following.

a) Describe the process of digestion and absorption of lipid. **[9]**

b) Explain the process of transfer of acetyl COA to cytoplasm. **[8]**

Total No. of Questions : 8] **SEAT No. :**

PB-3666

[Total No. of Pages : 2

[6261]-74
S.Y. B. Tech. (Biotechnology)
Cell Biology & Tissue Culture
(2019 Pattern) (Semester - IV) (215471)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) What is signal transduction and how is it important? **[8]**

b) What is GPCR protein and why is it so important? **[10]**

OR

Q2) a) What is the cell cycle? What are the important phases in it? **[8]**

b) Meiosis I and Meiosis II explain in brief. **[10]**

Q3) a) What is epithelial tissue and how is it significant? **[8]**

b) What is cancer? How it progresses? **[9]**

OR

Q4) a) With a labelled diagram explain what are Hematopoietic stem cells. **[8]**

b) What are the different types of muscle tissues? Describe with labelled diagrams. **[9]**

P.T.O.

Q5) a) What are the requirements of animal cell culture? What is confluency and contact inhibition? Why is contact inhibition an important property? **[8]**

b) Enlist the applications of animal cell culture. **[10]**

OR

Q6) a) What is the difference between primary cell culture and an established cell line? What makes a cell line continuous cell line? **[9]**

b) Write notes on **[9]**

i) Advantages of Serum free media

ii) Cryopreservation

iii) Viability testing

Q7) a) Which are the typical growth hormones used in plant tissue culture? **[9]**

b) What is micropropagation? Give significance with respect to regeneration of endangered plants. **[8]**

OR

Q8) Write short notes on:

a) Elaborate on transgenic plants and their uses. **[8]**

b) Difference between pollen culture and callus culture with their advantage and disadvantage. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3667

[Total No. of Pages : 2

[6261]-75

S.E.

BIOTECHNOLOGY

Thermodynamics

(2019 Pattern) (Semester - IV) (215472)

Time : 2½ Hours] ***[Max. Marks : 70***

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) What is carnot cycle/engine? Explain the various steps involved in carnot cycle. **[6]**

b) What is second law of thermodynamics? Discuss the various statements involved in second law of thermodynamics. **[6]**

c) A domestic food freezer maintain a temperature of –20°C. The ambient air is at 40°C. If the heat leaks into the freezer at continuous rate 1.75 KJ/sec. what is the least power necessary to pump the heat out continuously. **[6]**

Given : $T_L = -20°C$

$T_H = 10°C$

$Q_s = 1.75$ KW.

OR

Q2) a) What is entropy? Describe the relationship of entropy with heat, temperature and process. **[6]**

b) Derive the expression for mathematical statement of second law of thermodynamics. **[6]**

c) Explain the working mechanism involved in refrigerator system with neat labeled diagram. **[6]**

P.T.O.

Q3) a) What is chemical potential? Write about partial molar properties of solution arid derive the expression for the partial molar property. **[9]**

b) What is fugacity and fugacity coefficient? Derive the expression of fugacity for ideal gas and mathematical definition of fugacity. **[8]**

OR

Q4) a) Derive an expression for effect of temperature and pressure on chemical potential. **[9]**

b) Discuss in detail about phase Equilibria with neat labeled graph. **[8]**

Q5) a) What is equilibrium constant? Derive the formula for equilibrium constant.**[8]**

b) What is chemical reaction equilibrium? Discuss the factors affecting chemical equilibrium. **[10]**

OR

Q6) a) Discuss the relationship between Kc (equilibrium constant in terms of concentration) and Kp (equilibrium constant in terms of partial pressure) in equilibrium constant for reversible reaction and write the importance and applications of chemical equilibrium. **[10]**

b) Write note on Duhem's theorem for reacting systems. **[8]**

Q7) a) Describe in detail about Energy transformations in biological Systems.**[8]**

b) Discuss how feasibility of chemical reactions can be explained based on change in entropy, enthalpy and Gibbs energy. **[9]**

OR

Q8) a) Write note on Thermodynamics of biochemical changes. **[8]**

b) Write about the applications of thermodynamics in biological systems.**[9]**

Total No. of Questions : 8]

SEAT No. :

PB3668

[Total No. of Pages :2

[6261]-76

S.E. (Biotechnology)

GENETICS AND MOLECULAR BIOLOGY

(2019 Pattern) (Semester- IV) (215473)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of a Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) Explain the process of DNA replication in eukaryotes divided into the following stages: **[18]**

a) Initiation

b) Elongation

c) Termination

OR

Q2) a) Give functions of the following enzymes and proteins in DNA replication **[9]**

i) DNA Ligase

ii) Helicase

iii) SSBP

b) Give reasons- DNA polymerases require a template and a primer to begin the process of DNA replication. **[9]**

Q3) What is the hypothesis of RNA world theory? State the assumptions of the theory and explain its relevance with the structure and function of RNA in the central dogma. **[17]**

OR

P.T.O.

Q4) a) "RNAs' are important in the transfer of genetic information from DNA to Protein" Explain the statement and support your answer with suitable examples. **[10]**

b) How RNA can function like enzymes? Write a note on Hammerhead Ribozyme. **[7]**

Q5) Describe the process of transcription in prokaryotes with a suitable example and neat diagrams. **[18]**

OR

Q6) Describe the process of transcription in eukaryotes with a suitable example and neat diagram. **[18]**

Q7) Write a note on the initiation of translation. Why does mRNA need a stop codon? How does that help in the termination of translation? **[17]**

OR

Q8) a) Draw a table showing genetic codes defined for 20 amino acids. Describe the property of the genetic code and its use in the expression of diverse and complex proteome expressions. **[7]**

b) Write a note on: **[10]**

i) Heat shock proteins

ii) Wobble hypothesis

Total No. of Questions : 9]

SEAT No. : ____

PB3669

[Total No. of Pages : 5

[6261]-77

S.E. (Chemical/Printing/Bio-Tech.)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - III) (207004)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q1 is compulsory.***
2) ***Solve Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data, if necessary.***

Q1) Attempt the following :

a) If $f(x)=\begin{cases}2, & |x|<1\\ 0 & |x|>1\end{cases}$, then Fourier transform F(λ) of *f*(*x*) is given by **[2]**

i) $\frac{4\cos\lambda}{\lambda^2}$ ii) $\frac{4\sin\lambda}{\lambda}$

iii) $\frac{2\sin 2\lambda}{\lambda}$ iv) $\frac{\sin\lambda}{\lambda}$

b) Standard deviation of three numbers 9, 10 and 11 is **[2]**

i) $\frac{2}{3}$ ii) $1/3$

iii) $\sqrt{\frac{2}{3}}$ iv) $\sqrt{2}$

c) If $\overline{F}=r^2\overline{r}$ then $\overline{F}$ is _____ **[2]**

i) constant ii) conservative

iii) solenoidal iv) none of these

P.T.O.

d) The general solution of PDE $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ is _____. **[2]**

i) $u(xt) = (c_1 \cos mx + c_2 \sin mx)\bar{e}^{m^2 t}$

ii) $u(x, y) = (c_1 \cos mx + c_2 \sin mx)\bar{e}^{y}$

iii) $u(x,t) = (c_1 \cos mt + c_2 \sin mt)\bar{e}^{m^2 x}$

iv) $u(xt) = (c_1 \cos mx + c_2 \sin mx)(c_3 \cos mt + c_4 \sin mt)$

e) The Fourier sine transform Fs(λ) of odd function $f(x)$ in interval $-\infty < x < \infty$ is _____. **[1]**

i) $\int_0^\infty f(u) \sin \lambda u \, du$

ii) $\int_0^\infty f(u) \cos \lambda u \, du$

iii) $\int_0^\infty f(u) \tan \lambda u \, du$

iv) $\int_0^\infty f(u) \cot \lambda u \, du$

f) The coefficent of kurtosis β_2 is given by **[1]**

i) $\frac{\mu_4}{\mu_3}$

ii) $\frac{\mu_4}{\mu_2}$

iii) $\frac{\mu_4}{\mu_2^2}$

iv) $\frac{\mu_3}{\mu_2}$

Q2) a) Find the fourier sine transform of $(x) = \begin{cases} \sin x & 0 \le x \le a \\ 0 & x > a \end{cases}$. **[5]**

b) By considering fourier cosine transform of e^{-mx} $(m > 0)$.

Prove that $\int_0^\infty \frac{\cos \lambda x}{\lambda^2 + m^2} d\lambda = \frac{\pi}{2m} e^{-mx}, m > 0, x > 0$. **[5]**

c) Solve the following integral equation $\int_0^\infty f(x) \cos \lambda x \, dx = e^{-\lambda}, e > 0$. **[5]**

OR

Q3) a) Find the Fourier cosine transform of the function $f(x)=\begin{cases}\cos x\,, 0<x<a\\ 0\quad, x>a\end{cases}$. **[5]**

b) Using Fourier integral representations show that $\int_0^\infty \frac{2\cos\lambda x}{1+\lambda^2}\,d\lambda=\begin{cases}0, x<0\\ \pi e^{-x},\ x>0\end{cases}$. **[5]**

c) Solve the following integral equations $\int_0^\infty f(x)\cos\lambda x\,dx=e^{-\lambda}, \lambda>0$. **[5]**

Q4) a) Calculate the first four moments about mean of a given distribution. Also find β_1 & β_2 **[5]**

x	2	2.5	3	3.5	4	4.5	5
f	5	38	65	92	70	40	10

b) Find coefficient of correlation from given data, In analysis, variance of x is 9 and regression lines are $8x - 10y + 66 = 0$, $40x - 18y = 214$. **[5]**

c) An unbiased coin is thrown 10 times find probability of getting **[5]**

i) exactly 6 heads

ii) At least 6 heads

OR

Q5) a) Find regression lines for following data **[5]**

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

b) One percent of articles from a certain machine are defective. What is probability of **[5]**

i) No defective

ii) One defective

c) In a normal distribution 10% of items are under 40 and 5% are over 80. Find mean and standard deviation of distribution. **[5]**

[Given : A(1.29) = 0.4, A(1.65) = 0.45]

Q6) a) Find angle between tangent to the curve **[5]**

$\bar{r} = (t^3 + 2)\bar{i} + (4t - 3)\bar{j} + (t^2 - 6)\bar{k}$ at $t = 0, t = 1$

b) Show that $\bar{F} = (y^2 \cos x + z^2)\bar{i} + (2y \sin x)\bar{j} + 2zx\bar{k}$ is irrotational. Find scalar potential function ϕ such that $\bar{F} = \Delta\phi$. **[5]**

c) If $\bar{F} = (2xy + 3z^2)\bar{i} + (x^2 + 4yz)\bar{j} + (2y^2 + 6zx)\bar{k}$ evaluate $\int_C \bar{F}.d\bar{r}$ where c is the curve $x = t$, $y = t^2$, $z = t^3$ joining (0, 0, 0) and (1, 1, 1).**[5]**

OR

Q7) a) Find the directional derivative of $\phi = x^2yz^3$ at (2, 1, –1) along the vector $i - \bar{j} + \bar{k}$. **[5]**

b) Solve any one. **[5]**

i) Prove that $\nabla \times \left[\bar{a} \times (\bar{b} \times \bar{r})\right] = \bar{a} \times \bar{b}$.

ii) Prove that $\nabla^4 (\log r) = \frac{2}{r^4}$.

c) Evaluate $\iint_S (\nabla \times \bar{F}) \cdot d\bar{s}$ where $\bar{F} = (x^3 - y^3)\bar{i} - xyz\bar{j} + y^3\bar{k}$ and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$. **[5]**

Q8) a) Solve the wave equation $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$ under the condition. **[7]**

i) $u(0, t) = 0$

ii) $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$

iii) $u(\pi, t) = 0$

iv) $u(x, 0) = x \quad 0 \le x \le \pi$

b) Solve the equation if $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ subject to conditions - **[8]**

i) $u(0, t) = 0$

ii) $u(l, t) = 0$

iii) $u(x, 0) = x \quad 0 < x < l$

OR

Q9) a) Solve the PDE $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the boundary condition **[7]**

i) $u(0, y) = 0$

ii) $u(x, 0) = 0$

iii) $u(a, y) = 0$

iv) $u(x, \text{b}) = 40$

b) Solve $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$ if **[8]**

i) $u(x, t)$ is finite

ii) $u(0, t) = 0$

iii) $u(x, t) = 0$

iv) $u(x, 0) = u_0 x \quad 0 < x < l$, u_0 is constant

Total No. of Questions : 8]

SEAT No. :

PB3670

[Total No. of Pages : 2

[6261]-78
S.E. (Biotechnology Engineering)
BIOCHEMISTRY - I
(2019 Pattern) (Semester-III) (215461)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) Answer the following. **[18]**

a) Explain how amino acids can act as acids and bases with one example.

b) Classify peptides according to number of amino acids that are joined to form the peptide chain.

OR

Q2) Answer the following. **[18]**

a) What are the various techniques to separate proteins? Explain any one.

b) What is zwitterion? Give explanation on its amphoteric nature

Q3) Answer the following. **[17]**

a) Explain the concept of base pairing and its role in DNA stability.

b) Describe the diverse functions of nucleotides in cellular processes.

OR

Q4) Answer the following. **[17]**

a) Enlist and describe the three characteristic components of nucleotides.

b) Enlist the methods used for the determination of DNA sequences and explain any one in detail.

Q5) Answer the following. **[18]**

a) Explain the nomenclature of fatty acids with suitable example.

b) Define lipids and explain the functions of lipid.

OR

P.T.O.

Q6) Answer the following. **[18]**

a) Complete the following table.

Carbon skeleton	*Structure*	*Systematic name*	*Common name*
12:0	CH3(CH2)10COOH	*n*-Dodecanoic acid	------
------	CH3(CH2)12COOH	------	Myristic acid
------	CH3(CH2)16COOH	*n*-Octadecanoic acid	------

b) What is adsorption chromatography? How it is useful in separation of lipids.

Q7) Answer the following. **[17]**

a) What are the clinical manifestations of Calcium deficiency.

b) Discuss the neurological symptoms associated with magnesium deficiency and its impact on health.

OR

Q8) Answer the following. **[17]**

a) Discuss the clinical manifestations of vitamin C deficiency (scurvy) and preventive measures.

b) State the function and deficiency of vitamin K.

Total No. of Questions : 8]

SEAT No. :

PB3671

[Total No. of Pages : 2

[6261]-79
S.E.
BIOTECHNOLOGY
Fluid Flow & Unit Operations
(2019 Pattern) (Semester - III) (215462)

Time : 2½ Hours] *[Max. Marks : 70*

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 gravity sedimentation process and Write about sorting classifiers that uses sink and float method and differential settling method. **[6]**

b) Explain about Drag & Lift Force and Free & Hindered settling. **[6]**

c) Illustrate the design and operation of cyclones and hydrocyclones included in centrifugal settling. **[6]**

OR

Q2) a) Describe the statement of Stoke's Law and derive the expression for the same. **[6]**

b) Explain about Centrifugal settling including its advantages and disadvantages. **[6]**

c) Determine the rate at which an air bubble of 0.5 mm diameter will rise of in liquid having density 1400 kg/m^3 and dynamic viscosity 0.5 kg/ms. Assume that the rise of the bubble is within Stoke's range. Neglect density of air and justify the assumption of Stoke's range. **[6]**

Q3) a) Describe the phenomenon of Computational Fluid Dynamics (CFD) with examples. **[9]**

b) Write in detail about Kozeny Carmen equation for Laminar flow. **[8]**

OR

Q4) a) Explain the design and operational procedure involved in packed bed reactors with neat sketch. **[9]**

b) What is filtration? Derive the Darcy equation for flow of fluid through uniform constant filter bed. **[8]**

P.T.O.

Q5) a) Illustrates the design, operation and types of centrifugal Pumps with its characteristics. **[8]**

b) Write about NPSH (Net Positive Suction Head) in pumping systems. **[10]**

OR

Q6) a) What is the function of impellers in mixed systems? Describe the various types of impellers with neat labeled diagram. **[10]**

b) What is mixing? Explain different types of mixing units with neat labeled diagram . **[8]**

Q7) a) Explain the differences of the following. **[8]**

i) Open circuit grinding and Closed circuit grinding.

ii) Ideal screen and Actual screen.

b) Calculate the operating speed of a ball mill from the following data. **[9]**

Diameter of the ball mill = 800 mm

Diameter of ball = 60 mm

If i) Operating speed is 55% less than critical speed

ii) Critical speed is 40% more than operating speed.

OR

Q8) a) Explain the design, principle and working mechanism involved in Ball Mill with neat labeled diagram. **[8]**

b) Describe the working, construction specifications involved and uses of Jaw crusher and Gyratory crusher with neat sketch. **[9]**

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. : ____

PB-3672

[Total No. of Pages : 2

[6261]-80
S.Y. B.Tech. (Biotechnology)
HEAT TRANSFER
(2019 Pattern) (Semester - III) (215463)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data if necessary***

Q1) a) What is Newton's law of cooling? Where it can be used? **[9]**

b) What are types of condensation? Which one is desirable? **[9]**

OR

Q2) a) By using Rayleigh's method, which numbers are involved in forced convection give their significance. **[9]**

b) Write a short note on: Pool boiling curve **[9]**

Q3) a) Define reflectivity, absorptivity and transmitivity. In which type of surfaces these can be found? **[9]**

b) What is emissivity? State Stefan Boltzmann law and explain how is it utilized to calculate emissivity of grey body? **[8]**

OR

Q4) a) What is Reynold's anlogy and j-factor analogy? Give importance of these transfer analogies and their application. **[8]**

b) Explain in detail wein's law and derive an expression λ_{max} T=0.0029mk **[9]**

P.T.O.

Q5) a) Write a short note on fouling factor and give expression for unclean surfaces. **[9]**

b) Draw a neat sketch and write a short note on Plate and Frame type heat exchanger. **[9]**

OR

Q6) a) Alcohol flowing in inner pipe of double pipe exchanger is cooled with water flowing in the jacket. ID of inner pipe is 25 mm and 2 mm thick. The thermal conductivity of steel is 45 W/ m K. Film coefficient of alcohol is 1200 W/m^2K and that of water is 1800 W/m^2K. The inside and outside fouling factors are 5000 W/m^2K and 3000 W/m^2K respectively. Calculate the overall heat transfer coefficient depending on inside as well as outside area of tube. **[9]**

b) What is the overall heat transfer co-efficient? Give expression for rate of heat transfer? Why is it necessary to consider overall heat transfer co-efficient in case of heat exchangers? **[9]**

Q7) a) Give comparison between single effect evaporator and multiple effect evaporators. **[8]**

b) Write a short note on boiling point Elevation. **[9]**

OR

Q8) a) Draw and explain falling film evaporator? State their applications. **[9]**

b) What is Duhrings plot? Give significance of it. **[8]**

Total No. of Questions : 8]

SEAT No. :

PB3673

[Total No. of Pages :2

[6261]-81

S.E. (Biotechnology)

MICROBIOLOGY

(2019 Pattern) (Semester- III) (215464)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Figures to the right indicate full marks.***
3) ***Assume suitable data if necessary.***

Q1) a) Draw bacterial growth curve. What are the factors affecting lag phase? **[9]**

b) Differentiate between batch and continuous culture. **[9]**

OR

Q2) a) Define **[9]**

i) Generation time

ii) Specific growth rate

iii) Binary fission

b) Tabulate different bacterial enumeration methods with examples. **[9]**

Q3) a) Illustrate physical methods for control of microorganisms with its applications. **[9]**

b) Define **[8]**

i) MIC

ii) Disinfectants

iii) Sterilization

iv) Pasteurization

OR

P.T.O.

Q4) a) Give the mode of action of following chemical agents used for control of microorganisms: **[9]**

i) 70% Alcohol

ii) Quaternary ammonium compounds

iii) Phenolic compounds

b) Classify different methods of control of microorganisms with examples. **[8]**

Q5) a) Write short note on: **[8]**

i) Antagonism

ii) Commensalism

b) Summarize microbial interactions in environment with examples. **[10]**

OR

Q6) a) Give an overview on food microbiology. **[10]**

b) Write short note on **[8]**

i) Soil microbiology and

ii) Parasitism

Q7) a) Explain Rabies with respect to Symptoms, treatment, causes, and prevention. **[8]**

b) Write preventive measures for **[9]**

i) Candidiasis

ii) HIV and

iii) Cholera

OR

Q8) a) Describe Tuberculosis with its etiological agent, symptoms, treatments and preventive measures. **[8]**

b) Define **[9]**

i) Pandemic and

ii) Epidemic

iii) Endemic

Total No. of Questions : 8] **SEAT No. :**

PB3674 **[Total No. of Pages : 2**

[6261]-82
S.E. (Chemical Engineering)
INDUSTRIAL CHEMISTRY - II
(2019 Pattern) (Semester - IV) (209347)

Time : 2½ Hours] ***[Max. Marks : 70***

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.***

Q1) a) Demonstrate different types of volumetric analysis with examples. **[6]**

b) Explain theory of indicators and also explain a difference of 2 pH is required for colour change. **[6]**

c) 50 ml of 0.50M, barium hydroxide are required to fully titrate a 100 ml solution of sulfuric acid. What is the initial concentration of the acid? **[6]**

OR

Q2) a) What is precipitation titration? Explain it using Fajans method. **[6]**

b) What is complexometric titration? Explain direct titration with disodium EDTA. **[6]**

c) 30 ml of 0.1N HC1 is added from burette into 20 ml of 0.11 N $NaHCO_3$ solutions in flask. Calculate pH of the titration mixture. **[6]**

Q3) a) What is adsorption isotherm? Deduce the Langmuir adsorption isotherm equation. **[6]**

b) Explain mechanism of catalysis reaction involving adsorption phenomenon. **[6]**

c) 3g of activated charcoal was added to 50 ml of acetic acid solution (0.06 M) in a flask. After an hour it was filtered and the strength of filtrate was found to be 0.042 M. What amount of acetic acid adsorbed per gram of charcoal. **[5]**

OR

Q4) a) What are the assumptions of BET theory of adsorption? Give equation of BET adsorption isotherm and explain the meaning of terms in it. **[6]**

b) Give mechanism of metal co-ordination catalysed reactions of Wacker process. **[6]**

c) Explain photolysis of water molecules using coordination catalysis. **[5]**

P.T.O.

Q5) a) Give various types of conformation in propane with the help of P.E. diagram. **[6]**

b) Give optical activity of compound containing two chiral centres. **[6]**

c) Discuss the geometrical isomerism of the following compounds **[6]**

i) $CH_3CH = CHCH_3$

ii) CHCl = CHCl

OR

Q6) a) Explain various types of conformation in cyclohexane with their order of stability. **[6]**

b) Explain various types of conformation in ethane with the help of PE diagram. **[6]**

c) Explain the terms enantiomers and diastereomers giving examples. **[6]**

Q7) a) What are heat capacities at constant volume and constant pressure? What is the relationship between them? **[6]**

b) Explain the different conditions for spontaneity by using Gibbs free energy. **[6]**

c) Calculate work done when 2 moles of an ideal gas expand reversibly and isothermally from a volume of 0.5 L to a volume of 2 L at 298°K and normal pressure. **[5]**

OR

Q8) a) State and explain Kirchhoff's law and give its applications. **[6]**

b) Derive the relation between heat of reaction at constant pressure and at constant volume mentioned the three case of it. **[6]**

c) Calculate the heat of combustion of ethylene (gas) to from CO_2 (gas) and H_2O (gas) at 298K and 1 atmospheric pressure. The heats of formation of CO_2, H_2O and C_2H_4 are –393.7, –241.8, + 52.3 kJ per mole respectively. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB-3675

[Total No. of Pages : 3

[6261]-83
S.E. (Chemical)
Heat Transfer
(2019 Pattern) (Semester - IV) (209348)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) Define: **[8]**

i) Emissivity
ii) Irradiation
iii) Radiosity
iv) Kirchoff's Law
v) Wein's Displacement Law
vi) Emissive power
vii) Monochromatic emissivity
viii) Absorptivity

b) A thermos flask with evacuated space to reduce the heat losses having surfaces facing each other of emissivity 0.02. If contents of the flask are at 380 K & the ambient temperature is 298 K. Compute the heat loss from the flask? If same effect is to be achieved by using insulating material of conductivity 0.04 w/m K. What would be the thickness required? **[10]**

OR

Q2) a) What are the different laws of Radiation? Explain Stefan Boltzmann's law **[10]**

b) Two very large parallel planes with emissivities 0.8 and 0.7 exchange the heat. Estimate the percent reduction in heat transfer when a polished aluminium radiation shield with emissivity 0.03 is placed between them. **[8]**

P.T.O.

Q3) a) Draw and describe Pool Boiling Curve in details **[10]**

b) Define Condensation.? Compare between filmwise and dropwise condensation. **[7]**

OR

Q4) a) Define the terms in boiling phenomena **[7]**

i) Saturated Pool Boiling

ii) Subcooled boiling

iii) Peak heat flux

b) Vertical plate of 30 × 30 cm is exposed to steam at atmospheric pressure. The plate is at 371K. Calculate the mean heat transfer coefficient rate of heat transfer and mass of steam condensed per hour.

Data: Properties of condensate at mean film temperature are

Density = 960 kg/m^3 Dynamic Viscosity = 2.82 × 10^{-4} N s /m^2,

Thermal conductivity = 0..68 W/m.K, Latent heat of condensation = 2255kJ/.kg. Saturation temperature of steam = 373K. **[10]**

Q5) a) What is heat exchanger? Explain detail classification of Heat Exchanger? **[10]**

b) It is required to cool 250 kg/hr of hot liquid with inlet temperature of 393°K using parallel flow arrangement 1000 kg/hr of cooling water is available for cooling purpose at a temperature of 283°K. Taking overall heat transfer coefficient of 1160 W/m^2K and heat transfer surface area of 0.25 m^2, calculate the outlet temperature of liquid and water and the effectiveness of heat exchanger. **[8]**

OR

Q6) a) Draw neat sketch of double pipe heat exchanger **[10]**

b) Water enters a counter flow double pipe heat exchanger at 288K flowing at a rate of 1300kg/hr. It is heated by oil flowing at rate of 550kg/hr from an inlet temperature of 367K. Determine the total heat transfer and outlet temperature of oil and water for 1m^2 area of heat transfer.

Data: Specific heats of oil and water are 2000J/kg.K and 4187 J/kg.K Overall Heat transfer coefficient is 1075 W/m^2K **[8]**

Q7) a) What is evaporation? Define Boiling point elevation and explain Duhring's rule in evaporation. **[7]**

b) Define Steam Economy and Capacity of Evaporator **[3]**

c) An aqueous sodium chloride solution (10 wt %) is fed into a single effect evaporator at a rate of 10000 Kg/hr. It is concentrated to a 20 wt% sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 Kg/hr. Calculate Capacity (Kg/hr) & Economy of the evaporator.**[7]**

OR

Q8) a) Explain the different factors affecting the evaporation operation. **[7]**

b) A single effect evaporator is fed to concentrate 5000 kg/hr of solution at 303K containing 1% solute to 2% by weight. Steam is fed to the evaporator at pressure corresponding to the saturation temperature of 383 K. The evaporator is operating at atmospheric pressure. Calculate steam economy.
Data: Enthalpy of feed: 125.79 kJ/kg

Enthalpy of vapor at atm. pressure: 2676.1 kJ/kg

Enthalpy of saturated steam at 383K : 2691.5 kJ/kg

Enthalpy of product: 419.04 kJ/kg

Enthalpy of saturated water at 383K: 461.3 kJ/kg

Latent heat of condensing steam: 2230.2 kJ/kg **[10]**

Total No. of Questions : 8]

SEAT No. : ____

PB3676

[Total No. of Pages : 4

[6261]-84

S.E. (Chemical Engineering)

PRINCIPLES OF DESIGN

(2019 Pattern) (Semester - IV) (209349)

Time : 2½ Hours] ***[Max. Marks : 70***

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.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat figures wherever necessary.***
4) ***Use of scientific calculators is allowed.***
5) ***Assume suitable data wherever necessary.***

Q1) a) Derive the equation to determine the diameter of shaft for the following two conditions: **[8]**

i) Shaft subject to twisting moment only.

ii) Shaft subject to bending moment only.

b) Find the diameter of a solid steel shaft to transmit 20KW at 200 RPM. The ultimate shear stress may be taken as 360MPa and FOS as 08. If the hollow shaft is to be used in place of solid shaft, find the ID & OD, when the ratio of ID to OD is 0.5. **[10]**

OR

Q2) a) Prove that the length of key, by considering the crushing strength of key,**[6]**

$$L = \frac{\pi}{4} * \frac{f_{ss}}{f_{ck}} * \frac{d_s^2}{t}$$

Were,

L - Length of key,

f_{ss} - Permissible shear stress for saft material,

f_{ck} - Permissible crushing stress for key material,

d_s - Diameter of saft.

t - Thickness of key.

b) Design the rectangular key for a shaft of 5 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. **[12]**

P.T.O.

Q3) a) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm & 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing. Find the minimum force per pitch which will rupture the joint.
If the above joint is subjected to a load such that FOS is 4, find out the actual stresses developed in the plates and the rivets. **[10]**

b) Define welding. Classify welding joints. What are advantages of welded joints over riveted joints & how will you define strength of butt weld joint subjected to tensive force. **[7]**

OR

Q4) a) Prove that the ratio of driving tensions for flat belt derive along with proper sketch. **[7]**

$$\frac{T_2}{T_1} = e^{\mu.\theta}$$

Were,

T_2 : is tension in tight side.

T_1 : is tension in slack side.

θ : is angle of contact between belt and pulley.

μ : is the coefficient of friction between belt and pulley.

b) Two pulleys, one 450 mm diameter and other 200 mm diameter, on parallel shaft 1.95 m apart are connected by a crossed belt. Find the length of belt required and angle of contact between the belt and each pully.
What power can be transmitted by the belt when the larger pully rotates at 200 RPM, if maximum permissible tension in the belt is 1kN, and the coefficient of friction between belt and pully is 0.25?
Also draw the sketch. **[10]**

Q5) a) Write the short note on optimum proportions of a vessel. **[6]**

b) A pressure vessel having outer diameter 1.3 m and height 3.8 m is subjected to an internal pressure of 12 Kg/cm^2. If vessel is fabricated as class B vessel, joint efficiency is 85%, if the vessel is fabricated as class C vessel, with welded joint efficiency is 70% and 50% and if the vessel is provided with a strip all along the longitudinal joint, joint efficiency is 100%. Calculate the vessel thickness under these different conditions and find out how much is the % material saving by welding a strip along the longitudinal joint.

Allowable stress for the material is 1000 Kg/cm^2.

Corrosion allowance is 1 mm. **[12]**

OR

Q6) a) Calculate the thickness of a torispherical heads (100-6) and (80-10) elliptical head (2:1) for a pressure vessel having 1.0 m diameter and having design pressure of 3.5 kg/cm^2. Welded joint is fully tested so welded joint can be considered as 100%. The permissible stress for the material of contraction is 1250 kg/cm^2. **[12]**

b) Enlist the various types of heads used for pressure vessel along with proper sketch. Also write the equation to determine the thickness of each head with meaning of each notation. **[6]**

Q7) a) Proof that, for cylindrical pressure vessel with flat head at the top and at the bottom, **[7]**

$$L = D\left[1 + \frac{3DP}{4CfJ}\right]$$

$$V = \frac{\pi}{4}D^2L = \frac{\pi}{4}D^3\left[1 + \frac{3DP}{4CfJ}\right]$$

Were,

L - Optimum length of pressure vessel.

V - Optimum volume of pressure vessel.

C - Corrosion allowance.

P - Pressure in the pressure vessel.

f - Allowable stress of material

J - Welded joint efficiency.

D - Diameter of pressure vessel.

b) A pressure vessel is required to have a capacity of 20 m^3. The vessel has an operating pressure of 6 kg/cm^2. The material used for fabrication have an allowable stress of 1090 kg/cm^2 . Welded Joint efficiency is 85%. The corrosion allowance is 2mm. Estimate the optimum diameter and optimum length of pressure vessel. **[10]**

OR

Q8) a) A Pressure vessel is required to process 19 m^3 non-hazardous slurry at 17.7 kg/cm^2, maximum operating temperature are 5°C and 175°C. The cylindrical shell of the vessel is closed at both end by 2.1 elliptical head with 5 cm straight flange portion, the maximum ratio of liquid height to vessel diameter is 1.9. The vessel is fabricated from SS 316 having permissible stress 1140 kg/cm^2. The welded joint efficiency is 85%. No corrosion allowance is necessary. **[12]**

Maximum diameter of the vessel can be 2.4 m.

Calculate

i) The height of the vessel.

ii) Minimum thickness of shell and elliptical head.

b) Define Pressure vessel and give some industrial examples where these are used commonly. **[5]**

x x x

Total No. of Questions : 8]

SEAT No. : ____

PB3677

[Total No. of Pages :2

[6261]-85

S.E. (Chemical Engineering)

CHEMICAL TECHNOLOGY-I

(2019 Pattern) (Semester- IV) (209350)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of cell phone/Mobile phone is prohibited in the examination hall.***

Q1) a) List raw materials used throughout the world to manufacture ammonia and nitrogeneous fertilizers produced from ammonia. **[6]**

b) Explain in brief uses of Ammonium nitrate. **[4]**

c) Draw Process Flow Diagram (PFD) of stamicarbon urea stripping process. **[8]**

OR

Q2) a) Explain in brief uses and economics of Nitric Acid. **[5]**

b) Explain in brief stengel process for manufacture of Ammonium Nitrate. Draw its Process Flow Diagram. **[8]**

c) Draw a neat Process Flow Diagram (PFD) for manufacturing of urea from ammonium carbamate. **[5]**

Q3) a) Explain in brief surfactants. **[5]**

b) Draw a simplified continuous flow chart for the production of heavy-duty detergent granules. **[7]**

c) Describe in brief classification of soaps & detergents. **[5]**

OR

Q4) a) Draw and explain Process Flow Diagram (PFD) of a continuous process for the manufacturing of fatty acids and soap. **[8]**

b) Explain in brief reactions involved in manufacturing of detergent by sodium reduction of coconut oil. **[5]**

c) Explain in brief unit operations & unit processes involved in batch saponification. **[4]**

P.T.O.

Q5) a) Explain in brief copolymerization. **[5]**

b) State physical properties of plastic. **[4]**

c) Draw and explain Process Flow Diagram (PFD) for manufacturing of PVC. **[9]**

OR

Q6) a) Describe in brief Ethenic Polymer processes. **[8]**

b) Draw and explain Polymerization process for manufacturing of vinyl polymer with a simplified flow chart. **[7]**

c) State uses of Phenol-Formaldehyde. **[3]**

Q7) a) Explain in brief Drilling procedure for removal of crude oil. **[3]**

b) Describe in brief unit operations and unit processes any two of each involved in refining of crude oil. **[8]**

c) Draw a neat diagram of moving bed type catalytic cracking process. Explain Isomerization in the process. **[6]**

OR

Q8) a) Explain in brief classification of rubbers. **[5]**

b) Draw a simplified flow chart for manufacturing of polyvinyl resin. **[8]**

c) State uses of styrene butadiene rubber. **[4]**

Total No. of Questions : 8]

SEAT No. : ____

PB3678

[Total No. of Pages :2

[6261]-86

S.E. (Chemical Engineering)

MECHANICAL OPERATIONS

(2019 Pattern) (Semester- IV) (209351)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) Draw a neat sketch of Pressure drop and bed height vs. superficial velocity for a bed of solids and explain in detail conditions of fluidization. **[18]**

OR

Q2) a) Explain with a neat sketch: **[12]**

i) Cyclone separator

ii) Scrubber

b) Explain with a neat sketch any one type of electrostatic separator. **[6]**

Q3) a) What are turbines? Explain with a neat sketch different types of turbines. **[8]**

b) Write notes on: **[9]**

i) Internal screw mixer

ii) Pony Mixer

iii) Flow pattern with off centre propeller

OR

Q4) Explain and derive the necessary equations for **[17]**

a) Mixing Index

b) Power number

P.T.O.

Q5) Explain with a neat sketch Principle, construction and working of Plate and Frame Filter Press. **[18]**

OR

Q6) a) State the various factors on which rate of filtration depends. **[9]**

b) Explain with a neat sketch Basket type centrifugal filter. **[9]**

Q7) a) What are chain and flight conveyors? Explain any two types of chain conveyors. **[9]**

b) Explain with a neat sketch following parts of belt conveyors **[8]**

Belts

Belt idlers

Belt arrangements

OR

Q8) a) Explain with neat sketch pneumatic type of conveyors. **[8]**

b) Write an explanatory note on bucket elevator. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3679

[Total No. of Pages : 2

[6261]-87
S.E. (Chemical Engineering)
INDUSTRIAL CHEMISTRY - I
(2019 Pattern) (Semester - III) (209341)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain the principles of High-Performance Liquid Chromatography (HPLC) and describe the key components of an HPLC system. **[6]**

b) Explain the principles underlying Gas Chromatography (GC) and describe the essential components of a gas chromatography. **[6]**

c) Discuss the procedure involved in Thin Layer Chromatography (TLC) and its applications. **[6]**

OR

Q2) a) Describe the principles of UV-Visible spectroscopy and explain the Lambert-Beer law. **[6]**

b) Discuss the basic principles and instrumentation of Infrared (IR) spectroscopy. **[6]**

c) Describe the principle of Flame photometry and its instrumentation. **[6]**

Q3) a) Explain Raoult's Law in the context of ideal solutions and describe possible deviations observed in case of Raoult's Law. **[6]**

b) Derive the equation for the lowering of vapor pressure using Raoults Law. **[6]**

c) An aqueous solution of glucose has osmotic pressure of 2.72 atm at a temperature of 289 K. How many moles of glucose were dissolved per litre of solution? Given: **[5]**

$R = 0.082l$ litre atm. $Degree^{-1}$ $mole^{-1}$

OR

P.T.O.

Q4) a) Define the term "elevation of boiling point". How does the presence of a non-volatile solute affect the boiling point of a solvent? **[6]**

b) What is the Vant Hoff factor, and how does it relate to the dissociation or association of solute particles in a solution? **[6]**

c) Kf for benzene is 5.1 K/mole and its freezing point is 278.66 Kelvin. Its freezing point lowers by 2.3 ºC when 0.4gm of solute is dissolved in 9.3 gm Benzene. Calculate molar mass of solute. **[5]**

Q5) a) Explain the mechanism of SN^1 substitution at a saturated carbon. **[6]**

b) Describe the Friedel-Craft acylation reactions. **[6]**

c) Explain the Saytzeff and Hoffman products in elimination reactions. **[6]**

OR

Q6) a) Explain why Alkyl group is activating and Ortho and Para directing? **[6]**

b) Discuss the mechanism of Claisen rearrangement. **[6]**

c) Discuss the mechanism of Favorskii rearrangement. **[6]**

Q7) a) Describe any two methods for the preparation of Furan. **[6]**

b) Discuss the aromaticity of pyrrole and its structure. **[6]**

c) Give the synthesis of Crystal violet dye. **[5]**

OR

Q8) a) Describe the classification of dyes on the basis of application. **[6]**

b) Explain how the chromophore-auxochrome theory is used to predict the color of dyes. **[6]**

c) Give the synthesis of Phenolphthalein dye. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3680

[Total No. of Pages : 3

[6261]-88
S.E. (Chemical)
FLUID MECHANICS
(2019 Pattern) (Semester - III) (209342)

Time : 2½ Hours] ***[Max. Marks : 70***

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 diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data, if necessary.***
5) ***Use of calculator is allowed.***

Q1) a) What is Euler's equation of motion.' How will you obtain Bernoulli's equation from it? **[6]**

b) What is Venturimeter? Derive an expression for the discharge through a Venturimeter. **[6]**

c) The water is flowing through a tapper pipe of length l00 m having diameters 600mm at the upper end and 300mm at the lower end, at the rate of 50 liters/see. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62N/cm^2. **[6]**

OR

Q2) a) Derive the expression for continuity equation in three dimensional flow in Cartesian coordinates? **[6]**

b) What is Orifice meter? Derive an expression for the discharge through a Orifice meter. **[6]**

c) The following cases represents the two velocity components, determine the third component of velocity such that they satisfy the continuity equation: **[6]**

i) $u = x^2 + y^2 + z^2 : v = xy^2 – yz^2 + xy$

ii) $v = 2y^2, w = 2xy$

P.T.O.

Q3) a) Derive the relation between the maximum and average velocities along with their position in the cross section of, circular horizontal pipe. **[10]**

b) A laminar flow is taking place in a pipe of diameter of 200mm.The maximum velocity is 1 .5 m/s. find the mean velocity and the radius at which this occurs.Also calculate the velocity at 4 cm from the wall of the pipe. **[8]**

OR

Q4) a) Derive an expression for the loss of head due to friction in pipes. **[6]**

b) Derive an expression for loss of head due to sudden enlargement. **[6]**

c) Calculate the discharge through a pipe of diameter 200mm when the difference of pressure head between the two ends of pipe 500m apart is 4m of water. Take the value of f'= 0.009. **[6]**

Q5) a) What do you mean by separation of boundary layer? What is the effect of pressure gradient on boundary layer separation? **[5]**

b) State Buckingham's π-theorem Why this theorem is considered superior over the Rayleigh's method for dimensional analysis? **[6]**

c) The efficiency 'η'of a fan depends on the density 'ρ' the dynamic viscosity 'μ' of the fluid the angular velocity 'ω', diameter 'D' of the rotor and the discharge 'Q' Express 'η' in terms of dimensionless parameter. **[6]**

OR

Q6) a) What do you mean by repeating variables? How are the repeating variables selected for dimensional analysis? **[5]**

b) Define displacement thickness. Derive an expression for displacement thickness. **[6]**

c) The pressure difference 'Δp' in a pipa of diameter 'D' and length 'L' due to viscous flow depends on the velocity 'V', viscosity 'μ' and density 'ρ' Using Buckingham' s π-theorem obtain an expression for ΔP. **[6]**

Q7) a) Define the terms: suction head, delivery head, static head and monomeric head **[5]**

b) Explain fluidization with its type and application? **[6]**

c) Explain value and its type with application? **[6]**

OR

Q8) a) Why do different control valves have different characteristics? **[5]**

b) Differentiate between particulate fluidization and aggregative fluidization. **[6]**

c) Explain operating characteristic of centrifugal pump? **[6]**

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. :

PB-3681

[Total No. of Pages : 2

[6261]-89
S.E. (Chemical)
ENGINEERING MATERIALS
(2019 Pattern) (Semester - III) (209343)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
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) Define Polymerization and Explain addition and condensation polymerization. **[8]**

b) Draw Iron-Iron carbide equilibrium diagram with reaction. **[8]**

OR

Q2) a) Explain various phases observed in Iron -Iron carbide equilibrium diagram. **[8]**

b) Write down the difference between Natural and Synthetic rubbers. **[8]**

Q3) a) Define corrosion and explain in detail how to calculate rate of corrosion. **[9]**

b) Write a short note on Dry corrosion and Wet corrosion. **[9]**

OR

Q4) a) Give the methods for prevention of corrosion. **[9]**

b) Write a short note on Organic Protective Coatings. **[9]**

P.T.O.

Q5) a) What is Nanotechnology? Explain the application of Nanomaterials. **[9]**

b) Explain in details classification of Nanomaterials. **[9]**

OR

Q6) a) Explain in details procedure for synthesis of silver Nano-particles. **[9]**

b) Explain in details about Fullerenes and Bucky Balls. **[9]**

Q7) a) Explain principle and working of Scanning Electron microscopy (SEM). **[9]**

b) Write a short note on Scanning tunneling microscopy (STM). **[9]**

OR

Q8) a) Write a short note on X-ray diffraction. **[9]**

b) Write Principle, construction and working of Electron Microscope. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3682

[Total No. of Pages :4

[6261]-90

S.E. (Chemical)

PROCESS CALCULATIONS

(2019 Pattern) (Semester- III) (209344)

Time : 2½ Hours] ***[Max. Marks : 70***

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 diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Formaldehyde is produced from methanol in a catalytic reactor. The production rate of formaldehyde is 1000 kg/hr. If the conversion of methanol is 65%, calculate the required feed rate of methanol. **[4]**

b) A feed containing 60 mole % A, 30 mole% B and 10 mole% inerts enters a reactor. 80 % of the original A reacts according to the following reaction:

$2A + B \rightarrow C$

Find the composition of the products stream on mole basis. **[6]**

c) Orthoxylene of oxidation gives phthalic anhydride. The reaction taking place is: $C_8H_{10} + 3O_2 \rightarrow C_8H_4O_3 + 3H_2O$.

20% excess air is used. The conversion is 50% and the yield of phthalic anhydride is 90% Calculate the requirement of orthoxylene and air for 100 kmol of phthalic anhydride production. **[8]**

OR

Q2) a) 50 kg naphthalene and 200 kg of sulphuric acid of 98% strength are charged to a pilot plant reactor. The reaction was carried at 433 K for 3 hours, and all the naphthalene was reacted. The product distribution was found to be 18.6% monosulphonate naphthalene (MSN) and 81.4% disulphonate (DSN). **[14]**

Calculate:

i) The quantities of MSN and DSN produced.

ii) The complete analysis of the product mixture.

P.T.O.

b) The carbon monoxide is reacted with hydrogen to produce methanol. Calculate from the reaction: **[4]**

i) The stoichiometric ratio of H_2 to CO.

ii) Kilomol of CH3OH produced per kilomol CO reacted.

iii) The weight ratio of CO to H_2 if both are fed to reactor in stoichiometric proportion.

iv) The quantity of CO required to produce 1000 kg of CH_3OH.

Q3) a) Fuel gases leaving the boiler stack at 523 K have the following composition:

CO_2 = 11.31%, H_2O = 13.04%, O_2 = 2.17% and N_2 = 73.48%

Calculate the heat lost in 1 kmol of gas mixture above 298 K using the heat capacity data given below : $C_p^0 = a + bT + cT^2 + dT^3$, kj/kmol.K **[8]**

Gas	a	b x 10^3	c x 10^6	d x 10^9
CO_2	21.6355	64.2841	– 41.0506	9.7999
H_2O	32.4921	0.0796	13.2107	– 4.5474
O_2	26.0257	11.7551	– 2.3426	– 0.5623
N_2	29.5909	– 5.141	13.1829	– 4.968

b) Obtain an emprirical equation for calculating the heat of reaction at any temperature T (in K) for the following reaction : **[10]**

$CO\ (g) + 2H_2\ (g) \rightarrow CH_3OH\ (g)$

Data : $\Delta H_R^0 = -90.41$ kJ/mol

$C_p^0 = a + bT + cT^2 + dT^3$, kj/kmol.K

Component	a	b x 10^3	c x 10^6	d x 10^9
CO (g)	29.0277	– 2.8165	11.6437	– 4.7063
H_2 (g)	28.6105	1.0194	– 0.1476	0.769
CH_3OH (g)	21.137	70.843	25.86	– 28.497

OR

Q4) a) Calculate the standard heat of formation of chloroform gas from its elements using Hess's law. **[8]**

Data:

$C(s) + O_2(g) \rightarrow CO_2(g) \quad \Delta H_1 = -393.51$ kj/mol

$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l) \quad \Delta H_2 = -285.83$ kj/mol

$\frac{1}{2} H_2(g) + \frac{1}{2} Cl_2(g) \rightarrow HCl(g) \quad \Delta H_3 = -167.57$ kj/mol

$CHCl_3(g) + \frac{1}{2} O_2(g) + H_2O(l) \rightarrow CO_2(g) + 3HCl(aq)$ $\Delta H_c = -509.95$ kj/mol.

b) Pure CO is burned with 100% excess air. Combustion is 80% complete. The reactants are at 373 K and the products are 573K. Using the following data, calculate the quantity of heat added or removed per kmol of CO fed. Data are in KJ/(kmol.K). **[10]**

Component	C^0_{pm} (373-298 K)	C^0_{pm} (573-298 K)
CO	29.22	30.61
CO_2	-	43.77
O_2	29.84	30.99
N_2	29.17	29.66

ΔH_f^0 (CO) = –110524 kJ/mol and ΔH_f^0 (CO_2) = –393514 kJ/kmol

Q5) Crystallizer feed with saturated solution of $MgSO_4$ at 353 K. The solution cooled to obtain $MgSO_4.7H_2O$ crystal at 303 K. During cooling 4% of solution lost by evaporation of water. Estimate the quantity of solution that required to obtain the 1000 kg of $MgSO_4.7H_2O$ crystals. **[16]**

Data Solubility of $MgSO_4$ in water

a) At 353 K is 64.2 kg MgSO4/100 kg water.

b) At 303 K is 40.8 kg MgSO4/100 kg water.

[Atomic weight Mg-24, S-32, H-1, O-16].

OR

Q6) SO_2 is absorbed in water using a packed column operated at constant T and P. The gases entering the tower contain 14.8% SO_2 by volume. Water is distributed from the top of the column at the rate of 16.5 l/s. The volume of the gas handled at 101.325 kPa at 303 K is 1425 m^3/hr. The gases leaving the tower contain 1% SO_2 by volume. Find the % SO_2 in the outlet water (by weight). **[16]**

Q7) a) Explain the following : **[6]**

i) Classification of fuels

ii) Calorific values of fuels

b) The Orsat analysis of the fuel gases from a boiler house chimney gives CO_2 = 11.4%, O_2 = 4.2%, and N_2 = 84.4% (mole %). Assuming that complete combustion has taken place, **[12]**

i) Calculate the percentage excess air and

ii) Find the C: H ratio in the fuel.

OR

Q8) The analysis of a refinery gas by volume is :

H_2 = 74%, CH_4 = 13.5%, C_2H_6 = 7.4%, C_3H_8 = 3.6%, n-C_4H_{10} = 1.2% and n-C_5H_{12} = 0.3%.

Data :

Component	– GCV kJ/mol	– NCV kJ/mol
CH_4	890.65	802.62
C_2H_6	1560.69	1428.64
C_3H_8	2219.17	2043.11
n-C_4H_{10}	2877.40	2657.32
n-C_5H_{12}	3535.77	3271.67

ΔH_f^0 of H_2O (g) = –241.82 kJ/mol at 298 K

ΔH_f^0 of H_2O (l) = – 285.83 kJ/mol at 298 K

Specific volume of the refinary gas at 298.15 K and 101.3 kPa = 24.465 m^3/kmol. Calculate the GCV and NCV of the refinery gas in kJ/mol, kJ/kg and kJ/m^3. **[18]**

Total No. of Questions : 8]

SEAT No. :

PB3683

[Total No. of Pages : 2

[6261]-91

S.E. (Production Engineering & Industrial) (Sandwich)
ELECTRICAL AND ELECTRONICS ENGINEERING
(2019 Pattern) (Semester - IV) (203050)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain the construction of SCR with the help of diagram. **[4]**

b) Draw and explain the V-I characteristics of TRIAC. **[6]**

c) Explain the constructional details of MOSFET and draw the following curves of MOSFET: **[8]**

i) Transfer Characteristics

ii) Output Characteristics

OR

Q2) a) Write any two applications for the following devices: **[4]**

i) DIAC

ii) GTO

b) Explain the application of SCR as a switch in details. **[6]**

c) Explain the constructional details of IGBT and draw the following curves of IGBT: **[8]**

i) Tansfer Characteristics

ii) Output Characteristics

Q3) a) List the non-linear applications of an operational amplifier (OPAMP). **[3]**

b) Distinguish between an A to D Converter (ADC) and D to A Converter (DAC). **[6]**

c) Describe the characteristics of an OPAMP. **[8]**

OR

Q4) a) List the linear applications of an operational amplifier (OPAMP). **[3]**

b) Elaborate any two applications of an IC voltage regulator. **[6]**

c) Draw and explain the functional diagram of IC 555 Timer. List the features of an IC555. **[8]**

P.T.O.

Q5) a) Define a programmable Logic Controller (PLC). List the modules in a typical PLC. **[4]**

b) Explain the following PLC logic functions: **[6]**

i) AND

ii) OR

c) Elaborate the role of a PLC in automation. **[8]**

OR

Q6) a) Write the advantages and disadvantages of a PLC. **[4]**

b) Discuss the solid state memory organization in a PLC. **[6]**

c) What is ladder programming in PLC? Draw and explain the typical ladder diagram for an automatic water pump used to lift water overheads in a tank. **[8]**

Q7) a) Draw the typical organization of a microprocessor. **[3]**

b) Write any six important features of AT mega328P microcontroller. **[6]**

c) Explain the following concepts used in Arduino Programming with the help of suitable examples: **[8]**

i) Variables

ii) Functions

iii) Conditional statements

OR

Q8) a) Draw the typical organization of a microcontroller. **[3]**

b) Elaborate the features of Arduino IDE. **[6]**

c) What is data acquisition system? Draw the block diagram showing a typical data acquisition system and explain the function of each block. **[8]**

Total No. of Questions : 8] **SEAT No. :**

PB-3684

[Total No. of Pages : 4

[6261]-92

S.E. (Production & Industrial Engineering/Production S.W)

THEORY OF MACHINES

(2019 Pattern) (Semester - IV) (211091)

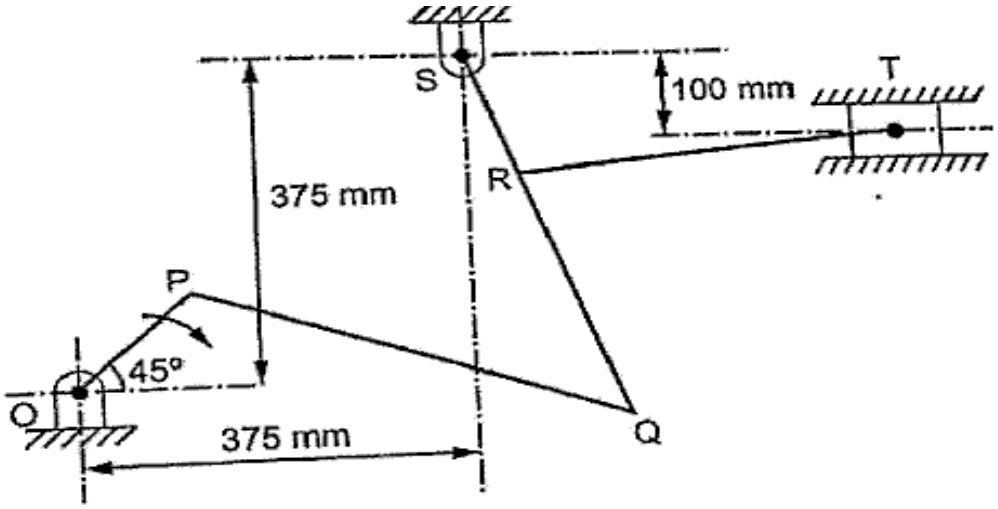
Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data if necessary.***
5) ***Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculator and steam table is allowed.***

Q1) a) Explain relative velocity and absolute velocity with example. **[6]**

b) Figure shows a mechanism in which dimensions of various links are as follows: OP=RS=150 mm, PQ=QS=450 mm and RT =375 mm. Crank OP rotating at uniform speed of 180 rpm. Determine velocity of slider T and Angular velocity of QS. Use relative velocity method. **[12]**



OR

P.T.O.

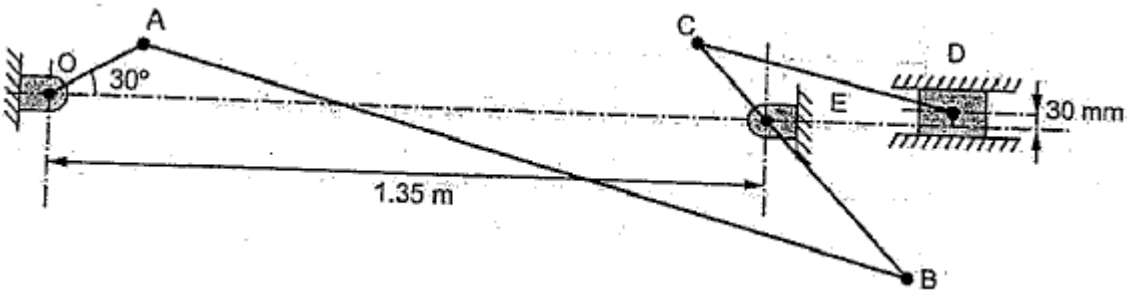
Q2) a) Explain different types of instantaneous centre of rotation. **[6]**

b) A mechanism as shown in fig. has following dimensions: **[12]**

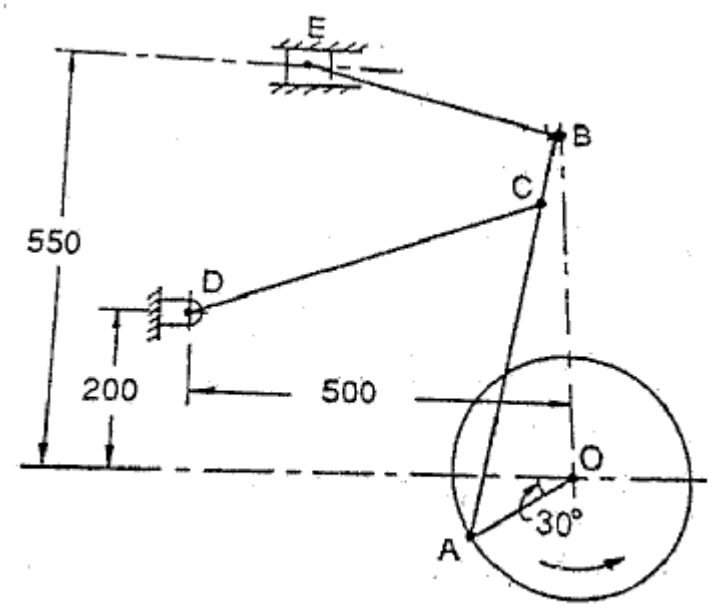
OA= 200 mm, AB = 1.5 m, BC =600mm, CD = 500 mm and BE =400mm. If crank OA rotate uniformly at 400 rpm anticlockwise,

find : i) velocity of D

ii) angular velocity of link BC and CD. Use Instantaneous centre of rotation method.



Q3) Figure shows the mechanism of a radial valve gear. The crank OA rotates at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are: OA = 150 mm, AB = 550 mm, AC = 450 mm, DC = 500 mm, BE = 350 mm. Determine velocity and acceleration of ram E for given position of mechanism. **[17]**



(All dimensions are in mm)

OR

Q4) a) In a slider crank mechanism, the lengths of crank and connecting rod are 90 mm and 360 mm respectively. The crank rotates uniformly at 600 rpm clockwise. When crank has turned through 45° from IDC, find by analytical method

i) Velocity and acceleration of piston

ii) Angular velocity and angular acceleration of connecting rod **[8]**

b) In a slider crank mechanism, the lengths of crank and connecting rod are 200 mm and 800 mm respectively. The crank is rotating at uniform speed of 480 rpm. Using klein's construction, find i) Acceleration of slider ii) Acceleration of middle point of connecting rod iii) Angular acceleration of connecting rod when the crank has turned through 45° from IDC.**[9]**

Q5) a) What is meant by initial tension in belts? Explain the influence of initial tension and co-efficient of friction on power transmitted by belt drive.**[8]**

b) An impregnated belt 0.6 cm x 10 cm of open belt drive has 140 N/cm^2 maximum stress in the belt. The angle of contact on pulley is 120°. Belt density is 970 kg/m^3. The coefficient of friction between belt and pulley is 0.3. Determine maximum power transmitted by the belt. **[10]**

OR

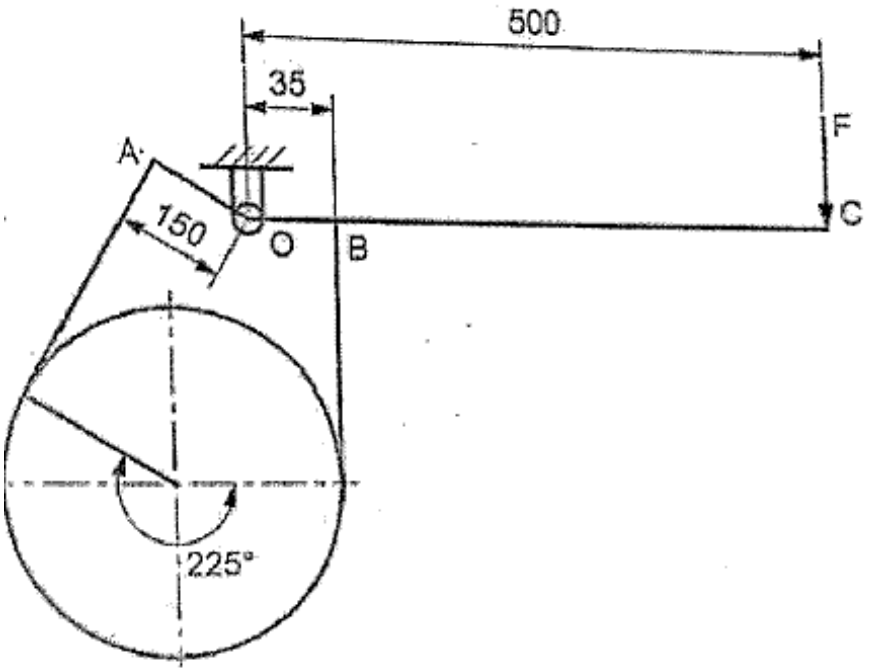
Q6) a) Explain the reasons why rubber is a commonly used material in belt manufacturing. What are the advantages and limitations of using rubber in belts? **[8]**

b) Explain following with suitable diagram **[10]**

i) Cone pulley drive ii) Fast and loose pulley drive

Q7) a) Explain different types of shoe brake systems with suitable diagrams.**[8]**

b) A differential band brake as shown in fig has an angle of contact 225°. The band has compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and coefficient of friction between band and drum is 0.30. Find necessary force for clockwise rotation of drum. **[9]**



(All dimensions are in mm)

OR

Q8) a) What are the general requirements of good brake lining materials? State the materials used for brake lining. **[8]**

b) Explain construction and working of rope brake dynamometer with the help of neat sketch. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3685

[Total No. of Pages : 3

[6261]-93

S.E. (Production Engineering Sandwich) (Production Engineering & Industrial Engineering)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - IV) (211092)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Assume suitable data, if necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of non-programmable electronic pocket calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Student will solve/write the Answers to any four questions in single answer book only.***

Q1) a) Derive the torque equation for the square threaded screw to lower the load. **[6]**

b) The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine **[8]**

i) the power required to drive the screw; and

ii) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.

c) Explain concept of overhauling and self-locking screws. **[4]**

OR

Q2) a) Explain with neat sketch recirculating ball screw mechanism. **[6]**

b) In a machine tool application, the tool holder is pulled by means of an operating nut mounted on a screw. The tool holder travel at a speed of 5 m/mm. The screw has single start square thread of 48 mm nominal diameter and 8 mm pitch. The operating nut exerts a force of 500 N to drive the tool holder. The mean radius of the friction collar is 40 mm. The coefficient of friction at thread and collar surfaces is 0.15. Calculate power and efficiency. **[8]**

c) Define power screw and explain with figures the types of power screw threads. **[4]**

P.T.O.

Q3) a) Explain the terms used in compression springs; Spring Rate, and Spring Index. **[4]**

b) A valve mechanism requires a compression spring as per the following data : **[8]**

i) Spring Index = 9
ii) Initial Compression = 25 mm
iii) Initial Load = 150 N
iv) Final Compression = 55 mm
v) Maximum shear stress = 485 MPa
vi) Modulus of Rigidity = 83500 MPa

Select required wire size from the following wire diameter: 1, 1.5, 2, 2.5, 3, 3.6, 4, 4.5, 5, 5.6, 6, 6.5 mm.

Draw a neat sketch of spring showing O.D, Free length, Pitch of the coil in free condition. Assume square and ground ends for the spring.

c) Define helical spring and explain types of springs with applications. **[5]**

OR

Q4) a) Derive the equation of maximum shear stress induced in the circular wire of the helical springs. **[6]**

b) Design a helical compression spring for a maximum load of 1000 N for the deflection of 25 mm using the values of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm^2. Take Wahl's factor, **[6]**

$$K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$$

c) Draw a neat sketch a leaf spring assembly. Mention the different utility components/parts in the assembly. **[5]**

Q5) a) Explain the terms used in gears : **[4]**

i) Pressure Angle, and
ii) Module.

b) The following particulars of a single reduction spur gear are given: Gear ratio = 10: 1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 rpm Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find : **[8]**

i) The nearest standard module if no interference is to occur;
ii) The number of teeth on each wheel;
iii) The necessary width of the pinion; and
iv) The load on the bearings of the wheels due to power transmitted.

c) Explain different causes of gear tooth failure. **[6]**

OR

Q6) a) Derive beam strength equation of gear teeth. **[7]**

b) A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20^{o} full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[8]**

c) Draw a neat sketch showing Gear Nomenclature and Tenninology. **[3]**

Q7) a) Explain antifriction bearing and advantages of rolling contact bearings over sliding contact bearings. **[5]**

b) A taper roller bearing has a dynamic load capacity of 30 kN. The desired life for 90 % of the bearings is 9000 h and the speed is 250 rpm. Calculate the equivalent radial load that the bearing can carry. **[6]**

c) Explain purpose of lubrication and guidelines for selecting lubrication for rolling contact bearings. **[6]**

OR

Q8) a) What do you understand by bearing life with example. **[4]**

b) Derive Stribeck's Equation. **[7]**

c) A single - row deep groove ball bearing is subjected to radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life L_{10h} of the bearing is 20000 h. The minimum acceptable diameter of the shaft is 75 mm. Calculate dynamic load capacity. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3686

[Total No. of Pages :2

[6261]-94

S.E. (Production Engineering and Industrial Engineering) (Sandwich)

ADVANCED MATERIALS

(2019 Pattern) (Semester- IV) (211093)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Draw neat figures whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data if necessary.***
5) ***Use of scientific calculators is allowed.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) Which are the common magnetic materials? **[6]**

b) What are the limitations of nanomaterials? **[6]**

c) What is vulcanization? **[6]**

OR

Q2) a) Which are the important properties desired from electrical materials? **[6]**

b) Which are the key properties of nanomaterials? **[6]**

c) How are polymers classified on the basis of their structure? **[6]**

Q3) a) How are magnetic materials classified based on relative permeability? **[6]**

b) What do you mean by carbon nanotubes? **[6]**

c) What is a biodegradable polymer? Give examples. **[5]**

OR

Q4) a) Where are semiconductors used? **[6]**

b) Give one example each of zero-, one- and two-dimensional nanomaterials? **[6]**

c) What do you mean by Engineering plastics? Give examples. **[5]**

P.T.O.

Q5) a) What do you mean by calandering of elastomers? **[9]**

b) Write note on: Mixing mechanisms of rubber/ elastomers. **[8]**

OR

Q6) a) Which are the manufacturing techniques used for processing of rubbers? **[9]**

b) Write note on: Extrusion of Rubber or elastomer. **[8]**

Q7) a) What do you understand by "Ceramics"? Distinguish between "Traditional" and "Advanced" ceramics. **[9]**

b) Explain with sketch slip casting for Ceramic processing. **[9]**

OR

Q8) a) What is mean by composite? Which are the attractive features of composites make them suitable for special areas of applications? **[9]**

b) Explain with sketch any one technique of metal matrix composite processing. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3687

[Total No. of Pages : 2

[6261]-95

S.E. (Production & Industrial Engineering) (Production Engg. - Sandwich)

INDUSTRIAL ENGINEERING AND MANAGEMENT

(2019 Pattern) (Semester - IV) (211094)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) What are the basic elements of Business plans? **[5]**

b) Why do very few entrepreneurial enterprises succeed? List the problems contributing to the failures. **[6]**

c) What are the parameters of selection of Business location? **[6]**

OR

Q2) a) What is Break even analysis? Explain with an example and state the assumptions to be considered in BEA. **[9]**

b) Explain the following: **[8]**

i) Strategies of Business Growth

ii) Technology and Business

Q3) a) State the Functions & Applications of Industrial Engineering. **[8]**

b) Explain the following: **[9]**

i) Procedure of Method study

ii) Process of analysis of Motion Pictures

OR

Q4) a) Explain the following techniques: **[8]**

i) Productivity measurement

ii) Productivity improvement

b) State the challenges faced in implementation of new Methods w.r.t.: **[9]**

i) Developing

ii) Presentation

iii) Installation

P.T.O.

Q5) a) Explain Two Handed Process Chart. Draw a Chart for Assembly of Nut and Washer to a Bolt. **[9]**

b) Explain the Multiple Activity Chart with Examples and Advantages. **[9]**

OR

Q6) a) Explain the following:

i) Principles of motion economy **[5]**

ii) 5W and 1 H **[5]**

b) Explain the following with neat diagrams/charts:

i) Difference between Cyclegraph and Chronocylegraph **[4]**

ii) Outline Process Chart and Flow process Chart **[4]**

Q7) a) What is a Time Study Form? State its Advantages and Applications. **[9]**

b) Define the following and state the formula for calculation: **[9]**

i) Normal time

ii) Work content

iii) Standard time.

iv) In a time study the observed time is 0.75 mm, performance rating factor is 110% and allowances are 20% of the normal time. Find the standard time.

OR

Q8) a) Explain the following: **[8]**

i) PMTS

ii) MOST

b) Define Time Allowances, its importance and types. **[6]**

c) State the Aim & Objectives of Work Measurement. **[4]**

Total No. of Questions : 9]

SEAT No. :

PB3688

[Total No. of Pages : 5

[6261]-96

S.E. (Production Engineering & Industrial Engg.) (Robotics & Automoble) (Sandwich)

ENGINEERING MATHEMATICS-III

(2019 Pattern) (Semester-III) (207007)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question No.1 is compulsory.***
2) ***Attempt Q2 or Q3,Q4 or Q5,Q6 or Q7,Q8 or Q9***
3) ***Figures to the right indicates full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Q1) choose correct option:

a) From the given information S.D. of $x = 4$, S.D. of $y = 1.8$ and coefficient of regression of y on x is 0.32. The coefficient of correlation is **[2]**

i) 0.711 ii) 0.622

iii) 0.743 iv) 0.543

b) The coefficient of Kurtosis β_2 is given by **[1]**

i) $\frac{\mu_3^2}{\mu_2^3}$ ii) $\frac{\mu_4^2}{\mu_2^4}$

iii) $\frac{\mu_4}{\mu_2^2}$ iv) $\frac{\mu_2^3}{\mu_3^2}$

c) If A and B are any two events with $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$ then P(A/B) is **[2]**

i) $\frac{1}{3}$ ii) $\frac{3}{4}$

iii) $\frac{1}{4}$ iv) $\frac{2}{3}$

d) Two dice are thrown, the probability of getting a score 10 is **[1]**

i) $\frac{1}{12}$ ii) $\frac{1}{6}$

iii) $\frac{1}{5}$ iv) $\frac{2}{3}$

P.T.O.

e) Value of $\nabla^2\left(\frac{1}{r}\right)$ is **[2]**

i) $\frac{-\bar{r}}{r^3}$ ii) $\frac{\bar{r}}{r^2}$

iii) $\frac{1}{r^4}$ iv) 0

f) For the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with general solution **[2]**

$u(x, t) = (C_4 \cos mx + C_5 \sin mx).\ e^{-m^2 t}$ if $u(0, t) = 0, \forall t$ then

i) $C_5 = 0$ ii) $C_4 = 0$

iii) $m = 0$ iv) None of these

Q2) a) Fit a straight line for the following data of the form $y = ax + b$ **[5]**

x	5	4	3	2	1
y	1	2	3	4	5

b) The first four moments about the mean 3.5 are 0.058064, 0.451612, 0.082259 and 0.5. Calculate the first four central moments. **[5]**

c) Compute correlation coefficient for the following data. **[5]**

x	152	158	169	182	160	166	182
y	198	178	167	152	180	170	162

OR

Q3) a) For the tabulated values of x and y given below, fit a straight line of the form $y = mx + c$ **[5]**

x	1.0	3.0	5.0	7.0	9.0
y	1.5	2.8	4.0	4.7	6.0

b) If $\sum f = 27$, $\sum fx = 91$, $\sum fx^2 = 359$, $\sum fx^3 = 1567$, $\sum fx^4 = 7343$. Find the first four moments about origin. **[5]**

c) Find the regression line of y on x from the data below. **[5]**

x	65	63	67	64	68	62	70	66	68	67
y	68	66	68	65	69	66	68	65	71	67

Q4) a) 20% of bolts produced by a machine are defective. Determine the probability that out of 4 bolts chosen at random **[5]**

i) 1 bolt is defective

ii) almost 2 bolts are defective

b) Number of road accidents on a highway during a month follows poisson's distribution with mean 5. Find the probability that in a certain month number of accidents on the highway will be **[5]**

i) less than 3

ii) more than 3

c) Suppose heights of students follows normal distribution with mean 190cm and variance 80 cm^2. In a school of 1000 students how many would you expect to be above 200cm tall. (Given Area A = 0.3686) **[5]**

OR

Q5) a) A die is thrown twice X denote the sum of digits in two throws. Find the mathematical expectation of X. **[5]**

b) The average number of misprints per page of a book is 1.5. Assuming the distribution of number of misprints to be poisson, find. **[5]**

i) The probability that a particular book is free from misprint.

ii) Number of pages containing more than one misprint if the book contains 900 pages.

c) A coin is so biased that appearance of head is twice likely as that of tail. If a throw is made 6 times, find the probability that atleast 2 heads will appear. **[5]**

Q6) a) Evaluate $\int_C \bar{F}.d\bar{r}$ where $\bar{F} = x^2\bar{i} + xy\bar{j}$ and C is the are of the parabola $y = x^2$ joining (0, 0) and (1, 1) **[5]**

b) Show that the vector field given by **[5]**

$\bar{F} = (y^2 \cos x + z^2)\,\bar{i} + (2y \sin x)\,\bar{j} + 2xz\bar{k}$ is irrotational-

Find scalar potential ϕ such that $\bar{F} = \nabla\phi$

c) Find the directional derivative of $\phi = x^2 + y^2 + z^2$ at (1, –1, 1) along the vector $\bar{i} + 2\bar{j} + 2\bar{k}$ **[5]**

OR

Q7) a) Evaluate $\int_C \bar{F}.d\bar{r}$ where $\bar{F} = (xy + y^2)\ \bar{i} + x^2\ \bar{j}$ and C is the straight line joining (0, 0) to (2, 2), the equation of the straight line is $y = x$. **[5]**

b) Prove that (any one) **[5]**

i) $\nabla\left(\frac{\bar{a}.\bar{r}}{r^3}\right) = \frac{\bar{a}}{r^3} - \frac{3(\bar{a}.\bar{r})\bar{r}}{r^5}$

ii) $\nabla^2\left(\frac{1}{r^2}\right) = \frac{2}{r^4}$

c) Find the directional derivative of $\phi = 2x + y + z^2$ at (2, –1, 1) along the vector $2\bar{i} + \bar{j} + 2\bar{k}$. **[5]**

Q8) a) If $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$ represents the vibrations of a string of length l fixed at both ends, find the solution with boundary conditions. **[8]**

i) $y(0, t) = 0, \forall t$

ii) $y(l, t) = 0, \forall t$

and initial conditions

iii) $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$

iv) $y(x, 0) = a \sin\left(\frac{\pi x}{l}\right)$

b) Solve $\left(\frac{\partial v}{\partial t}\right) = K\frac{\partial^2 v}{\partial x^2}$ if **[7]**

i) $V \neq \infty$ as $t \to \infty$

ii) $\left(\frac{\partial v}{\partial x}\right)_{x=0} = 0, \forall t$

iii) $V(l, t) = 0, \forall t$

iv) $V(x, 0) = v_0$, for $0 < x < l$.

OR

Q9) a) If $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ represents the vibrations of a string of length l fixed at both ends, find the solution with boundary conditions, **[8]**

i) $y(0, t) = 0$

ii) $y(l, t) = 0$

and initial conditions

iii) $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$

iv) $y(x, 0) = k(lx - x^2),\ 0 \le x \le l$

b) Solve the equation $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ with conditions **[7]**

i) V = 0 when $y \to +\infty$ for all x.

ii) V = 0 when $x = 0$ for all values of y.

iii) V = 0 when $x = 1$ for all values of y.

iv) $V = x(1 - x)$ when y = 0 for $0 < x < 1$.

Total No. of Questions : 8] **SEAT No. :**

PB3689 **[Total No. of Pages : 2**

[6261]-97

S.E. (Production/Industrial Engineering) (Sandwich)

HEAT AND FLUID ENGINEERING

(2019 Pattern) (Semester - III) (211081)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Derive derivation of DarcayWeisbachs for major losses of fluid? **[9]**

b) What are types of fluid flows? Discuss in detail. **[9]**

OR

Q2) a) What is Total Energy Line and Hydraulic Gradient Line? **[9]**

b) Write short note on turbines and pumps. **[9]**

Q3) a) Explain with neat sketch any one boiler. **[9]**

b) A boiler plant supplies 5400 kg of steam/hr. at 750 KN/m^2 and 0.98 dry from feed water at 41.5ºC, when using 670 kg of coal/hr. having a calorific value of 31000KJ/kg. Determine **[8]**

i) The efficiency of the boiler.

ii) The equivalent of evaporator from &at 100º c.

OR

Q4) a) Discuss proximate and ultimate analysis of fuel. **[9]**

b) How electrical vehicles are replaced to Internal Combustion engine. Comments. **[8]**

Q5) a) Explain wet bulb temperature, dry bulb temperature and pure air. **[9]**

b) What is vapour compression refrigeration system? Explain with neat sketch. **[9]**

OR

Q6) a) Discuss the severity of environmental effect of refrigeration systems. **[9]**

b) How conditioning system is useful for micro manufacturing and metrology laboratories? **[9]**

P.T.O.

Q7) a) How internal combustion engine are classify? Discuss in detail. **[9]**

b) An air compressor is required to compress air from a pressure of 1 bar to 10 bar, Calculate the amount of work required per kg of air, when index n = l.2 for compression. Assume initial temperature as 15°c & R for air is 0.287kj/kg.K. **[8]**

OR

Q8) a) What is indicator diagram of compressor? Discuss in detail. **[9]**

b) The following results refer to a test on a petrol engine. **[8]**

Indicator power – 30Kw, Brake power – 26Kw, Engine speed – 1000rpm, Fuel per brake power hr. – 0.35kg, C.V. of fuel used – 43.900 KJ/kg.

Calculate,

i) Indicated thermal efficiency

ii) Brake thermal efficiency &

iii) Mechanical efficiency.

Total No. of Questions : 8]

SEAT No. :

PB3690

[Total No. of Pages : 3

[6261]-98

S.E./(Production Engineering and Industrial Engineering/(Production Engineering Sandwich)/(Robotics & Automation Engineering)

STRENGTH OF MATERIALS

(2019 Pattern) (Semester - III) (211082)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Derive relation between Maximum shear stress and average shear stress for Rectangular cross - sectional Beam **[8]**

b) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50kN. Determine: A verage shear stress, Maximum shear stress, and shear stress at a distance of 25mm above the neutral axis. **[9]**

OR

Q2) a) Derive relation between Maximum shear stress and average shear stress for circular cross - sectional Beam **[8]**

b) A circular cantilever beam of span 4 Meter is subjected to a point load of 2 KN at free end. If the cross section of beam is 50 mm wide and 75 mm deep. Determine maximum bending stress in beam. **[9]**

Q3) a) A metal block of 100 mm^2 cross sectional area carries an axial tensile load of 10 kN. For a plane inclined at 30º with the direction of applied load, calculate: **[7]**

i) Normal stress
ii) Shear stress
iii) Maximum shear stress,
iv) Angle of Obliquity

b) Define - Principal stress, Principal plane and Angle of Obliquity. **[6]**

c) A circular rod of 60 KN is gradually applied to a circular bar of 40 mm diameter and 5 Meter long. Given E = 2×10^5 mm^2 Determine Stress in rod, Elongation of rod and Strain Energy absorbed by rod **[5]**

OR

P.T.O.

Q4) a) At a point in a crank shaft the stresses on two mutually perpendicular planes are 30 MPa (tensile) and 15 MPa (tensile). The shear stress across these planes is 10 MPa. Find the normal and shear stress on a plane making an angle 30º with the plane of first stress. Find also magnitude and direction of resultant stress on the plane. **[7]**

b) Define- Resilience, Proof Resilience and Modulus of Resilience. **[6]**

c) A bar 50 mm diameter, 2 Meter long is fixed at upper end and provided with collar at lower end. A weight of 450 N ids dropped on a collar from height 250 mm. Given E = 2×10^5 mm^2 Find instantaneous stress and strain energy stored in bar **[5]**

Q5) a) A cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm , is subjected to an internal pressure of 4.5 MN/m2.

i) Calculate the tangential and longitudinal stresses in the steel

ii) To what value may the internal pressure be increased if the stress in the steel in the steel is limited to 120 MN/m^2 **[6]**

b) Define - Hoop or Circumferential Stress, Longitudinal stress, Radial pressure . **[6]**

c) Design a solid circular shaft to transmit a power of 200 KW running at130 rpm taking maximum allowable shear stress 120 N/mm2 with permissible angle of twist 1.5º over a length of 4 meter with G = 80 $\times10^3$ Mpa **[6]**

OR

Q6) a) Derive a equation for circular shaft subjected to torsion

$$\frac{\tau}{R}=\frac{T}{J}=\frac{G\theta}{L}$$

Where J = Polar moment of inertia τ = Shear stress induced due to torsion T. G = Modulus of rigidity θ = Angular deflection of shaft R, L = Shaft radius & length respectively. **[6]**

b) A hollow steel rod 200 mm long is to be used as torsional spring. The ratio of inside to outside diameter is 1 : 2. The required stiffness of this spring is 100 N.m/degree. Determine the outside diameter of the rod. Value of G is 8×10^{-4} N/mm^2 **[6]**

c) A thick cylinder is subjected to an internal pressure of 60 MPa. If the hoop stress on the outer surface is 150 MPa, find the hoop stress on the internal surface **[6]**

Q7) a) Explain procedure for finding deflection in beam by Macaulay's method **[7]**

b) A beam 6 m long, simply supported at its ends, is carrying a point load of 50 KN at its centre. The moment of inertia of the beam is 78×10^6 mm^4. If E for the material of the beam = 2.1×10^5 N/mm^2 calculate deflection at the center of the beam and slope at the supports. **[5]**

c) Write assumptions of Euler's Theory for column design **[5]**

OR

Q8) a) Determine the crippling load for a column having diameter 50mm and length 3000 mm, E = 2.1×10^5 N/mm^2 and Moment of Inertia (I) = $30.86\times10^4 N/mm^4$ when used with following conditions **[7]**

i) One end of column is fixed and other rend is free,

ii) Both ends of column are fixed

b) Derive a relation for slope and deflection for a simply supported beam with central point load. **[10]**

* * *

Total No. of Questions : 8]

SEAT No. :

PB-3691

[Total No. of Pages : 2

[6261]-99

S.E. (Production Engineering and Industrial Engg./ Production S/W)

MANUFACTURING PROCESSES-I

(2019 Pattern) (Semester - III) (211083)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
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 following parts of a lathe by neat sketches: **[8]**

i) Lathe Bed

ii) Carriage

iii) Headstock

iv) Tailstock

b) What is indexing? State different indexing methods? Explain compound indexing in detail. **[10]**

OR

Q2) a) List out various taper turning methods on lathe machine. Explain Tail Stock set over method with neat sketch in detail. **[10]**

b) State various operations performed on milling machine. Differentiate between up milling and down milling. **[8]**

Q3) a) With the help of sketch, explain the construction and working of radial drilling machine. **[10]**

b) Explain the standard marking system used for grinding wheels. **[7]**

OR

P.T.O.

Q4) a) Sketch and describe various operations which can be performed on drilling machine **[8]**

b) Explain with neat sketch centreless grinding machine. **[9]**

Q5) a) Compare the Honing and Lapping processes with respect to **[6]**

i) Principle of working

ii) Types of abrasive

iii) Area of applications

iv) Surface finish

b) Explain Buffing, Polishing and Tumbling processes in short, stating its applications. **[11]**

OR

Q6) a) Compare between the Electroplating, Galvanizing and Metal spraying processes. **[8]**

b) Explain Hot dipping and Burnishing processes in detailed. **[9]**

Q7) a) What is additive manufacturing? What are its merits and demerits? **[7]**

b) Describe VAT Polymerization process in short. State its merits, demerits and applications. **[11]**

OR

Q8) a) Describe Material Extrusion process in short. State its merits, demerits and applications. **[9]**

b) Explain Powder Bed Fusion process in short. State its merits, demerits and applications. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3692

[6261]-100

[Total No. of Pages :2

S.E. (Production Engineering & Industrial Engineering) (Sandwich)

MATERIALS SCIENCE AND METALLURGY

(2019 Pattern) (Semester- III) (211084)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Assume Suitable data if necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Draw neat figures whenever necessary.***
5) ***Use of scientific calculators is allowed.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) What is Powder Metallurgy (PM)? Discuss advantage and disadvantage of PM. **[8]**

b) Explain following Terms: **[8]**

i) Self-lubricating bearings

ii) Cermets

OR

Q2) a) Write note on **[8]**

i) Diamond impregnated Cutting Tools

ii) Cemented carbide tipped tools

b) Describe any two component which can be manufactured by only powder metallurgy technique. **[8]**

Q3) a) Define following. **[10]**

i) Ferrite

ii) Austenite

iii) Pearlite

iv) Cementite

v) Bainite

b) Draw Fe-C equilibrium diagram and label the temperature, composition and phase. **[8]**

OR

P.T.O.

Q4) a) What is steel? What do you understand by eutectoid, hypereutectoid and hypereutectoid steel? **[10]**

b) Explain the follwoing with neat diagram. **[8]**

i) Peritectic transformation

ii) Eutectic transformation

Q5) a) Draw and Explain the method of plotting TTT diagram and what information is obtained from this diagram? **[10]**

b) Explain terms: **[8]**

i) Quenching

ii) Annealing

iii) Normalizing

iv) Carburizing

OR

Q6) a) Define hardenability. How it is measured? **[8]**

b) What is retained austenite? Why it is not desirable? **[10]**

Q7) a) Write note on High temperature alloy. **[9]**

b) Write Note on Copper and its Alloy. **[9]**

OR

Q8) a) Write Note on Aluminum and its alloy. **[9]**

b) Write Note on Composite Material and Nano Materials. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3693

[6261]-101

[Total No. of Pages :2

S.E. (Production Engineering) (Sandwich)
MANUFACTURING PROCESS-II
(2019 Pattern) (Semester- IV) (211121)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain different types of coordinate systems used in NC/CNC operations. **[10]**

b) Explain the concept of FMS (Flexible Manufacturing System) and its significance in modern manufacturing. **[7]**

OR

Q2) a) For Machinig Centre, Explain the following: **[12]**

i) Principles, Working & Advantages

ii) Applications & Parts Programming

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

i) G 03

ii) G 63

iii) M 06

iv) M 09

v) M 30

Q3) a) Explain with neat sketch Compression Moulding Process with its Advantages & Applications? **[10]**

b) Explain the Extrusion Process for thermoplastic Material? **[8]**

OR

P.T.O.

Q4) a) Explain in details of Blow Moulding Process with its Advantages & Applications? **[10]**

b) What is Pressure Forming in Thermoforming, and how does it affect the final product? **[8]**

Q5) a) Explain with neat sketch EDM. State the Advantages, Limitations and Applications. **[9]**

b) Explain with neat sketch USM. State the Advantages, Limitations and Applications? **[8]**

OR

Q6) a) What is the function of electrolyte in ECM? List the common electrolyte used in ECM. **[5]**

b) Explain the Principle with neat sketch of following. (Any Two) **[12]**

i) PAM

ii) AJM

iii) IBM

Q7) a) Describe the various types of jigs and fixtures used in manufacturing processes? **[12]**

b) Describe factors considered for designing jig & fixture? **[6]**

OR

Q8) a) What are some general guidelines and procedures followed in the design of jigs and fixtures? **[13]**

b) Explain fool-proofing for jig & fixture? **[5]**

Total No. of Questions : 8]

SEAT No. :

PB3694

[Total No. of Pages : 1

[6261]-102
S.E. (Printing Engineering)
ELECTRICAL MACHINES AND UTILIZATION
(2019 Pattern) (Semester - IV) (203155)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) Draw Torque-Slip characteristic with modes of operation of 3 phase induction Motor. **[9]**

b) Explain any two types of starters of 3 phase induction Motor. **[9]**

OR

Q2) a) Explain any one method of speed control of 3 phase induction Motor. **[9]**

b) Explain how rotating magentic field is produced in 3 phase induction Motor. **[9]**

Q3) a) Explain types of lighting scheme. **[9]**

b) Explain laws of illumination. **[8]**

OR

Q4) a) Write short note on flood lighting design. **[9]**

b) Explain requirement of good lighting scheme. **[8]**

Q5) a) Explain Vertical core type induction furnace. **[9]**

b) Explain high frequency eddy-current heating. **[9]**

OR

Q6) a) Explain any two temperature control methods in furnaces. **[9]**

b) Write short note on indirect Arc furnace. **[9]**

Q7) a) Explain various types of relays. **[9]**

b) Explain difference between individual and group drive. **[8]**

OR

Q8) a) Explain selection of motors depending on load characteristics. **[9]**

b) Write short note on Photo Cell. **[8]**

Total No. of Questions : 8]

SEAT No. :

PB-3695

[Total No. of Pages : 2

[6261]-103
S.E. (Printing)
FINISHING TECHNIQUES
(2019 Pattern) (Semester - IV) (208286)

Time : 2½ Hours] *[Max. Marks : 70*

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***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Write Short Note on Buckle Folding. **[6]**

b) Write Short Note on folding schemes. **[6]**

c) Describe in detail a Collating marks. **[5]**

OR

Q2) a) Write Short Note on folding machine. **[6]**

b) Write Short note on Cutting machine. **[5]**

c) Compare gathering and in setting process with suitable diagram. **[6]**

Q3) a) Distinguish between hot melt adhesives and water based adhesives. **[6]**

b) Explain in brief the factors governing the choice of adhesives. **[6]**

c) Write short note on securing materials. **[6]**

OR

Q4) a) Explain in brief factors to be considered while selecting a adhesives. **[6]**

b) Describe in detail the speed of setting of adhesive. **[6]**

c) Explain in brief the effect of wet adhesives on paper and board. **[6]**

P.T.O.

Q5) a) Write Short note on lamination methods. **[6]**

b) Compare hot and cold foil stamping. **[6]**

c) Write Short note on utility operations. **[5]**

OR

Q6) a) Distinguish between wet lamination and dry lamination process. **[6]**

b) Write Short note on calendar rimming process. **[5]**

c) Compare embossing and foil stamping process. **[6]**

Q7) a) Calculate papers for endpapers in double crown size for 5000 books in crown 8vo size with 1% allowance. **[6]**

b) Estimate boards of 45DKg in RA1 Size for 10000 books in A5 size. **[6]**

c) Calculate cost of papers for endpapers in 2RA0 size with 90 gsm@ Rs. 70 per kg for 10000 books in A5 size. **[6]**

OR

Q8) a) Calculate papers for endpapers in Quad royal size for 10000 books in royal 8v0 size with 1% wastage allowances. **[6]**

b) Calculate boards of 45Dkg of 22″ × 28″ for 1000 books in A5 size. **[6]**

c) Calculate cost of endpapers in RA1 size with 80 GSM@ Rs 70 per Kg for 2000 books in A5 size having 240 pages with 2% wastage allowance. **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PB3696

[Total No. of Pages : 2

[6261]-104

S.E. (Printing Engineering)

INTRODUCTION TO PACKAGING CONCEPTS

(2019 Pattern) (Semester - IV) (208287)

Time : 2½ Hours] ***[Max. Marks : 70***

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) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of electronic pocket calculator is allowed.***

Q1) a) What is the importance of demography. **[9]**

b) How packaging is promoting the product in market explain in detail. **[9]**

OR

Q2) a) Explain demographic segmentation in detail with examples. **[9]**

b) Explain retail market of packaging industry. **[9]**

Q3) a) Explain biological effect on product and package. **[9]**

b) Explain 4 different scenarios of product and package relationship. **[8]**

OR

Q4) a) Explain product's physical characteristics. **[8]**

b) Explain plastic characteristics. **[9]**

P.T.O.

Q5) a) What is the significance of specifications in quality standards. **[9]**

b) Write down the checklist of the items to be considered for quality control. **[9]**

OR

Q6) a) Explain different packaging standards used to manufacture or maintain quality in packaging products. **[9]**

b) What is the need of quality control in packaging. **[9]**

Q7) a) Explain packaging perception v/s reality. **[8]**

b) Explain the growth of food and beverage packaging industry in India. **[9]**

OR

Q8) a) How India has become the world's fifth largest packaging industry. **[8]**

b) Explain different packaging laws and regulations. **[9]**

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Total No. of Questions : 8]

SEAT No. :

PB3697

[Total No. of Pages :2

[6261]-105

S.E. (Printing Engineering)

MICROPROCESSOR AND MICROCONTROLLER TECHNIQUES IN PRINTING

(2019 Pattern) (Semester- IV) (208288)

Time : 2½ Hours] *[Max. Marks : 70*

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 side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) Describe what are interrupts? and interrupts available in 8051 microcontroller. **[17]**

OR

Q2) a) Describe the registers in 8051. Write a program to move the data from one register to another register. **[9]**

b) Explain the Control bus, Address bus and Data bus available in 8051.**[8]**

Q3) Explain the addressing modes used in 8051 microcontroller. **[18]**

OR

Q4) Explain following instructions in microcontroller 8051. **[18]**

a) MOV A, #40
b) ADD @B, @R0
c) MOV R0,32
d) SWAP A
e) DIV AB
f) MUL AB
g) DEC @R0
h) SUB R0, @R1
i) MOVX A, @DPTR

P.T.O.

Q5) Describe the Pin configuration of IC8255. **[18]**

OR

Q6) a) Describe the block diagram of programmable IC 8255. **[9]**

b) Explain the block diagram of IC 8259. **[9]**

Q7) Explain the interfacing concept and describe the Interfacing of printer with 8085. **[17]**

OR

Q8) Explain the use of microprocessor and microcontroller in the printing industry. **[17]**

Total No. of Questions : 8]

SEAT No. : ____

PB3698

[Total No. of Pages : 1

[6261]-106

S.E. (Printing Engineering)

PRINT PRODUCTION TECHNIQUES

(2019 Pattern) (Semester - IV) (208289)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain Additive colour theory and subtractive colour theory. **[10]**

b) What is halftone and how it is created . **[8]**

OR

Q2) a) What is hybrid screening with its advantages. **[10]**

b) Explain AM and FM Screening with diagrams. **[8]**

Q3) Draw the diagram and explain Subtractive Color Model for C, M,Y, C+M, M+Y, Y+C, C+M+Y. **[17]**

OR

Q4) Explain UCR and GCR with diagram. **[17]**

Q5) a) Explain types of densitometers. **[10]**

b) Calculate Hue Error and grayness for Magenta. Patch **[8]**
Where
Density of C = 0.76
Density of M = 1.18
Density of Y = 0.35

OR

Q6) a) Explain mechanical dot gain and factors responsible for the same. **[10]**

b) Explain optical dot gain and factors responsible for the same. **[8]**

Q7) Explain various parameters of Post Press Consideration. **[17]**

OR

Q8) Explain Relation between Customer – Printer - Designer. **[17]**

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Total No. of Questions : 8]

SEAT No. :

PB3699

[Total No. of Pages : 3

[6261]-107
S.E. (Printing Engineering)
THEORY OF PRINTING MACHINE AND MACHINE COMPONENTS
(2019 Pattern) (Semester - III) (202060)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of electronic pocket calculator is allowed.***

Q1) a) Write short note on pivoted block brake. **[5]**

b) Define brake and gives general requirement for good brake lining material. **[5]**

c) A single block brake has a brake drum diameter of 1.5 m and angle of contact is 30º. It takes 350 Nm torque at 400 rpm. [Take u = 0.30] Determine required force P when drum rotating clockwise. **[7]**

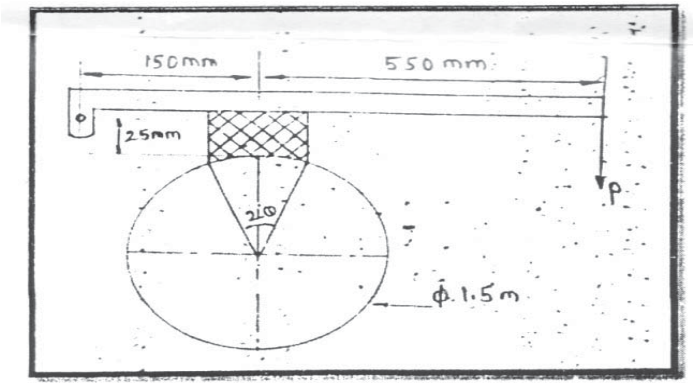


Fig. 1(c)

OR

Q2) a) What are band brakes? Explain simple band brake with sketch. **[5]**

b) Explain double block brake with neat sketch. **[5]**

c) A bicycle and rider of mass 125 kg are travelling at a speed of 10 km/hr on a level road. The rider applies brake to the rear wheel which is 1 m diameter. How Far bicycle will travel before it comes to rest? Pressure applied 120 N and u = 0.05. Also find number of revolutions. **[7]**

P.T.O.

Q3) a) Derive an equation for maximum power transmitted by belt. **[5]**

b) Differentiate between Belt drive and chain drive. **[5]**

c) A prime mover running at 300 rpm drives DC generator at 500 rpm by belt drive. Diameter of pulley on output shaft is 600mm assume slip of 3%.

Determine diameter of generator pulley if the belt running over 6mm thick. **[7]**

OR

Q4) a) Define rope drive and its types. **[5]**

b) Differentiate between Flat belt and V-Belt. **[5]**

c) A belt embraces the shorter pulley 165° and runs at a speed of 1700 m/min. Dimenstion of belt are 20 cm, thickness 8mm. Its weights 1 gm/cm^3, u = 0.25. Find maximum power transmitted if stress is 25×10^5 N/m^2. **[7]**

Q5) Find velocity and acceleration of piston. When crank rotates at non-uniform speed of 200 rpm and angular acceleration of 100rad/s^2. The length of connecting rod is 450 mm and crank is 150 mm long. Which rotates 45° from i.d.c. **[18]**

OR

Q6) The kinematics diagram of one of the cylinders of a rotary engine is shown in figure. The crank OA which is vertical and fixed is 50 mm long. The length of the connecting rod is 125 mm. The line of the stroke OB is inclined at 50° to the vertical. The cylinder is rotating at a uniform speed of 300 rpm in a clockwise direction, about the fixed centre O. **[18]**

Determine:

i) Acceleration of the piston inside the cylinder.

ii) Angular acceleration of the connecting rod.

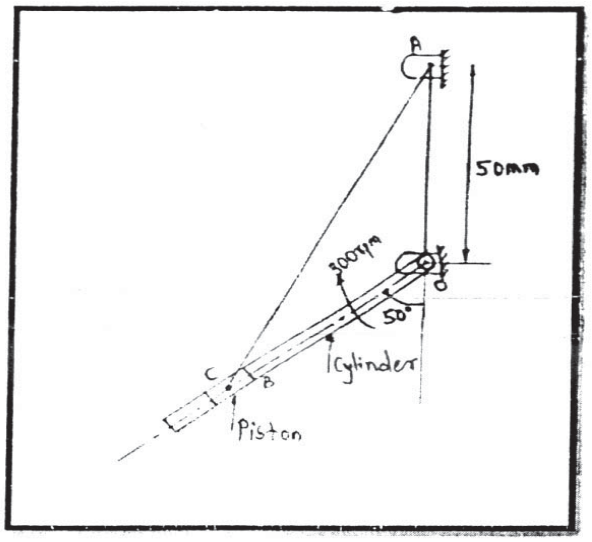


Fig.6

Q7) Find,

a) The velocity and Acceleration of piston

b) The Angular velocity of connecting rod.

For following mechanism. Using klein's construction method. **[18]**

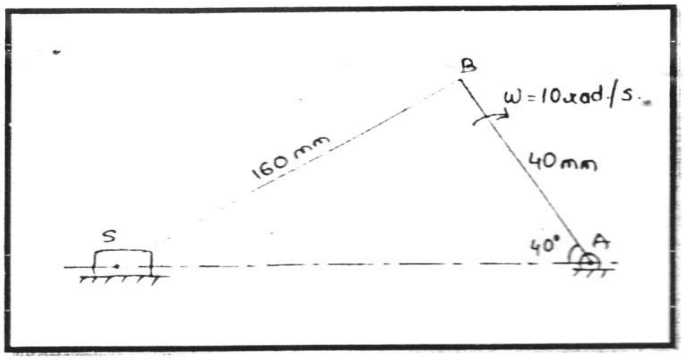


Fig. 7

OR

Q8) Figure shows a mechanism in which crank OA is rotating anticlockwise at 10 rad/s. DE is an oscillating lever pivoted at D and it passes through cylinder pivoted to crank OA at point A. The coupler CF drives slider F as shown. For the instant shown.

Find

a) Angular acceleration of lever DE.

b) Acceleration of slider F. **[18]**

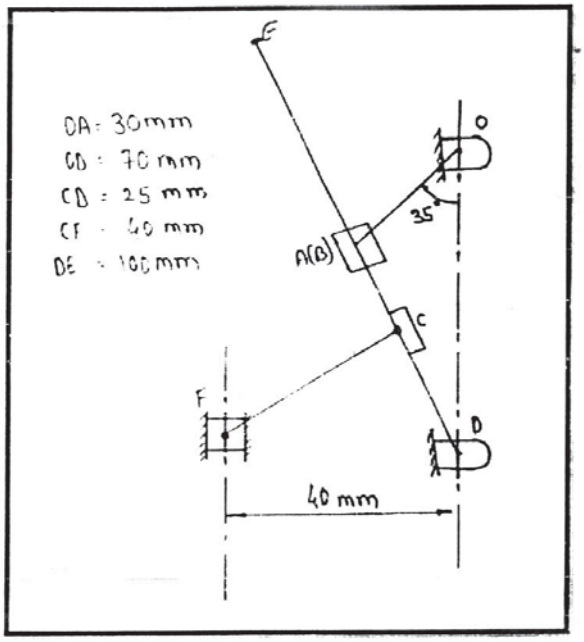


Fig. 8

Total No. of Questions : 8]

SEAT No. :

PB3700

[Total No. of Pages :2

[6261]-108

S.E. (Printing Engineering)

INTRODUCTION TO PRINTING PROCESSES

(2019 Pattern) (Semester- III) (208281)

Time : 2½ Hours] *[Max. Marks : 70*

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.***

Q1) a) What are the important elements which affect the screen-printing process? **[6]**

b) What is the purpose of a screen-printing frame? **[6]**

c) Explain briefly about the different types of screen-printing frames. **[6]**

OR

Q2) a) What are the criteria for selecting a screen-printing frame for a particular job. **[6]**

b) What is the purpose of squeegee in screen printing? **[6]**

c) What are the different types of materials used as squeegee in screen printing? **[6]**

Q3) a) What is the purpose of screen-printing mesh and what are its requirements? **[6]**

b) With a neat sketch explain mesh count. **[6]**

c) What is nominal thread diameter and the type of weave in screen printing? **[5]**

OR

P.T.O.

Q4) a) Briefly explain nylon screen printing mesh and its applications. **[6]**

b) What is the role of thread diameter in screen printing? **[6]**

c) What are the factors which affect ink transfer in screen printing? **[5]**

Q5) a) Explain in brief the different screen stretching methods. **[6]**

b) Write short notes on adhesives used for stretching. **[6]**

c) Write short notes on different screen angles used for halftone reproduction in screen printing. **[6]**

OR

Q6) a) Explain in detail the two-part adhesive systems and the single part adhesive systems. **[6]**

b) What is moire pattern? How it is prevented? **[6]**

c) Write about hot melt adhesives and its applications. **[6]**

Q7) a) With a neat sketch explain the direct screen-printing method. **[6]**

b) Briefly explain the screen-printing on both the print side and the squeegee side. **[6]**

c) Calculate the time for exposing light sensitive emulsion in screen printing. Given light intensity (L) (in Lumens)=400, desired exposure time T=10, Image density=0.7 and calibration constant=1.3. **[5]**

OR

Q8) a) What is screen printed overlays? Which materials are used in screen printed overlays? **[6]**

b) Explain in detail the screen printing of fabrics. **[6]**

c) Write short notes on screen printed gaskets. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB-3701

[Total No. of Pages : 2

[6261]-109
S. E. (Printing Engineering)
MATERIAL SCIENCE IN PRINTING AND PACKAGING
(2019 Pattern) (Semester - III) (208282)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of electronic pocket calculator is allowed.***

Q1) a) Draw neat and labelled diagram of paper making machine and explain the process in details. **[18]**

OR

Q2) a) Explain following with diagram:

i) Cross direction and machine direction

ii) Caliper of paper

b) What is opacity and porosity of paper? Why properties are significant and which are the applications where they are needed to be used?

[18]

Q3) a) Describe thermoset and thermoplastic polymers on the basis of: **[17]**

i) Properties

ii) Types

iii) Applications

P.T.O.

OR

Q4) Explain following types of polymers with properties, types and applications **[17]**

i) Polyethylene

ii) Polypropylene

iii) Polyvinyl chloride

iv) polystyrene

Q5) What are varieties of corrugated ply? Explain each with details and state applications. **[18]**

OR

Q6) Explain glass as a packaging material with respect to its properties, advantages, limitations and applications in detail . **[18]**

Q7) a) What is FBB ? Explain its properties and applications.

b) What is SBS? Explain its properties and applications. **[17]**

OR

Q8) With neat diagram, explain various methods of testing grain direction and cross direction of paper. **[17]**

Total No. of Questions : 8]

SEAT No. :

PB3702

[Total No. of Pages :2

[6261]-110
S.E. (Printing Engineering)
PRINTING DIGITAL ELECTRONICS
(2019 Pattern) (Semester-III) (208283)

Time : 2½ Hours] *[Max. Marks : 70*

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 indicates full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) Perform Following **[18]**

a) Convert the $[25]_{10}$ decimal in binary and calculate its 1's complement

b) 2's complement of 1011001

c) 10011×101

d) $1111 \div 10$

e) Solve (25-5) using 2's complement method

f) Convert the 15 and 18 in BCD

g) $1101 - 1001$

h) $101011 + 010110$

i) Multiply 1010110 and 101

OR

Q2) a) Design full adder with the help of K-Map. **[9]**

b) Describe the design of one bit magnitude comparator using k-Map. **[9]**

Q3) Draw the R-S flip flop configuration explain its truth table **[17]**

OR

Q4) a) Draw and explain 3 bit synchronous down counters **[6]**

b) Draw the circuits of JK flip flop along with the timing diagrams **[6]**

c) Depict Serial in Serial out shift register in detail **[5]**

P.T.O.

Q5) a) Differentiate PLA and PAL **[6]**

b) Describe the Counter type ADC **[6]**

c) Describe 7 segment Display in detail **[6]**

OR

Q6) a) Write a short note on programmable logic devices **[6]**

b) Explain any SRAM and ROM memories **[6]**

c) Describe LCD display device in detail **[6]**

Q7) a) Differentiate Serial port and parallel Port **[8]**

b) Describe one types of input and output devices of computer **[9]**

OR

Q8) Elucidate any 2 uses of sequential and combinational circuits in the field of printing. **[17]**

Total No. of Questions : 8] **SEAT No. :**

PB3703 **[Total No. of Pages : 2**

[6261]-111
S.E. (Robotics and Automation)
INDUSTRIAL ENGINEERING AND MANAGEMENT
(2019 Pattern) (Semester - IV) (211508)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Describe the elements of entrepreneurial eco system. **[5]**

b) Following data is available for XYZ company: **[12]**

Variable cost per Unit = Rs.16
Selling Price per unit = Rs. 34
Total units sold = 34000
Fixed cost= Rs.25000
Calculate:

i) PV ratio
ii) BEP in units
iii) BEP in sales
iv) Total Profit
v) Margin of Safety

OR

Q2) a) Describe the support organizations which helps an entrepreneurship (start ups) **[5]**

b) Following data is available for XYZ company: **[12]**

Variable cost per Unit= Rs.8
Selling Price per unit = Rs. 14
Total units sold = 50000
Fixed cost= Rs.12000
Calculate:

i) PV ratio
ii) BEP in units
iii) BEP in sales
iv) Total Profit
v) Margin of Safety

P.T.O.

Q3) a) Describe the following tools and techniques of Industrial Engineering **[8]**

i) Work study

ii) Micro motion study

iii) Value analysis

iv) Plant layout

b) Define Basic work content. Describe the factors which affects the basic work content (i.e.excess work content) **[9]**

OR

Q4) a) Describe Taylor Piece Wage System and Merrick Piece Wage System with suitable illustration. State the advantages and limitations of these systems. **[8]**

b) Define Job evaluation and Job specification. What are the different methods of Job evaluation? **[9]**

Q5) a) Define Method study. Explain the different factors to be considered while selecting the job for method study. **[9]**

b) Describe SIMO chart with suitable illustration and appropriate symbols. **[9]**

OR

Q6) a) Describe principles of motion economy related to workplace design with neat sketches. **[9]**

b) Describe Multiple activity chart with suitable illustration & appropriate symbols. **[9]**

Q7) a) Describe MTM with suitable illustration. **[8]**

b) Describe the following types of Rating **[10]**

i) Westinghouse system

ii) Synthetic Rating

OR

Q8) a) Describe the process to carry out work sampling study. State how the standard time is calculated using work sampling study. **[9]**

b) Describe Maynard Operation Sequence Technique with suitable illustration. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB-3704

[Total No. of Pages : 2

[6261]-112
S.E. (Robotics & Automation Engineering)
CONTROL SYSTEM ENGINEERING
(2019 Pattern) (Semester - IV) (211509)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6. and Q.7 or Q.8.***
2) ***Assume suitable data, if necessary.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) Explain Routh's array with stability criteria, state advantages and disadvantages of Routh's criteria. **[9]**

b) If G = K/S (S+6) (S+8) and H(S) = S+2 . Comment on stability. **[8]**

OR

Q2) a) What is stability? Explain stable, unstable, marginally and conditionally stable system with locations of roots in s plane. **[9]**

b) i) The System with Characteristics Equation $Q(S) = S^3 + 2KS^2 + (K + 2) S + 4 = 0$ find range of K for stability **[4]**

ii) Investigate the stability of system with Characteristics equation $Q(S) = S^5 + 5S^4 + 10S^3 + 10S^2 + 5S + 1 = 0$ **[4]**

Q3) a) Define phase margin and gain margin. Also draw a 40 db/dec line passing through w=1, 5 db till w=5. **[8]**

b) Derive the expression for Resonant Frequency and Resonant Peak. **[9]**

OR

Q4) a) Draw the polar plot for (S) = 1 + as **[8]**

b) Draw a typical frequency response of system and explain different frequency response specifications. **[9]**

P.T.O.

Q5) a) Explain digital control system in detail. Enlist its advantages and Applications. **[9]**

b) Explain the selection criteria used for PLC. **[9]**

OR

Q6) a) Explain PLC interfacing with I/O devices? What are the different types of command used in PLC. **[9]**

b) What is sampling? Explain the process of sampling with waveform. **[9]**

Q7) a) Design a lead compensator for the system with open loop transfer function **[11]**

G(S)=9/S(S+3) to meet following specifications

i) Steady state error for ramp input be less than or equal to 0.05

ii) Phase margin of at least 45 degree

b) Explain the Procedure to design of lead compensator using root locus.**[7]**

OR

Q8) a) Explain the feedback compensator with necessity of compensation. **[9]**

b) Explain the Procedure to design lead compensator using Bode diagram.**[9]**

Total No. of Questions : 8]

SEAT No. : [ ]

PB3705

[Total No. of Pages : 3

[6261]-113

S.E. (Robotics and Automation)

DESIGN OF MACHINE ELEMENT

(2019 Pattern) (Semester - IV) (211510)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Use of scientific calculator is allowed.***
3) ***Figures to the right side indicate full marks.***

Q1) a) Discuss the different types of threads used in power screw. **[6]**

b) Derive the expression Maximum Efficiency of a Square Threaded Screw. **[5]**

c) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20. **[7]**

OR

Q2) a) In a machine tool application, the tool holder is pulled by means of an operating nut mounted on a screw. The tool holder travel at a speed of 5 m/min. The screw has single start square thread of 48 mm nominal diameter and 8 mm pitch. The operating nut exerts a force of 500 N to drive the tool holder. The mean radius of the friction collar is 40 mm. The coefficient of friction at thread and collar surfaces is 0.15. Calculate power and efficiency. **[7]**

b) Explain concept of overhauling and self-locking screws. **[5]**

c) A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2, find: **[6]**

i) the torque required to rotate the screw;

ii) the stress in the screw; and

iii) the number of threads of nut in engagement with screw.

P.T.O.

Q3) a) Define the Following Terms **[4]**

i) Solid length

ii) Spring index

iii) Free length

iv) Spring rate

b) Deflection of Helical Springs of Circular Wire derive the expressions.**[6]**

c) A Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm^2. Also calculate the maximum shear stress induced. **[8]**

OR

Q4) a) Design a helical spring for a spring loaded safety valve (Ramsbottom safety valve) for the following conditions: Diameter of valve seat = 65 mm ; Operating pressure = 0.7 N/mm^2; Maximum pressure when the valve blows off freely = 0.75 N/mm^2; Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm^2 = 3.5 mm ; Maximum allowable stress = 550 MPa; Modulus of rigidity = 84 kN/mm^2; Spring index = 6. Draw a neat sketch of the free spring showing the main dimensions. **[8]**

b) Derive the relegation ship between Springs in Series and Parallel. **[6]**

c) Write a short Note on Surge in Spring. **[4]**

Q5) a) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4: 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **[9]**

b) Discuss Advantages and Disadvantages of Gear Drives. **[4]**

c) Explain different causes of gear tooth failure. **[4]**

OR

Q6) a) Explain the terms used in gears: **[4]**

i) Pressure Angle, and

ii) Module

b) How are the gears classified and what are the various terms used in spur gear terminology? **[5]**

c) A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate center distance between the shafts may be taken as 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. **[8]**

Q7) a) Explain along with fig Types of Rolling Contact Bearings. **[4]**

b) Write a short note on Reliability of a Bearing. **[5]**

c) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. **[8]**

OR

Q8) a) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20 × 106 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. **[7]**

b) How do you express the life of a bearing? What is an average or median life? **[4]**

c) Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 million of revolutions at 300 r.p.m. Assume uniform and steady load. **[7]**

Total No. of Questions : 8]

SEAT No. : ____

PB3706

[6261]-114

[Total No. of Pages :2

S.E. (Robotics & Automation Engg.)

METROLOGY AND QUALITY ASSURANCE

(2019 Pattern) (Semester- IV) (211511)

Time : 2½ Hours] ***[Max. Marks : 70***

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 side indicate full marks.***
4) ***Assume suitable data if necessary.***
5) ***Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.***

Q1) a) Define the following terms. **[8]**

i) Roughness

ii) Roughness Height

iii) Roughness width

iv) Waviness

v) Waviness height

vi) Waviness Width

vii) Primary Texture

viii) Secondary Texture

b) Explain concept of RMS and CLA value for surface roughness measurement. **[9]**

OR

Q2) a) Explain with neat sketch Tool Maker's Microscope. **[8]**

b) With neat sketch explain coordinate measuring machine. **[9]**

Q3) a) Differentiate between Random(Chance) Causes & Assignable(Special) Causes. **[9]**

b) Explain $\bar{x}$-Chart & P-Chart. **[9]**

OR

P.T.O.

Q4) a) The following table gives the number of defects in a casting used for making crank case of diesel engine, construct c-chart and comment on casting process. **[9]**

Casting No.	1	2	3	4	5	6	7	8	9	10
No. of defects (c)	15	11	25	10	12	20	15	10	17	13

b) Draw OC curve and explain following terms. **[9]**

i) Producer's Risk

ii) Consumer's Risk

iii) AQL

iv) LTPD/RQL

Q5) a) Explain Deming's approach towards Quality. **[8]**

b) List Seven QC tools & explain any three with neat sketch. **[9]**

OR

Q6) a) With nat sketch explain Juran's Trilogy. **[8]**

b) Draw and explain house of quality. **[9]**

Q7) a) State & Explain prerequisites for implementing ISO 9000 quality standards. **[9]**

b) Explain ISO 4000 & list its benefits in detail. **[9]**

OR

Q8) a) Explain in detail ISO 9000:2000 series standards. **[9]**

b) What is Quality audit and explain three types of quality audit? **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3707

[6261]-115

[Total No. of Pages :2

S.E. (Robotics and Automation Engineering)

COMPUTER GRAPHICS FOR ROBOTICS

(2019 Pattern) (Semester- IV) (211512)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) A quaternion q_1 rotates 30° about Y axis and quaternion q_2 rotates 90° about Y axis. Obtain the interpolation quaternion at parameter $t = 0.3$. **[12]**

b) With suitable examples, explain the application of natural neighbour method for 3D surface generation. **[5]**

OR

Q2) a) Use Lagrange method to determine y co-ordinates of a point having x-co-ordinate as 6 on a curve which is generated by using 4 data points having following co-ordinates: **[12]**

x	2	5	7	10
y	8	12	6	10

b) Explain the application of quaternions to obtain the combined roll, pitch and yaw motion of a robot gripper. **[5]**

Q3) a) Obtain x, y, and z co-ordinate of a point on the Bazier surface patch at $u = 0.3$ and $v = 0.7$ using following control points: **[9]**

$$\begin{bmatrix} (2,8,5) & (4,8,10) & (6,8,14) & (8,8,6) \\ (2,6,12) & (4,6,8) & (6,6,10) & (8,6,15) \\ (2,4,8) & (4,4,12) & (6,4,8) & (8,4,5) \\ (2,2,4) & (4,2,8) & (6,2,5) & (8,2,10) \end{bmatrix}$$

b) Obtain x-y co-ordinates of a point on Bezier curve at parameter value $t = 0.5$ considering control points as (1,1), (4,10), (8,2) and (14,15). **[8]**

OR

P.T.O.

Q4) a) Explain the applications of B spline and Bezier curves in robot path planning. **[7]**

b) Find the midpoint (i.e. point at parameter $t = 0.5$) of a Hermite cubic spline with two end points as (1,1) and (6,5) and corresponding tangent vectors are (0,4) and (4,0). **[10]**

Q5) a) A plane contains vectors $a = 2i + j - 3k$ and $b = 2i - j$. A point in the plane is (2,5,1). Obtain the equation of plane. **[10]**

b) A triangle has vertices $P_1(2,6)$, $P_2(6,9)$, $P_3(4,11)$. Determine whether point $P(5,8)$ lies inside the triangle, outside triangle or on the edge. If it is on the edge then mention that particular edge. **[8]**

OR

Q6) a) Obtain a point (P) in a plane parallel to XZ plane and containing point (1,1,1). Assume the values of arbitrary scalers for two vectors as 2 and 1 respectively. **[12]**

b) Write note on: Application of analytic geometry in robotics. **[6]**

Q7) a) What do you mean by an outer product? What are the properties of outer product? **[9]**

b) Explain the applications of applied geometric algebra for modelling of robotics physics. **[9]**

OR

Q8) a) Write note on: Geometric product for vectors **[9]**

b) Write short note on: Reflection and rotation **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3708

[Total No. of Pages : 3

[6261]-116

S.E. (Robotics and Automation Engineering)

INDUSTRIAL ELECTRONICS AND ELECTRICAL TECHNOLOGY

(2019 Pattern) (Semester - III) (211501)

Time : 2½ Hours] *[Max. Marks : 70*

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) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Draw interfacing diagram of temperature sensor (LM35) with ArduinoAtmega 328P. Output of LM35 is connected to Arduino analog input pin number A2. **[4]**

b) Explain the concept of PWM with waveform. **[6]**

c) Draw and explain interfacing of strain gauge with Arduino Atmega 328P. Write its algorithm. **[8]**

OR

Q2) a) What is ADC? Write features of ADC in AtMega 328P microcontroller. **[4]**

b) Explain following functions used in ADC **[6]**

i) analogRead() function;

ii) analog Write() function;

iii) analogReference() function

c) Draw and explain interfacing of LVDT with Arduino Atmega 328P. Write its algorithm. **[8]**

Q3) a) Draw and explain Speed-Armature current characteristics for DC series motor. **[4]**

b) Derive the torque equation of DC motor. **[6]**

c) Explain construction of DC generator along with its neat diagram. **[7]**

OR

P.T.O.

Q4) a) Draw and explain Torque-Armature current characteristics for DC series motor. **[4]**

b) Explain the following types of DC motors with the neat diagram. **[6]**

i) DC Series Motor;

ii) DC Shunt motor.

c) Explain the armature resistance control method used for controlling the speed of the DC motor. Explain with neat diagram. What are the drawbacks of that method? **[7]**

Q5) a) Explain power stages in three phase induction motor. **[4]**

b) A 6 pole, 50 Hz, 3-phase induction motor running at full load with 5% slip develops a torque of 155 N-m at the shaft. The friction and windage losses are 250 W, and stator iron losses amounts to 1600W. **[6]**

Calculate

i) Output Power;

ii) Rotor Copper loss;

iii) Efficiency at full load.

c) Explain working, principle of three-phase induction motor along with the neat diagram. **[8]**

OR

Q6) a) Draw and explain Torque-slip characteristics for three phase induction motor. **[4]**

b) The power input to the 550 V, 50 Hz, 6 pole, 3 phase induction motor running at 970 rpm is 45 kW. The stator losses are 1 kW and windage loss are 2 kW. **[6]**

Calculate

i) Slip;

ii) Rotor copper loss;

iii) Efficiency of motor.

c) What is the need of the starter? Explain the star-delta starter used to start three phase induction motor, with the neat sketch. **[8]**

Q7) a) Compare AC series and DC series motor in detail. **[4]**

b) Draw neat sketch of Universal motor and explain its working. **[6]**

c) Explain the construction and working of the permanent magnet stepper motor with neat diagram. **[7]**

OR

Q8) a) Write down two applications of the following motors. **[4]**

i) Stepper motor;

ii) BLDC motor.

b) Draw the sketch of shaded pole induction motor and explain its working. **[6]**

c) Explain construction and working of Linear Induction Motor with neat sketch. **[7]**

Total No. of Questions : 8]

SEAT No. :

PB4532

[Total No. of Pages :2

[6261]-117

S.E. (Robotics And Automation Engineering)

MANUFACTURING TECHNOLOGY

(2019 Pattern) (Semester-III) (211502)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) How to do you analysis of wire drawing operation. **[9]**

b) Compare direct extrusion process with indirect extrusion process. **[8]**

OR

Q2) a) Explain strip drawing operation in detail. **[9]**

b) Define extrusion ratio and discuss its significance in the process. **[8]**

Q3) a) List and explain fundamental principles involved in spot welding process. Also state its advantages and limitations. **[9]**

b) Explain ultrasonic welding process in detail. **[8]**

OR

Q4) a) Elaborate equipment/accessories needed to carry MIG operation. **[9]**

b) Write various welding defects. How prevention of welding defects are important? **[8]**

Q5) a) Explain with a neat sketch process of plasma arc machining. **[9]**

b) Compare conventional machining process to non - conventional machining process. Also write advantages and limitations of both processes. **[9]**

OR

P.T.O.

Q6) a) Discuss laser beam machining in detail. **[9]**

b) Explain working principle of ECM. **[9]**

Q7) Write a short note on:

a) Robotic arc welding process. **[6]**

b) Assembly of parts using robot. **[6]**

c) Application of robot for painting work. **[6]**

OR

Q8) Write a short note on:

a) Application of robotics in forging working operation. **[6]**

b) Utilization of robotics in casting process. **[6]**

c) Advantages of robotics in manufacturing and chemical industry. **[6]**

Total No. of Questions : 8]

SEAT No. : ____

PB-3709

[Total No. of Pages : 2

[6261]-118

S.E. (Robotics & Automation Engineering)

MATERIAL SCIENCE AND ENGINEERING METALLURGY

(2019 Pattern) (Semester - III) (211503)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8***
2) ***Assume Suitable data if necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Draw neat figures whenever necessary***
5) ***Use of scientific calculators is allowed.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) What is powder Metallurgy? Give its application? **[8]**

b) Explain Term: **[8]**

i) Refractory Metals.

ii) Cemented carbide tipped tools.

OR

Q2) a) Why it is necessary to control atmosphere during sintering? And also write down advantages of powder metallurgy. **[8]**

b) Write note on: **[8]**

i) Electrical Contact Materials.

ii) Self-lubricating bearings.

Q3) a) Write down the classification of steel on the basis of carbon content and also give two application of each. **[10]**

b) What are stainless steel? Give typical composition and two uses of various types of stainless steel. **[8]**

OR

P.T.O.

Q4) a) What is steel? What do you understand by eutectoid, hypereutectoid and hypoeutectoid steel? **[10]**

b) Write down effects of various parameters on structures and properties of cast irons. **[8]**

Q5) a) What is retained austenite? Why it is not desirable? **[10]**

b) Explain terms: **[8]**

i) Quenching.

ii) Carburizing.

OR

Q6) a) Explain the method of plotting TTT diagram and what information is obtained from this diagram? **[9]**

b) What is purpose of Tempering? Give its classification and explain types of tempering heat treatment process **[9]**

Q7) a) What is equivalent zinc of a brass? Explain its significance and usefulness. **[10]**

b) Write note on **[8]**

i) Composite materials.

ii) Super Alloys

OR

Q8) a) Write Note on Aluminum and its Alloy. **[9]**

b) Give composition and properties of any three bearing materials. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3710

[Total No. of Pages : 4

[6261]-119

S.E. (Mechanical/Automobile Engineering)/(Mechanical Sandwich)/ (Automation & Robotics Engg.)/(Mechatronics Engg.)

KINEMATICS OF MACHINERY

(2019 Pattern) (Semester - IV) (202047)/(217547)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

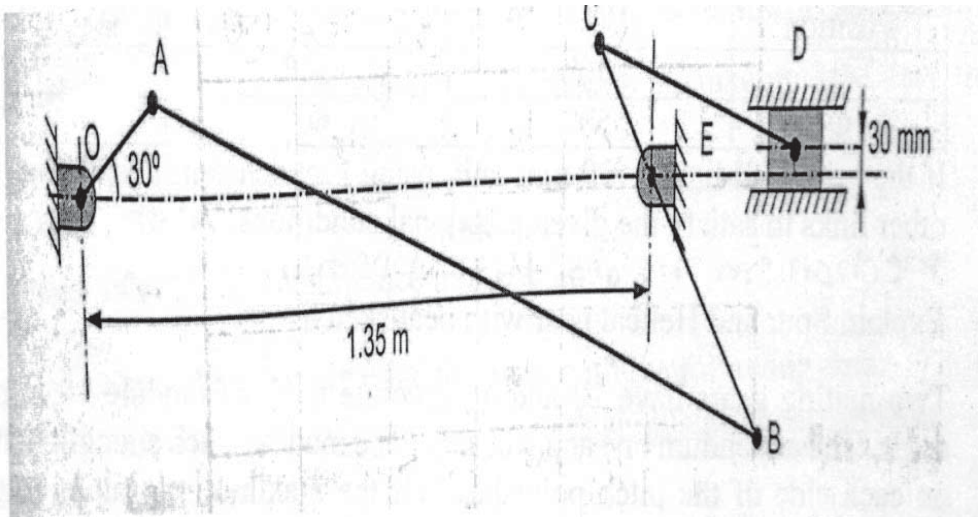
1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Explain With neat sketch Kennedy's theorem. **[5]**

b) A mechanism as shown in figure has the following dimensions: OA = 200 mm, AB 1500 mm, BC = 600 mm, CD = 500 mm and BE = 400 mm. Locate all the possible ICR by inspection, if crank OA rotates uniformly at 400 rpm clockwise, find **[13]**

i) Velocity of B,C and D

ii) Angular velocities of link AB, BC, CD



OR

Q2) a) Explain velocity image principle With neat sketch. **[5]**

b) The following data relate to a slider crank mechanism, crank radius AB = 0.50m is rotating in clockwise direction, connecting rod length = 2 m long, crankshaft speed = 600 rpm. When crank is turned 450 from inner dead center (I.D.C) find, **[13]**

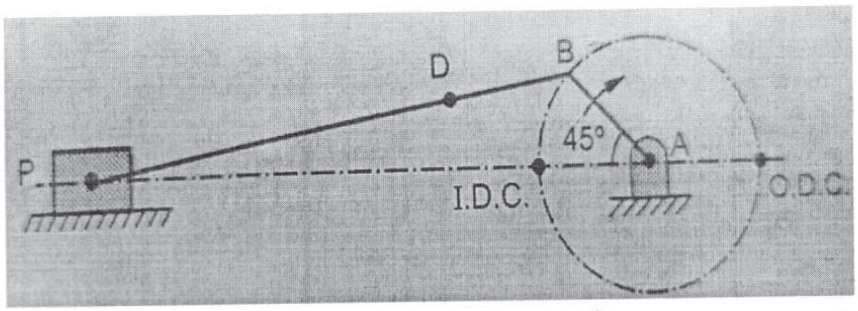
P.T.O.

i) The velocity of piston P

ii) The angular velocity connecting rod BP

iii) Velocity of point D on the connecting rod which is at a distance of 0.5 m from B.

iv) Acceleration of point D and angular acceleration of connecting rod.



Q3) a) Explain in short **[6]**

i) Type synthesis.

ii) Number synthesis.

iii) Dimensional synthesis

b) For function $y = e^x$ for the range of $0 \leq x \leq 4$ having three precision points, Determine the Chebychev spacing using graphical approach only. Also determine the values of θ and ϕ if starting positions of θ and ϕ are 40º and 50° Also consider $\Delta\theta = 65º$ and $\Delta\phi = 100°$ required to be considered. **[11]**

OR

Q4) a) Explain with neat sketches three position synthesis of four bar mechanism inversion method. **[6]**

b) Design a four-bar mechanism with input link l_2, coupler link l_3, and output likn l_4. Angles θ and Φ for three successive positions are given below:**[11]**

Position	1	2	3
θ	40º	55º	70º
Φ	50º	60º	75º

If the grounded link l_1 = 30 mm unit, using Freudenstein's equation, find out lengths of other links to satisfy the given positional conditions. Also draw the synthesized mechanism in its first position.

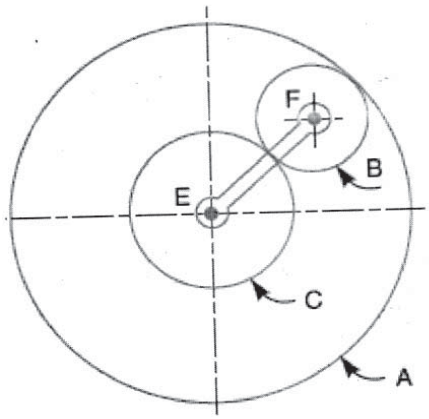
Q5) a) Explain Spur and Helical gear with neat sketch. **[5]**

b) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, legth of the path of contact. arc of contact and contact ratio. **[12]**

OR

Q6) a) Give comparison between Bevel gear nad Worm gear. **[5]**

b) An epicyclic gear train consist of three gears A, B and C as shown in fig. The number of teeth on annular gear A is 74 and on gear C is 34. The gear B meshes with both gear A and C and it is carried on an arm F which rotates about the centre A at 25 rpm. If the gear A is fixed, find the speed of gear B and C. **[12]**



Q7) a) Define automation. Why automation is important for any industry? **[6]**

b) A cam operates a roller, inline reciprocating fol1ower while rotating at 300 rpm. The further specifications are: Minimum radius of the cam = 25mm, Lift of follower = 30mm, Diameter of roller = 15mm Angle of lift =120° (Nature of lift is S.H.M.), Outer dwell angle = 30°, Angle of return = l50° (Nature of return is uniform acceleration and retardation where acceleration is equal to retardation in magnitude).Draw the cam profile.

[12]

OR

Q8) a) Explain concept of artificial intelligence in automation. **[6]**

b) A cam is to be designed for a knife edge follower with the following data: **[12]**

i) Cam lift = 40 mm during 90º of cam rotation with simple harmonic motion.

ii) Dwell for the next 30°

iii) During the next 60° of cam rotation, the follower returns to its original position with uniform velocity.

iv) Dwell during the remaining, 180°

Draw the profile of the cam when the line o stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

◀▶ ◀▶ ◀▶

Total No. of Questions : 8]

SEAT No. :

PB-3711

[Total No. of Pages : 3

[6261]-120

S.E. (Mechanical & Automobile Engineering)

APPLIED THERMODYNAMICS

(2019 Pattern) (Semester - IV) (202048)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn whenever necessary.***
4) ***Make suitable assumption whenever necessary.***
5) ***Scientific calculator is allowed.***

Q1) a) Explain the various engine variables influences abnormal combustion in SI engines. **[8]**

b) Classify fuel injection system used in CI Engines and explain working of Bosch fuel pump with neat sketch. **[9]**

OR

Q2) a) Draw p-θ diagram and explain the different stages of combustion in SI engine. **[8]**

b) What is ignition delay in CI engines? Explain any three factors affecting the ignition delay. **[9]**

Q3) a) During the trial of a single cylinder, four stroke oil engine, the following results were obtained: Cylinder diameter = 20cm, stroke = 40cm, mean effective pressure = 6bar,Torque = 407 Nm, Speed = 250 rpm, Fuel consumption = 4 kg/hr., C.V. of fuel = 43 MJ/kg, Cooling water flow rate = 4.5 kg/min, Air used per kg of fuel =30 kg of air / kg of fuel, rise in cooling water temperature = 45 °C, Temperature of exhaust gases = 420 °C, Room temperature = 20 °C, Mean specific heat of exhaustgas = 1 kJ/kg-K, Specific heat of water = 4.18 kJ/kg-K.Calculate, IP, BP and draw heat balance sheet for the test. **[10]**

b) Write short note on Indian Driving Cycle and European Driving Cycle.**[8]**

OR

P.T.O.

Q4) a) In a test of a four-cylinder petrol engine of 75mm bore and 100mm stroke, the following results were obtained at full throttle at a constant speed and with a fixedsetting of the fuel supply of 0.082 Kg/min. **[10]**

BP with all cylinder working = 15.24 kW,

BP with cylinder I is cut-off = 10.45 kW,

BP with cylinder 2 is cut-off = 10.38 kW,

BP with cylinder 3 is cut-off = 10.23 kW,

BP with cylinder 4 is cut-off = 10.35 kW,

Find,

i) Total indicated power of the engine,

ii) Total friction power and

iii) Indicated thermal efficiency of the engine if the CV of the fliel is 44MJ/Kg.

b) Define IP, BP and FP. Explain Willan's Line Method to find Friction Power. **[8]**

Q5) a) Explain with neat sketch pump assisted thermo-syphon water-cooling systems. Differentiate between air-cooling and water-cooling system.**[9]**

b) Explain with neat sketch wet sump lubrication system. Enlist the required property of a good lubricant. **[8]**

OR

Q6) a) Explain battery ignition system and state its advantages and disadvantages. **[9]**

b) What is turbocharging? Explain with neat sketch any one turbocharger. **[8]**

Q7) a) A single stage, single cylinder reciprocating air compressor delivers air at 6 bars. The rate of air taken in during suction is 12 kg/min. at 1.013 bar and 27°C. the compression take place with the index of 1.25. **[9]**

Calculate,

i) Work required for delivering 1 kg of air.

ii) Actual power required to run the compressor if η_{mech} = 80%.

b) What is multi-stage compression? Justify it save power required for compression as compared to single stage compression. **[9]**

OR

Q8) a) A single acting single cylinder reciprocating air compressor has stroke volume 0.012 m^3 at 111rpm. The suction pressure and temperature are 1.013 bar and 27 °C respectively. The delivery pressure is 8 bar. **[9]**

Calculate,

i) Temperature after compression

ii) Compression work done required if compression is with index 1.4.

iii) Isothermal efficiency.

b) Give the classification of compressor? Differentiate between reciprocating and rotary compressor. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3712

[Total No. of Pages : 3

[6261]-121

S.E. (Automobile & Mechanical Engineering)

FLUID MECHANICS

(2019 Pattern) (Semester - IV) (202049)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Explain Eulerian method of Flow Description. **[4]**

b) Show that the streamlines and equipotential lines form a net of mutually perpendicular lines. **[6]**

c) Velocity of a fluid flow medium is given by,

$V = (10x^2y)i + (15xy)j + (25t + 3xy)k$

Find acceleration of medium at (1, 2, –1) *m* and $t = 0.5$ sec. **[7]**

OR

Q2) a) Explain Circulation and Vorticity. **[4]**

b) State weather the flow of liquid given by $u = 5x$ & $v = -5y$ is **[6]**

a) Continuous

b) Rotational

c) The velocity components in flow are given by, $u = 6y$ and $v = -6x$. **[7]**

Find:

i) Whether the flow is possible?

ii) Stream function ψ.

P.T.O.

Q3) a) Explain HGL and TEL. **[4]**

b) Derive expression for discharge through venturimeter. **[6]**

c) A Laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/s. Determine the mean velocity and radius at which this occurs. Also calculate the velocity at 40mm from the wall the pipe. **[8]**

OR

Q4) a) Explain following terms. **[4]**

i) Potential head,

ii) Velocity head

b) Derive expression for velocity distribution for flow in fixed parallel plates. **[6]**

c) A vertical pipe conveying oil of relative density 0.8, two pressure gauges has been installed at A and B where diameters are 160 mm and 80 mm respectively. Point A is 2m above point B. The pressure gauge readings have been shown that the pressure at B is greater than at A by 0.981 N/cm^2. Neglecting losses find the flow rate through the pipe. **[8]**

Q5) a) Explain factors affecting the growth of Boundary layer. **[4]**

b) Explain Streamlined Body and Bluff Body. **[6]**

c) A pipe line of 600 mm diameter is 1.5 km long, to increase the discharge, another pipeline of same diameter is introduced parallel to the first in the second half of the length. If f = 0.04 and head at the inlet is 300 mm, determine increase in discharge. Neglect minor losses in pipelines and f are a Darcy friction factor. **[8]**

OR

Q6) a) A solid sphere of 400 mm diameter is completely immersed in the flow of sea water. Velocity of flow is 1.2 m/s and specific gravity of sea water is 1.02 5. Determine the drag force on a sphere. Assume C_D = 0.6. **[4]**

b) Show that corresponding to the maximum power transmission through pipe, the power transmission efficiency is 66.67%. **[6]**

c) The velocity distribution in the boundary layer is, **[8]**

$$\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)2$$

Where δ = Thickness of boundary layer.

Determine:

i) Ratio of (δ^*/δ)

ii) ratio of (θ/δ)

Q7) a) Explain dimensional homogeneity. **[4]**

b) Explain Mach Model Law and Give its applications. **[4]**

c) Using Buckingham π theorem, show that the velocity through a circular orifice is given by : **[9]**

$$V = \sqrt{2gH}\,\Phi\left(\frac{D}{H}, \frac{\mu}{\rho VH}\right)$$

Where H = Head, ρ = Mass Density, g = Acceleration due to gravity, D = Diameter of orifice, μ = Coefficient of Viscosity.

OR

Q8) a) How are the repeating variables selected for dimensional analysis? **[4]**

b) Explain Geometric Similarity. **[4]**

c) The Efficiency η of a fan depends on density p, the dynamic viscosity μ of the fluid, the angular velocity ω, diameter D of the rotor and discharge Q. Obtain expression of η in terms of dimensional parameter. **[9]**

Total No. of Questions : 8]

SEAT No. :

PB3713

[Total No. of Pages :2

[6261]-122

S.E. (Automobile and Mechanical / Automation & Robotics)

MANUFACTURING PROCESSES

(2019 Pattern) (Semester- IV) (202050)

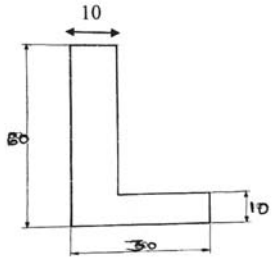
Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume Suitable data if necessary.***

Q1) a) what is forming Limit diagram? How to draw forming limit diagram? **[8]**

b) Find conter of pressure of the component as shown in fig. **[10]**



OR

Q2) a) What is center of Pressure? Enumerate the procedure to calculate center of pressure. **[8]**

b) Washer with 10 mm internal hole and 25 mm outside diameter is to be made from a strip of 2 mm thickness. Considering elastic recovery of the material, find **[10]**

i) Clearance

ii) Blanking die opening size

iii) Blanking punch size

iv) Piercing punch size

v) Piercing die opening size.

Assume clearnace to be 5% of the stock thickness. Also calculate maximum cutting force if ultimate shear strength is 450 N/mm^2.

P.T.O.

Q3) a) Discuss the factors on which selection of welding processes depends. **[5]**

b) Explain GTAW process with neat sketch. **[6]**

c) Explain SAW process with neat sketch. **[6]**

OR

Q4) a) enumerate the function of coating in flux coated electrode? **[5]**

b) State and explain any three welding defects with their causes. **[6]**

c) Explain the seam welding process with neat sketch. **[6]**

Q5) a) Compare Thermoplastics and Thermosetting plastics. **[6]**

b) What are the typical mold temperature for compression molding? What is the most common mold materials? **[6]**

c) What are some of the attractive features of transfer molding process? **[6]**

OR

Q6) a) Write short note on Thermoforming process in plastics. **[6]**

b) Describe screw type injection molding with neat sketch. **[6]**

c) Explain Compression molding process in plastics with neat sketch. **[6]**

Q7) a) Write short note on polymer matrix composites. **[5]**

b) Explain filament winding process in details with sketch. **[6]**

c) write short note on metal matrix composites. **[6]**

OR

Q8) a) Write a note on “Nano-composites”. **[5]**

b) Discriminate between ceramic matrix, metal matrix and polymer matrix composites. **[6]**

c) Explain compression molding process of composite manufacturing. **[6]**

Total No. of Questions : 9]

SEAT No. :

PB3714

[Total No. of Pages : 5

[6261]-123

S.E. (Automobile & Mechanical Engineering)/(Mechanical Sandwich)/ (Automation & Robotics Engineering)/(Mechatronics Engineering)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - IV) (207002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Solve Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicates full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Choose the correct option :

a) If the data presented in the form of frequency distribution then the arithmatic mean $\bar{x}$ is given by **[1]**

i) $\frac{\sum fx}{N}$ ii) $\frac{1}{N}\sum f\left|x-\bar{x}\right|$

iii) $N\sum fx$ iv) $\frac{\sum fx^2}{N}$

b) From the given information standard deviation of $x = 4$, standard deviation of $y = 1.8$, coefficient of regression of y on x is 0.32. The coefficient of correlation is **[2]**

i) 0.711 ii) 0.622

iii) 0.743 iv) 0.543

c) The mean and variance of binomial probability destribution are 36 and 3 rspectively. Number of trials n is given by **[2]**

i) 42 ii) 36

iii) 48 iv) 24

P.T.O.

d) The tangent vector to the curve $\bar{r} = t\bar{i} + t^2\bar{j} + t^3\bar{k}$ at $t = 1$ is _____. **[2]**

i) $\bar{i} + \bar{j} + \bar{k}$ ii) $\bar{i} + 2\bar{j} + 3\bar{k}$

iii) $\bar{i} - 2\bar{j} + 3\bar{k}$ iv) $\bar{i} - 2\bar{j} - 3\bar{k}$

e) Solution of $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$ representating the vibration of string of length l fined at end points with initial and boundary conditions **[1]**

I) $y(0, t) = 0$

II) $y(l, t) = 0$

III) $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$

IV) $y(x, 0) = f(x)$

The most general solution $y(x, t)$ is **[1]**

i) $(c_1 \cos mx + c_2 \sin mx)(c_3 \cos cmt + c_4 \sin cmt)$

ii) $(c_1 e^{mx} + c_2 e^{-mx})$

iii) $(c_1 e^{-my} + c_2 e^{-my})$

iv) None of these

f) The value $\nabla \cdot \bar{r} =$ _____. **[1]**

i) 0 ii) 1

iii) 2 iv) 3

Q2) a) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. Obtain the First Four central moments, also find β_1 and β_2. **[5]**

b) Obtain correlation coefficient for the following data **[5]**

x	200	500	400	700	800
y	12	18	16	21	10

c) Fit a straight line of the form $y = mx + c$ for the following data **[5]**

x	0	1	2	3	4	5	6	7
y	–5	–3	–1	1	3	5	7	9

OR

Q3) a) The first four moments about the value 25 are –1.1, 89, –110 and 23300. Calculate the first four central moments. **[5]**

b) Obtain regression lines for the following data **[5]**

x	6	2	10	4	8
y	9	11	5	8	7

c) Use least square method to fit a straight line for the following data. **[5]**

x	0	2	4	6	8	12	20
y	10	12	18	22	20	30	30

Q4) a) A can hit the target 1 out of 4 times, B can hit the target 2 out of 3 times, c can hit the target 3 out of 4 times. Find the probability of at least two hit the target. **[5]**

b) On an average a box containing 10 articles in Likely to have 2 defectives. If we consider a consignment of 100 boxes. How many of them are expected to have three or less defectives? **[5]**

c) In a certain factory turning out razor blades, there is a small chance of 1/500 for any blade to be defective. The blades are supplied in a packet of 10. Use poisson distribution to calculate the approximate number of packets containing no defective and two defective blades, in a consignment of 10,000 packets. **[5]**

OR

Q5) a) Variable x takes the value 0, 1, 2, 3, 4, 5 with probability of each as $\frac{1}{15},\frac{2}{15},\frac{3}{15},\frac{3}{15},\frac{5}{15},\frac{1}{15}$. Find expectation of x. **[5]**

b) The mean weight of 500 students is 63 kgs and the standard deviation is 8 kgs. Assuming that the weights are normally destributed, find how many students weight 52 kgs? **[5]**

[Given at $z_1 = +1.44 = A_1 = 0.4049$ and $z_2 = +1.13 = A_2 = 0.4251$]

c) A set of five similar coxins are tossed 210 times and the result is

No of heads	0	1	2	3	4	5
Frequency	2	5	20	60	100	23

Test the hypothesis that the data follow a bionomial destribution. Given $x^2_{5,0.05} = 11.07$. **[5]**

Q6) a) Find the angle between tangent to the curve $x = t^2+1$, $y = t^2-1$, $z = t$ at $t = 1$, $t = 2$. **[5]**

b) Show that $\bar{F} = \left(y^2 \cos x + z^2\right)\bar{i} + \left(2y \sin x\right)\bar{j} + 2zx\bar{k}$ is irrotational. Find scalar potential function ϕ. Such that $\bar{F} = \nabla\phi$. **[5]**

c) If $\bar{F} = \left(2xy + 3z^2\right)\bar{i} + \left(x^2 + 4yz\right)\bar{j} + \left(2y^2 + 6zx\right)\bar{k}$ evaluate $\int_C \bar{F}.d\bar{r}$ where c is curve $x = t$, $y = t^2$, $z = t^3$ joining (0, 0, 0) & (1, 1, 1). **[5]**

OR

Q7) a) Find the directional derivative of $\phi = x^2yz^3$ at (2, 1, –1) along the vector $i - \bar{j} + \bar{k}$. **[5]**

b) Solve any one. **[5]**

i) Show that $\nabla^2\left[\nabla \cdot \left(\frac{\bar{r}}{r^2}\right)\right] = \frac{2}{r^4}$.

ii) If $\rho\,\bar{E} = \nabla\phi$ prove that $\bar{E} \cdot \text{curl}\,\bar{E} = 0$.

c) Evaluate $\iint_s (\nabla \times F) \cdot d\bar{s}$ where $\bar{F} = \left(x^3 - y^3\right)\bar{i} - xyz\bar{j} + y^3\bar{k}$ and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the surface $x = 0$. **[5]**

Q8) a) A homogeneous rod of conducting material of length 10 cm has its ends kept at zero temperature and the temperature initially is **[8]**

$u(x, 0) = x, \quad 0 \le x \le 50$

$= 100–x, \quad 50 \le x \le 100$

Find the temperature $u(x, t)$ at any time t.

b) A tightly streatched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by $y(x, 0) = y_o \sin^3\left(\frac{\pi x}{l}\right)$. If it is released from rest from this position, find the displacement y at any distance x from one end and at any time t. **[7]**

OR

Q9) a) A rectangular plate with insulated surfaces is 10 cm wide and so long compaired to its width that it may be considered infinite in length without introducing an appreciable error. If temperature along short edge $y = 0$ is given **[8]**

$$u(x, 0) = 100 \sin\left(\frac{\pi x}{10}\right), 0 \le x \le 10$$

While two edges $x = 0$ and $x = 10$ as well as other short edge are kept at 0°C - find the steady state temperature $u(x, y)$.

b) Use Fourier sine transform to solve **[7]**

$$\frac{\partial u}{\partial t} = 2\frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0 \text{ subject to}$$

i) $u(0, t) = 0$

ii) $u(x, 0) = e^{-x}, x > 0$

iii) u and $\frac{\partial u}{\partial x} \to 0 \text{ as } x \to \infty$

Total No. of Questions : 8]

SEAT No. :

PB3715

[Total No. of Pages : 5

[6261]-124

S.E. (Automobile & Mechanical/Mechanical S.W. / Automation & Robotics Engineering)

SOLID MECHANICS

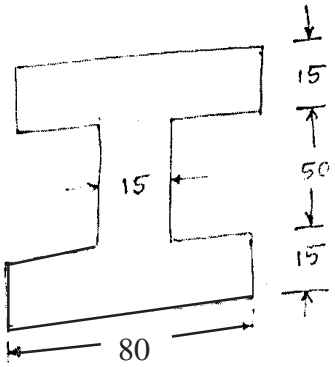
(2019 Pattern) (Semester - III) (202041)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

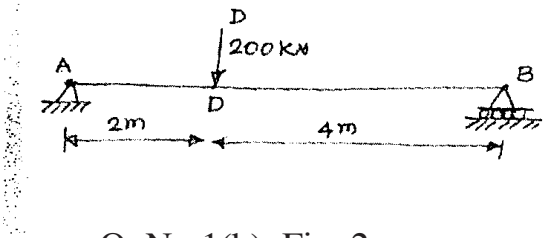
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Use Graph Paper for Graphical solution.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) A beam of cross section shown in Fig. 1 is bent about horizontal axis. If a bending moment is 12 kN-m determine the stresses at the top fiber and also at 35 mm from top fiber. Draw bending stress distribution diagram.**[8]**



Q. No 1(a), Fig. 1

b) A horizontal beam as shown in Fig. 2 is hinged at point (A) and supported at roller at point (B) it carries a vertical load of 100kN at Point (D). Determine deflection at point (D) by taking E = 210 GPa, I = 2×10^8 mm^4.**[9]**

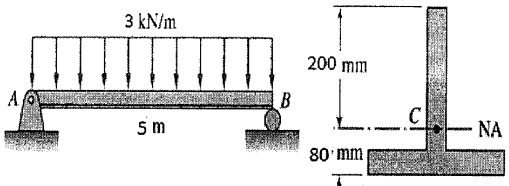


Q. No 1(b), Fig. 2

OR

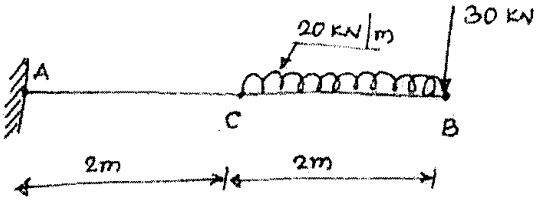
P.T.O.

Q2) a) Determine the maximum tensile and compressive bending stresses in the beam shown in Fig. 3. Take I = 30×10^6mm^4 **[8]**



Q. No 2(a), Fig. 3

b) Calculate slope and deflection at point (B) for a given beam shown in Fig. 4. Take E = 200 GPa and I = 3×10^8mm^4. **[9]**



Q. No 2(b), Fig. 4

Q3) a) A hollow steel rod 300 mm long is to be used as torsional spring. The ratio of inside to outside diameter is 1:2. The required stiffness of this spring is 200 N-m /degree. Determine the outside diameter of the rod. If value of G is 8×10^4 N/mm^2. **[9]**

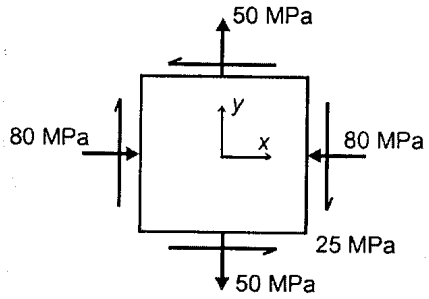
b) A rectangular steel bar 40 mm × 50 mm in cross-section, pinned at each end and subjected to axial compression. The bar is 2 m long and E = 200 GPa. Determine the buckling load using Euler's formula and corresponding stress. **[9]**

OR

Q4) a) Determine the diameter of a solid shaft which will transmit 300 kW at 400 rpm. The maximum shear stress should not exceed 40 N/mm^2 and twist should not be more than 10 in a shaft length of 3 m. The modulus of rigidity of the material is 1×10^5 N/mm^2. **[9]**

b) A hollow cast iron column of 400 mm external diameter and 300 mm internal diameter is used as a column 4 m long with both ends hinged. Determine the safe compressive load the column can carry without buckling using Euler's formula. E = 0.7×10^5 N/mm^2, FOS = 4, Crushing Stress (σ_c) = 500 N/mm^2. **[9]**

Q5) a) The state of plane stress at a point is represented by the stress element shown in Fig. 5. Determine the stresses acting on an element oriented 30° clockwise with respect to the original element. **[9]**



Q. No 5(a), Fig. 5

b) A solid shaft is subjected to bending moment of 20 kN-m and twisting moment 10 kN- m. Find the diameter of the shaft according to **[9]**

1) Maximum distortion energy theory

2) Maximum strain energy theory

Take stress at elastic limit = 210 MPa, Poisson's ratio = 0.3 and Factor of safety = 2.5.

OR

Q6) a) A point is subjected to a tensile stress of 250 MPa in the horizontal direction and another tensile stress of 150 MPa in the vertical direction. The point is also subjected to a simple shear stress of 30 MPa, such that when it is associated with the major tensile stress, it tends to rotate the element in the clockwise direction. What is the magnitude of the normal and shear stresses inclined on a section at an angle of 20° with the major tensile stress. Use Mohr's Circle Method. **[9]**

b) A bolt is subjected to an axial pull of 10 kN & a transverse shear force of 5 kN. Determine the diameter of the bolt required based on. **[9]**

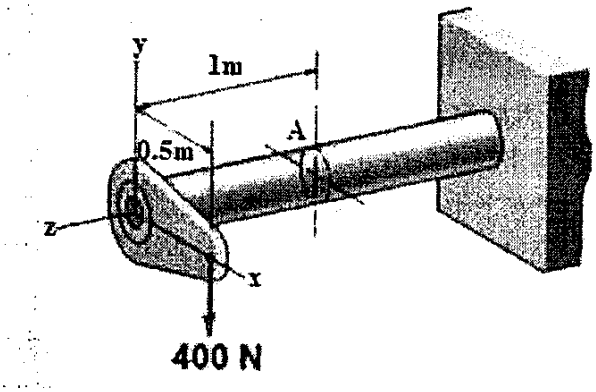
1) Maximum distortion energy theory

2) Maximum shear stress theory

3) Maximum principal stress theory

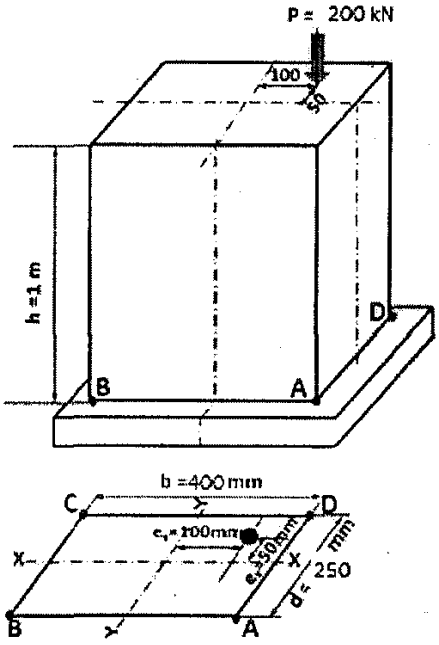
Take elastic limit in simple tension = 200 MPa, Poisson's ratio = 0.2 and Factor of safety = 3.

Q7) a) A 100 mm diameter bar with a built in bracket is fixed to the wall and loaded as shown in Fig. 6. Determine the principal stresses at the top extremity of the vertical diameter for the section marked A. **[8]**



Q. No 7(a), Fig. 6

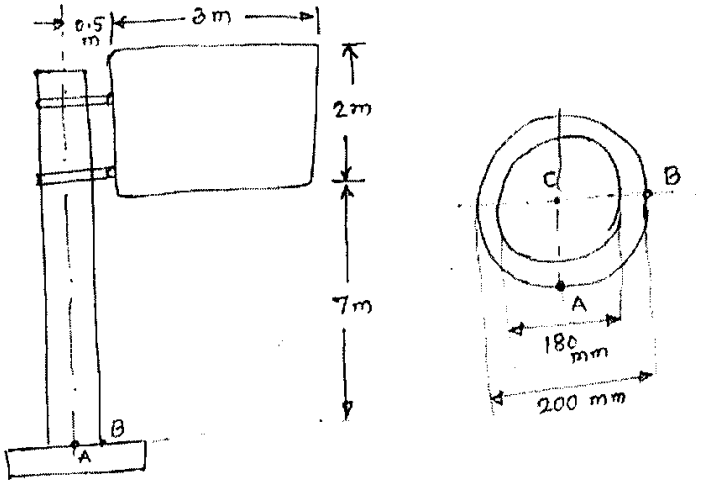
b) A Load of 100 kN load is applied at a point of X = 100mm and Y = 50 mm from X and Y axis as shown in fig. 7 on a short vertical post of rectangular cross section of 400 mm × 250 mm and height 1 m. Determine the stress applied at point A, B, C and D. And its nature of stress. **[9]**



Q. No 7(b), Fig. 7

OR

Q8) A signboard shown in Fig. 8 of dimensions 3.0 m × 2 m is supported by a hollow circular pole having outer diameter 200 mm and inner diameter 180 mm. The sign is offset 0.5 m from the centerline of the pole and its lower edge is 7.0 m above the ground. Determine the principal stresses and maximum shear stresses at points A and B at the base of the pole due to a wind pressure of 4.0 kPa against the signboard. **[17]**



Q. No 8, Fig. 8

✪ ✪ ✪

Total No. of Questions : 8]

SEAT No. :

PB-4463

[Total No. of Pages : 2

[6261]-125
S.E. (Automobile & Mechanical / Automation & Robotics / Mechanical Sandwich)
SOLID MODELING & DRAFTING
(2019 Pattern) (Semester - III) (202042)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

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

Q1) a) Explain Constructive Solid Geometry in detail with advantages and disadvantages. **[9]**

b) What is Geometry & Topology? Also differentiate between Sweep & Loft? **[8]**

OR

Q2) a) Explain the concept of Parametric Solid Modeling with its advantages and disadvantages. **[9]**

b) Write note on any two of the following. **[8]**

i) Design for Manufacturing (DFM)

ii) Design for Assembly (DFA)

iii) Design for Safety (DFS)

Q3) a) Given a square with coordinate with coordinates points A (0,3), B (3,3), C (3,0) and D (0,0). Apply the translation with distance 1 towards X axis and 1 with towards Y axis. Obtain the new coordinates of the square.**[9]**

b) Compare between translation, scaling, rotation. **[9]**

OR

P.T.O.

Q4) a) Explain with neat sketches the any two types of coordinate system? **[8]**

b) What is Geometric Projection? Explain any two types of projections in details. **[10]**

Q5) a) Explain CAD conversion with its advantages and disadvantages? **[9]**

b) Explain CAD Kernels in details with its different types. **[9]**

OR

Q6) a) Explain Computer Aided Engineering with its benefits and applications. **[9]**

b) Explain the concept of CAD Geometry Clean-up with suitable example? **[8]**

Q7) a) Explain the concept of Product and Manufacturing Information in details with neat sketch? **[9]**

b) Explain CAD customization with advantages, disadvantages and applications. **[9]**

OR

Q8) a) Write a short note on any two of the following. **[10]**

i) Application Programming Interface (API).

ii) Coding / Scripting for customization.

iii) CAD API and macros.

b) Explain CAD Automation with process working and advantages. **[8]**

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Total No. of Questions : 8]

SEAT No. :

PB3716

[6261]-126

[Total No. of Pages :4

S.E. (Mechanical Sandwich) (Automobile & Mechanical Engg.)

ENGINEERING THERMODYNAMICS

(2019 Pattern) (Semester- III) (202043)

Time : 2½ Hours] *[Max. Marks : 70*

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 electronic calculator is allowed.***
6) ***Use of steam table is allowed.***

Q1) a) Define: **[4]**

i) Dead State

ii) Exergy

b) The metal block of 5 kg in mass with specific heat 0.4 kJ/kgK at temperature 450 K is thrown in a water tank at temperature 20°C. Calculate the change in entropy of the universe. **[8]**

c) State and prove the Principle of Increase of Entropy. **[5]**

OR

Q2) a) Show that entropy is property of the system. **[5]**

b) A heat engine receives 600 kJ of heat from a high temperature reservoir at a temperature of 1000K during a cycle. It converts 150 kJ of this heat into net work and rejects the remaining 450 kJ heat to a low temperature sink at 300 K temperature. Determine if this heat engine violates the second law of Thermodynamics on the basis of **[8]**

i) Clausius Inequality

ii) Carnot Theorem

c) Define: **[4]**

i) Available Energy

ii) Unavailable Energy

P.T.O.

Q3) a) Define dryness fraction. Draw neat sketch of throttling calorimeter and derive the formula for dryness fraction measurement by throttling calorimeter. **[6]**

b) Rankine cycle working between a boiler pressure of 30 bar and condenser pressure of 0.5 bar. The mass leaving the boiler and entering the turbine having a dryness fraction of 0.85 determine the following. **[8]**

i) Rankine cycle efficiency

ii) Turbine work

iii) Pump work

Pb	h_f (kJ/kg)	h_{fg} (kJ/kg)	h_g (kJ/kg)	S_f (kJ/kgK)	S_{fg} (kJ/kgK)	S_g (kJ/kgK)
30 bar	1008.3	1794	2802.3	2.646	3.538	6.184
Pc	h_f (kJ/kg)	h_{fg} (kJ/kg)	h_g (kJ/kg)	S_f (kJ/kgK)	S_{fg} (kJ/kgK)	S_g (kJ/kgK)
0.5 bar	340.6	2305.4	2646	1.091	6.504	7.595

c) Explain Rankine vapour power cycle with the help of T-S diagram. **[4]**

OR

Q4) a) 2 kg of steam is at 8 bar pressure and 0.85 dry. Determine **[6]**

i) Total enthalpy of steam

ii) Total volume of the steam

iii) Total entropy of steam.

This steam is further heated at the same pressure till it becomes completely dry saturated. Estimate a total change in enthalpy to the steam during the process.

b) A throttling calorimeter is used to measure dryness fraction of the steam in the steam mains which has steam flowing at a pressure of 8 bar. The steam after passing through the calorimeter is at 1 bar pressure and 115 deg centigrade temperatures. Calculate the dryness fraction of the steam in the mains. Take specific heat of superheated steam as 2.1 kJ/kg K.**[8]**

c) Write difference between Carnot and Rankine cycle. **[4]**

Q5) a) Define the following terms. **[4]**

i) Mass fraction

ii) Mole fraction

b) Explain Boy's Gas Calorimeter with a neat schematic diagram. **[5]**

c) Determine the Air-Fuel ratio and the theoretical mass of air required for complete combustion of a fuel containing 85% of Carbon, 8% of Hydrogen, 3% of Oxygen, 1% of Sulpher and remaining ash by mass. If 40% of excess air is used, what volume of air at 27deg centigrade and 1.05 bar pressure, does this represent per kg of fuel. **[8]**

OR

Q6) a) Define: **[4]**

i) Stoichiometric Air

ii) Stoichiometric Mixture

b) Write a note on 'Orsat Apparatus' used for volumetric analysis of Dry Exhaust Gases. **[5]**

c) Coal with following mass analysis is burnt with 100% excess air. C=74%, H_2=4.3%, S=2.7%, N2=1.5%, H_2O=5.5%, O_2=5%, Ash =7%. Find the moles of gaseous product if 100 kg of fuel are burnt. **[8]**

Q7) a) Give the function and location of the following (Any two)? **[4]**

i) Super heater

ii) Air pre heater

iii) Fusible plug

b) A water tube boiler produces 6000 kg/hour of steam at a pressure of 10.5 bar and consumes coal at a rate of 10.83 kg/min. The steam produced has a temperature of 250°C. The calorific value of fuel is 30500 kJ/kg. The water initially enters into the economizer and has temperature of 49°C at the economizer outlet. Determine **[8]**

i) Boiler Efficiency

ii) Equivalent Evaporation

c) Derive the formula for: **[6]**

i) Equivalent Evaporation

ii) Boiler efficiency

OR

Q8) a) Define steam generator. Write down classification of boiler. **[4]**

b) The following results obtained from boiler trial: **[8]**

i) Feed water per hour = 700 kg at 27°C

ii) Steam pressure = 8 bar of dryness 0.97

iii) Coal consumption = 100 kg/hr

iv) C.V. of coal = 25000kJ/kg

v) Unburnt coal collected = 7.5 kg/hr

vi) Flue gas formed per kg of fuel = 17.3 kg at 327°C (Cp of flue gas = 1.025 kJ/kgK)

vii) Room temperature = 16°C

Draw heat balance sheet kJ/min basis & Boiler Efficiency.

c) Explain the boiler heat balance sheet with formulas used. **[6]**

Total No. of Questions : 8]

SEAT No. :

PB-4744

[Total No. of Pages : 3

[6261]-127R

S.E. (Automobile & Mechanical / Mechanical Sandwich / Automation & Robotics)

ENGINEERING MATERIALS AND METALLURGY

(2019 Pattern) (Semester - III) (202044)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of Logarithmic tables, slide rule, electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is solid solution? Explain substitutional & interstitial solid solution? Explain Hume-Rothery's rule for solid solubility? **[10]**

b) What is nucleation? What are its types? Explain solidification of pure metal? **[7]**

OR

Q2) a) Draw the cooling curves & show the application of Gibbs phase rule in each region. **[8]**

i) Pure metal
ii) Binary solid solution alloy
iii) Binary Eutectic alloy
iv) Off-eutectic binary alloy

b) Draw neat labelled Iron - Iron carbide equilibrium diagram & write 3 transformation reactions in it? **[9]**

Q3) a) What are the various transformation products of austenite? Explain any one in detail with respect to transformation mechanism, temperature, characteristics and structure? Arrange the transformation products in descending order with respect to hardness **[9]**

b) What is retained austenite? What are its effects? Differentiate between TTT & CCT curve? **[9]**

OR

P.T.O.

Q4) a) What is hardenability? Which test is used to find it? Explain the test in detail? Enlist Surface hardening heat treatments? **[9]**

b) Differentiate between : **[9]**

i) Annealing & Normalizing

ii) Austempering & Martempering

iii) Induction hardening & Flame hardening

Q5) a) Mention the names of alloying elements used and the amount in present of alloy used in the following steels **[8]**

i) C40

ii) AISI 1040

iii) Fe 410 K

iv) St 42

v) Fe E 270

vi) 80 T 11

vii) 25 C 5

viii) T 75 W 18 Cr 4 V 2

b) What is stainless steel? Classify it with application? Explain sensitization of stainless steel? **[9]**

OR

Q6) a) What is Cast Iron? Enlist its important properties & applications? Write composition, properties & application of gray cast Iron? **[9]**

b) Draw the microstructure of **[8]**

i) Nodular cast iron

ii) Gray cast iron

iii) Malleable cast iron

iv) White cast iron

Q7) a) Suggest suitable nonferrous material for the following. Give typical composition of it. **[10]**

i) Cartridge case

ii) Measuring Tape

iii) Gun Barrel

iv) Coins

v) Bell

b) What is Additive Manufacturing? What are the advantages of it over conventional manufacturing? Give the properties, composition & application of any two materials used for it. **[8]**

OR

Q8) a) What is Age Hardening? Explain steps involved in it? Which are the factors influencing aging process? **[9]**

b) What are the requirements for good bearing alloys? Enlist important bearing alloys? Explain any two with properties, composition & application. **[9]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

PB-3718

[6261]-128

S.E.(Automobile & Mechanical/Mechanical Sandwich)

ELECTRICAL AND ELECTRONICS ENGINEERING

(2019 Pattern) (Semester - III) (203156)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Derive the emf equation of a DC machine; mentioning about all the parameters involved. **[6]**

b) A 250 V, 4 pole lap wound DC shunt motor takes no-load current of 4 A when running at 1200 rpm. The resistance of armature winding is 0.1 Ω and shunt field winding is 125 Ω. The brush drop is 2 V. If it takes current of 61 A on full-load, calculate its full-load speed. Assume that the flux gets weakened by 5% on full- load condition due to armature reaction. **[6]**

c) How is the direction of rotation of a DC shunt motor reversed? Discuss the concept of load torque and hence explain the dynamics of motor and load combination briefly. **[6]**

OR

Q2) a) Explain the following methods of controlling speed of a DC shunt motor; mentioning each of their application: **[6]**

i) Flux control method

ii) Armature voltage control method

b) A 200 V, 4 pole lap wound DC shunt motor has 800 conductors on its armature. The resistance of armature winding is 0.5 Ω and that of shunt field winding is 200Ω. The motor takes current of 21 A and flux per pole is 30 mWb. Find the speed and gross torque developed in motor. **[6]**

c) Explain regenerative braking in a DC shunt motor with the help of neat diagrams. Also enlist any two applications of regenerative braking. **[6]**

P.T.O

Q3) a) Differentiate between squirrel cage and slip ring type induction motors; mentioning significant points. **[6]**

b) A 4 pole, 50 Hz, three phase induction motor has rotor resistance and reactance of 0.025 Ω and 0.1 Ω respectively. Determine **[6]**

i) synchronous speed

ii) the speed and the corresponding slip at which maximum torque occurs

iii) the additional resistance per phase that must be connected in series with the rotor to obtain maximum torque at starting

iv) the value of slip at which maximum torque occurs and corresponding speed if an external resistance of 0.025 Ω is connected in series with the rotor.

c) Describe in brief the voltage control method for the speed control of a three phase induction motor. **[5]**

OR

Q4) a) Derive the generalised torque equation of a three phase induction motor and hence obtain the condition for maximum torque. **[6]**

b) The useful full load torque of a three phase, 6 pole, 50 Hz induction motor is 162.84 N-m. The rotor is running at a speed of 970 rpm. Calculate **[6]**

i) motor output

ii) copper losses in rotor

iii) % efficiency of the motor, if mechanical torque lost in windings and friction is 20.36 N-m and stator losses are 830 W.

c) Draw a neat sketch and explain the operation of a Direct On Line (DOL) type starter used for starting a three phase induction motor. **[5]**

Q5) a) Elaborate the functioning of main subsystems of an Electric Vehicle (EV). **[6]**

b) Discuss the major challenges faced by EV Technology for its growth. **[6]**

c) Explain the impact made by usage of EVs on power grid. **[6]**

OR

Q6) a) Define Electric Vehicle (EV). State its types and explain any one type of EV. **[6]**

b) Explain configuration of Series Hybrid Vehicle and state its advantages and disadvantages. **[6]**

c) Explain Vehicle to Grid (V2G) Technology with the help of block diagram. **[6]**

Q7) a) Elaborate construction and working of Lithium Iron Phosphate (LFP) battery. **[6]**

b) Explain use of a supercapacitor in an EV; stating its necessity and advantages. **[6]**

c) Explain Vehicle Battery Management System (BMS) with the help of block diagram. **[5]**

OR

Q8) a) Elaborate the factors used in selection of energy storage devices in case of EVs. **[6]**

b) Explain characteristics and speed control of BLDC motor. **[6]**

c) Discuss the working of hydrogen fuel cell and its suitability in EVs. **[5]**

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

PB-4756

[6261]-128A
S.E.(Automation & Robotics Engineering)
INDUSTRIAL ELECTRONICS
(2019 Pattern) (Semester - III) (202522)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) State and explain the types of programming languages used in PLC. **[6]**

b) State the types of timers. Explain on delay timer operation with diagram **[6]**

c) Draw a ladder diagram for stepper motor control. **[6]**

OR

Q2) a) Explain the rules for constructing the ladder diagram of PLC **[6]**

b) Explain the types of counters with their timing diagram. **[6]**

c) Draw the ladder diagram for traffic light controller for following Switch 11 is used to start and 12 is used to stop the cycle. There will be three lamps red, yellow and green lamps as output. **[6]**

Q3) a) Explain MODBUS Protocol used in PLC. **[6]**

b) State the need of HMI in industrial Automation **[6]**

c) What are the functions of HMI **[5]**

OR

Q4) a) Explain the types of HMI? **[6]**

b) List out the Communication Protocols used in PLC. Explain any two. **[6]**

c) Discuss about RS 485 Serial Communication **[5]**

P.T.O

Q5) a) Explain the types of models in Batch Process. **[6]**

b) Develop PLC Programming Batch Process ladder logic program according to logic given below, **[6]**

i) Ingredient A is sent to the tank first by energizing solenoid 1. The flow meter gives one pulse for every gallon of flow. Solenoid Valve will be open until 200 gal has poured in.

ii) After ingredient A is in the tank, 200 gal of ingredient B should be added. The process of adding follows the same procedure as ingredient A.

iii) Once step 2 is done, the mixer motor starts and runs for 10s.

iv) After mixing is complete. solenoid 3 should open. let the mixed batch goes to the finished tank.

v) When the tank is empty, the low-level sensor turns ON to open solenoid 3 to close and restarts the process again.

c) Define recipe as per ANSI/ISA S88 standard. Explain its types **[6]**

OR

Q6) a) What is Extrusion? Explain in detail types of extrusion? **[6]**

b) Develop ladder logic program for Multiple Pumps Control according to the logic given below: **[6]**

i) The start/stop push button is provided for control of the two input pump motors P1 and P2.

ii) The Start/Stop pushbutton station is operated to control pump P1.

iii) When the tank is full drain pump motor P3 is started automatically and runs until the low-level sensor is actuated.

iv) After 3 fillings of the tank by pump P1 control automatically shifts to pump P2.

v) The operation of the start/stop pushbutton now controls pump P2.

vi) After 3 fillings of the tank by pump P2, the sequence is repeated.

c) Explain in brief (a) Batch Process (b) Discrete Control. **[6]**

Q7) a) Compare CMOS and TTL logic family. **[6]**

b) Define the following terms: **[6]**

i) Power Dissipation

ii) Propagation delay

iii) Noise Margin

c) Explain with a neat diagram CMOS NOR gate. **[5]**

OR

Q8) a) Explain the concept of Tristate logic. **[6]**

b) What is logic family? Give comparisons between TTL, ECL and CMOS logic families. **[6]**

c) Explain with a neat diagram CMOS inverter. **[5]**

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Total No. of Questions : 8]

SEAT No. :

PB-3719

[Total No. of Pages : 3

[6261]-129

S.E. (Mechanical - Sandwich Engineering)

FLUID MECHANICS AND MACHINERY

(2019 Pattern) (Semester - IV) (202062)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Explain major and minor losses in the pipe with fig and formulae in detail. **[8]**

b) Derive an expression for maximum power transmitted through the pipe. **[8]**

OR

Q2) a) Derive an expression of velocity and Shear stress distribution for laminar flow between fixed Parallel plates. **[8]**

b) Power P developed by a water turbine on rotational speed N operating head H, diameter D, breadth B of runner, density ρ and viscosity μ of fluid show that **[8]**

$$P = \rho D^5 N^3 \phi\left(\frac{H}{D}, \frac{B}{D}, \frac{\rho D^2 N}{\mu}\right)$$

Q3) a) A jet of water of diameter 60 mm strikes a curved plate at its centre with a velocity of 18 m/s. The curve plate is moving with velocity of 6 m/s in the direction of jet. The jet is deflected through an angle of 165 degree : find (i) the force exerted by the jet on the plate, ii) work done by the jet on the plate per second, (iii) power of the jet, and (iv) efficiency of the jet. **[10]**

b) Prove that the condition for maximum efficiency (V = 3u) for a jet of water strikes at centre of a curved vane also finds an expression for maximum efficiency. **[8]**

P.T.O.

OR

Q4) a) A Pelton wheel has 2.5m of diameter operates under a following conditions

Net Head = 300m

Speed = 300rpm

Jet deflection angle = 165°

Cv = 0.98, Jet Diameter = 0.2 m

Relative velocity at outlet = 0.9 times relative velocity at inlet. Mechanical efficiency = 95% Calculate the power delivered by the runner, speed ratio , Hydraulic Efficiency, Overall efficiency and Draw velocity triangle. **[10]**

b) Define Gross Head, Net Head, Jet Ratio, Run Away Speed, volumetric efficiency, Hydraulic Efficiency, Mechanical Efficiency and Overall Efficiency related to Pelton wheel. **[8]**

Q5) a) Explain unit quantities in reaction turbine. **[6]**

b) For the Francis turbine following data is available **[8]**

shaft power = 130kW

Net Head = 9m, Speed = 120 RPM,

Overall efficiency = 75%,

Hydraulic efficiency = 90%,

Velocity of flow at inlet = $1.15\ (H)^{½}$

Maximum absolute velocity at inlet = $3.45(H)^{½}$ assume radial discharge at exit,

Find

i) Guide blade angle and moving vane angle at inlet

ii) Diameter of runner at inlet

c) Draw Velocity Triangles of Francis Turbine. **[4]**

OR

Q6) a) A Kaplan turbine operates at a discharge of 77 m^3/s. The runner diameter and hub diameter are 4.2m and 1.5 m respectively. Taking the speed ratio of 2.1. **[8]**

Determine :

i) The net head,

ii) The power developed and

iii) The specific speed.

Assume the mechanical and hydraulic efficiency of 88% and 92% respectively and no whirl at outlet.

b) Write difference between Impulse turbine and Reaction turbine. **[5]**

c) Explain details classification of Hydraulic turbines. **[5]**

Q7) a) A centrifugal pump is running at 1000 r.p.m. The outlet vane angle of the impeller is 30° and velocity of flow at outlet is 3 m/s. The pump is working against a total head of 30 m and the discharge through the pump is 0.3 m^3 /s. If the manometric efficiency of the pump is 75%, **[8]**

Determine :

i) the diameter of the impeller and

ii) the width of the impeller at outlet.

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

i) Suction head

ii) Delivery head

iii) Static head

iv) Virtual head

v) Manometric head

c) Explain cavitation and NPSH in pump. **[5]**

OR

Q8) a) The internal and external diameter of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the flow velocity and work done by the impeller per unit weight of water. **[7]**

b) Explain working principle of centrifugal pump with figure. **[7]**

c) What is Priming? Explain methods of priming in pump. **[4]**

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Total No. of Questions : 8]

SEAT No. :

PB-3720

[Total No. of Pages : 2

[6261]-130
S.E.(Mechanical Sandwich)
MANUFACTURING ENGINEERING
(2019 Pattern) (Semester - IV) (202063)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory i.e. Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) a) How do you classify the different weld positions? Discuss with neat sketch. **[5]**

b) What is the importance of flux in welding operation? Explain different types of fluxes used. **[6]**

c) Describe the different types of flames used in oxyacetylene welding with the type of metal to be welded. **[6]**

OR

Q2) a) What are the effects of DCSP, DCRP and AC on the deposition of welding bead. **[5]**

b) Explain GTAW (Gas Tungsten Arc Welding) process with neat sketch. **[6]**

c) Illustrate with neat sketches common types of welded joints. Also discuss various welding positions. **[6]**

Q3) a) What are the types of chips generated? Explain their favorable conditions to generate. **[6]**

b) The Taylor's tool life equation for machining Mild steel with HSS cutting tool is given by $VT^n = C$, where n and C are constants: **[6]**

V (m/min) 35 45

T (min) 60 20

Calculate

i) n and C

ii) recommend the cutting speed for desired tool life of 50 Minutes.

c) Explain any one method of taper turning with neat sketch. How to calculate taper angle? **[6]**

P.T.O

OR

Q4) a) What are the types of tool failure? Explain flank wear and crater wear. **[6]**

b) Explain the relation between tool life and cutting velocity. Which other factors effects on tool life? **[6]**

c) What are the materials used for cutting tool? Explain Single point cutting tool geometry with neat sketch. **[6]**

Q5) a) Draw a neat sketch of Radial Drilling Machine and explain various motions of tool head can be adopted? **[5]**

b) Explain following Milling operations with suitable sketch: **[6]**

i) T-slot Milling

ii) Face Milling

c) Compare Up milling and Down milling operations with sketch. **[6]**

OR

Q6) a) Explain vertical milling machine with neat sketch. **[5]**

b) Index for 51 divisions by compound indexing using following Brown and Sharpe Plate. **[6]**

Plate 1 - 15, 16, 17, 18, 19, 20 holes

Plate 2 - 21, 23, 27, 29, 31, 33 holes

Plate 3 - 37, 39, 41, 43, 47, 49 holes

c) Explain any three drilling operations. **[6]**

Q7) a) Explain the followings in relation to grinding wheel **[6]**

i) Loading

ii) Glazing &

iii) Dressing

b) Explain the Principle of centreless grinding with neat sketch. **[6]**

c) Classify broaching machines. Discuss advantages and disadvantages of broaching. **[6]**

OR

Q8) a) Explain the Standard Marking System of a grinding wheels. **[6]**

b) Draw a neat sketch of broach and name its different parts. **[6]**

c) Write a note on “Mounting of Grinding Wheels” **[6]**

Total No. of Questions : 8]

SEAT No. :

PB-3721

[Total No. of Pages : 3

[6261]-131
S.E.(Mechanical Sandwich)
THERMAL ENGINEERING
(2019 Pattern) (Semester - IV) (202061)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables, slide rule, Steam table, Psychrometric Chart. And electronic pocket calculator is allowed.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary.***

Q1) a) Define the following terms **[8]**

i) Due point depression

ii) Relative humidity

iii) Wet bulb depression

iv) Absolute Humidity

b) Explain on the Psychrometric Chart following Processes **[9]**

i) Sensible Cooling and Sensible Heating

ii) Humidification and Dehumidification

OR

Q2) a) How the air conditioning systems are classified and explain the year-round air- conditioning system with neat sketch. **[8]**

b) Atmospheric air with dry bulb temperature of 30 °C and wet bulb temperature of 17 °C is cooled to 15 °C without changing its moisture content. Find **[9]**

i) Original relative humidity

ii) Final relative humidity

ii) Final wet bulb temperature.

P.T.O

Q3) a) Explain Briefly Otto cycle with the help of P-V & T-S diagram, and derive an expression for ideal efficiency of Otto cycle. **[9]**

b) How gas turbines are classified and explain Open cycle gas turbine and closed cycle gas turbine with neat sketch. **[9]**

OR

Q4) a) Explain gas turbine cycle with reheating and derive expression for thermal efficiency. **[9]**

b) Calculate the ideal air-standard cycle efficiency of a petrol engine operating on Otto cycle. The cylinder bore is 60 mm, a stroke is of 80 mm and the clearance volume is of 26 cm^3. assume $\gamma = 1.4$. **[9]**

Q5) a) Explain the supercharging and turbocharging with neat sketch. **[8]**

b) Explain with neat sketch battery ignition system. **[9]**

OR

Q6) a) What is necessity of cooling the engine, what is effect of undercooling and overheating of an engine. **[8]**

b) What is necessity of lubrication system and what are different types Lubrication systems? **[9]**

Q7) a) What are the different methods of emission control in SI engine? **[9]**

b) Explain Normal combustion and abnormal combustion Phenomena in SI engine. **[9]**

OR

Q8) a) Explain stages of combustion in C I engine with P - θ diagram **[9]**

b) In a test of a single-cylinder, four-stroke **[9]**

Diesel engine, the following data were recorded.

Indicated mean effective pressure = 755 kPa

cylinder diameter = 10 cm

piston stroke = 15 cm

engine speed = 480 rpm

brake wheel diameter = 62.5 cm

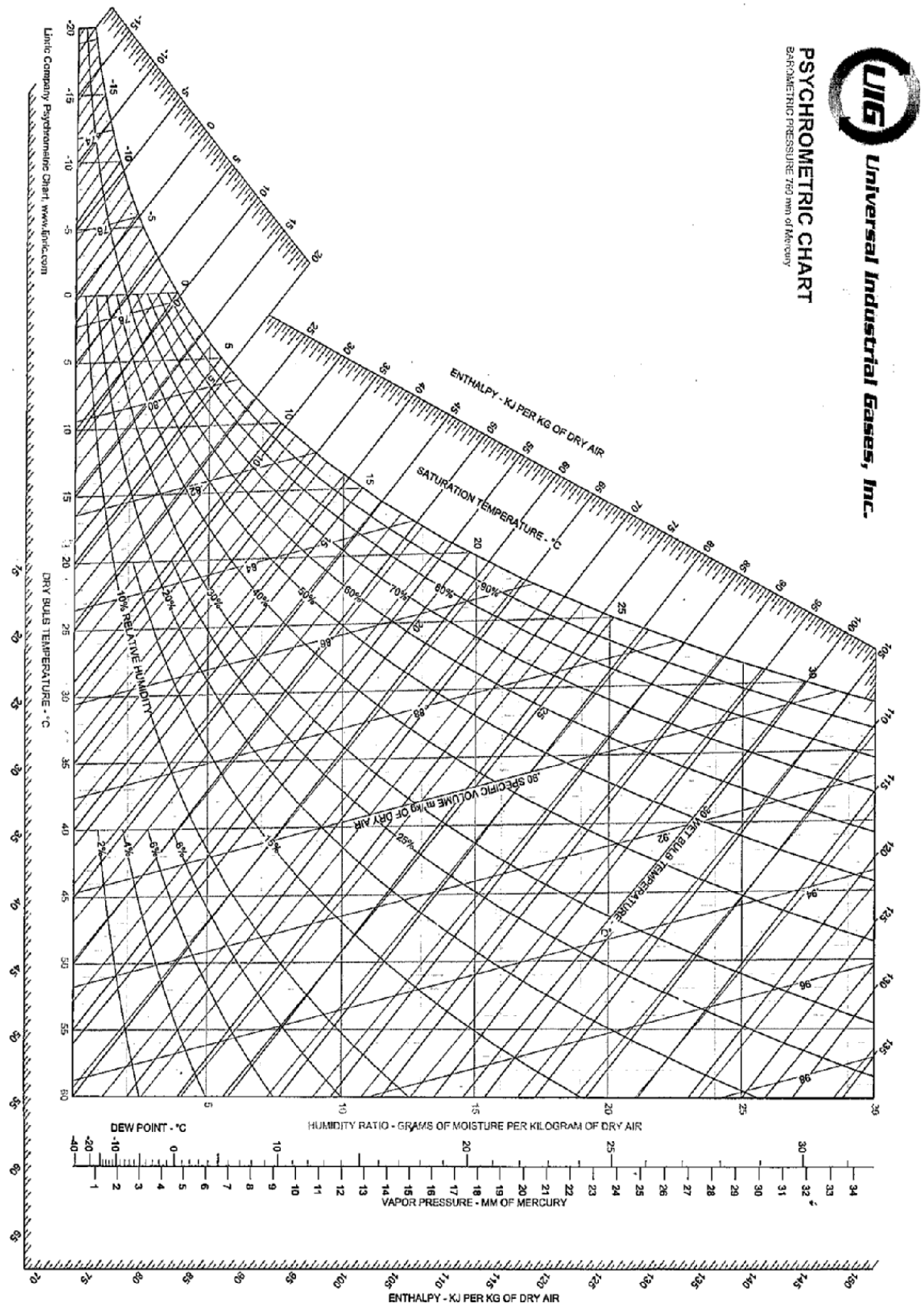
net load on the brake wheel = 170 N

Calculate

i) indicated power

ii) brake power, and

iii) the mechanical efficiency of the engine.


Universal Industrial Gases, Inc.
PSYCHROMETRIC CHART
BAROMETRIC PRESSURE 760 mm of Mercury
Linric Company Psychrometric Chart, www.linric.com
DRY BULB TEMPERATURE - °C
ENTHALPY - KJ PER KG OF DRY AIR
SATURATION TEMPERATURE - °C
10% RELATIVE HUMIDITY
.80 SPECIFIC VOLUME m³/kg OF DRY AIR
WET BULB TEMPERATURE - °C
HUMIDITY RATIO - GRAMS OF MOISTURE PER KILOGRAM OF DRY AIR
DEW POINT - °C
VAPOR PRESSURE - MM OF MERCURY
ENTHALPY - KJ PER KG OF DRY AIR

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Total No. of Questions : 8]

SEAT No. :

PB-3722

[Total No. of Pages : 3

[6261]-132

S.E. (Automation and Robotics)

PRINCIPLES OF ROBOTICS

(2019 Pattern) (Semester - IV) (202524)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer four questions from the following.***
2) ***Draw neat labeled diagrams wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of non programmable electronic calculator is permitted.***
5) ***Assume Suitable/Standard data if necessary.***

Q1) a) Classify the robot gripper from the view point of its control. Sketch and explain a mechanical gripper used for robots. **[4]**

b) Sketch and explain a pneumatic manipulator control circuits used for robots. **[6]**

c) Distinguish between two-point and three-point centering of robot gripper. Explain any two types of gripper used for robots. **[8]**

OR

Q2) a) Discuss the design considerations for robot end-effectors in industrial use. **[4]**

b) Suggest which type of gripper is suitable for following application and justify. **[6]**

i) Industrial welding applications

ii) Pick & Place

c) Write short notes on : **[8]**

i) Magnetic grippers.

ii) Adaptive Grippers.

P.T.O.

Q3) a) Explain sensor selection and design consideration for robotic application. **[4]**

b) Discuss response, accuracy and sensitivity in relation to robot sensors. Explain the working of proximity and range sensors. **[6]**

c) Distinguish between tactile and no-tactile sensors. Sketch and explain the working of an acoustic sensor. **[7]**

OR

Q4) a) What are the different types of sensor? Classify them. Sketch and explain the use of vision sensor. **[4]**

b) What are safety sensors? Discuss the use of light curtain in industrial robots. **[6]**

c) Sketch and explain the working of optical encoder and specify its application. **[7]**

Q5) a) What are homogeneous transformations of coordinates? Write the homogeneous transformation matrix for translation in 3D space. **[4]**

b) Discuss the various inputs to an inverse kinematics of 2 DOF robots. **[6]**

c) A point P (8, 4 and 1) is attached to a robo frame and subjected to following transformation. Find the coordinate of point relative to reference frame. **[8]**

i) Rotation of 90° about Z-axis.

ii) Followed by rotation of 90° about Y-axis.

iii) Followed by translation of [4, –3, 7].

OR

Q6) a) Discuss the major parameters of DH convention for robot manipulator. **[4]**

b) A frame F has been moved 8 units along y-axis and 4 units along z axis of reference frame. Find new location of frame. **[6]**

$$F = \begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

c) Explain the geometric based inverse kinematic analysis of two joints robot. **[8]**

Q7) a) Discuss the relative merits and demerits of different textual robot languages. Explain the different program instructions. **[4]**

b) Write a program to write below letters by Robot using VAL Language for Figure 7-C. **[6]**

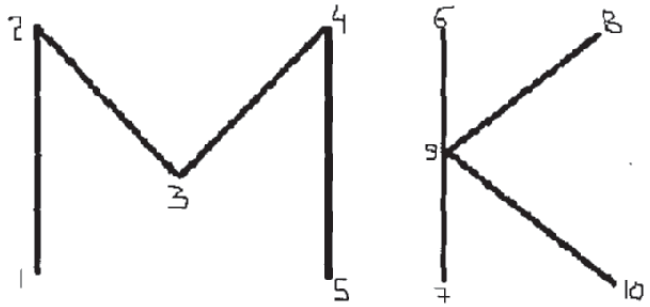

Figure 7-C

c) State characteristics of work which promote application of robots. Discuss robot application for assembly and inspection. **[7]**

OR

Q8) a) What is robot software and explain common software elements of a robot? **[4]**

b) Sketch and explain with suitable example "A Robot Program as a path in Space". **[6]**

c) Enumerate the non-manufacturing areas where robots are expected to be used. Discuss robot application for welding and machine loading. **[7]**

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Total No. of Questions : 8]

SEAT No. : ____

PB-3723

[Total No. of Pages : 2

[6261]-133
S.E. (Automation and Robotics)
FLUID AND THERMAL ENGINEERING
(2019 Pattern) (Semester - IV) (202523)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer four questions from the following.***
2) ***Draw neat labeled diagrams wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of non programmable electronic calculator is permitted.***
5) ***Assume Suitable/Standard data if necessary.***

Q1) a) Explain major losses and derive equation for finding out losses due to friction. **[9]**

b) Two reservoirs at different elevations are connected with a compound pipe of 1 km total length; consisting of two sections. First section connected to higher level reservoir is 500 m long and 200 mm in diameter. Other half is connected to lower level reservoir and has 100 mm diameter. Darcy - Weisbach friction factors for the pipes are 0.019 and 0.02 respectively if velocity of flow of water in the second setion is 1.5 m/s. Find the difference in water levels in the reservoirs considering all losses. Find the rate of flow of water also. **[9]**

Find diameter of a single uniform diameter pipe to replace the above pipe line to carry same discharge, Take $f = 0.018$ for this pipe.

OR

Q2) a) What happens when pipes are connected in series and in parallel. Explain the concept of equivalent pipe. **[9]**

b) Two reservoirs containing water have difference of levels of 70m and are connected by a 250mm diameter pipe which is 4 km long. The pipe is tapped midway between reservoirs and water is drawn at rate of 0.04 m^3/sec. Assuming friction factor = 0.04, determine rate at which water enters in the lower reservoir. **[9]**

Q3) a) What are the advantages and disadvantages of: **[8]**

i) Butterfly Actuator

ii) Globe Valve.

b) Write a short note on: Hydraulic Actuators. **[9]**

P.T.O.

OR

Q4) a) Define control valve. Explain the classification of control valve. **[8]**

b) Discuss the desired characteristics of control valves. **[9]**

Q5) a) What is an air compressor? Explain the roots blower compressor with neat sketch. **[8]**

b) A single stage, single acting reciprocating air compressor delivers 0.7 kg of air per min at 6 bar. The suction, temperature and pressure are 25°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150mm respectively. The clearance is 3% of swept volume. Assuming index of compression and expansion to be 1.3, find: **[9]**

i) Volumetric efficiency of the compressor

ii) Power supplied to drive the compressor if mechanical efficiency is 85%.

iii) Speed of the compressor (R.P.M.).

OR

Q6) a) Explain Vane type Compressor with neat sketch. **[8]**

b) Determine the size of the cylinders for a single acting single stage compressor consuming 35kW. Also calculate, mean effective pressure. Intake conditions are 1 bar and 15°C and polytropic index is 1.3, speed is 100 rpm and mean piston speed is 152 m/min, delivery pressure is 6 bar. Also calcu1ate isothermal power. Neglect clearance. **[9]**

Q7) a) Write a short note on 'Electronic cooling system'. **[9]**

b) A plane wall is 15 cm thick of surface area 4.5m^2 Thermal conductivity of the wall is 9.5 W/mK. The inner and outer surface temperature of the wall are maintained at150°C and 45°C respectively. Determine, **[9]**

i) Heat flow rate across the wall

ii) Temperature gradient in the flow direction

iii) Temperature of surfaces at 5 cm and 10 cm away from the inner surface.

OR

Q8) a) Explain the modes of heat transfer: Conduction, Convection and Radiation. **[9]**

b) A horizontal plate (K = 30 W/mk) 600mm × 900mm × 30mm is maintained at 300°C. The air at 30°C flows over the plate. If the convective heat transfer coefficient over the plate is 22 W/m^2k and 250 W heat is lost from the plate by radiation, calculate the bottom surface of the plate.**[9]**

Total No. of Questions : 8]

SEAT No. :

PB3724

[Total No. of Pages :3

[6261]-134

S.E. (Automation & Robotics Engineering)

ELECTRICAL TECHNOLOGY

(2019 Pattern) (Semester- III) (202521)

Time : 2½ Hours] ***[Max. Marks : 70***

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 side indicate full marks.***
4) ***Assume suitable data if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Explain working principle of a capacitor start and run motor with the help of a suitable diagram. Also state it's any two applications. **[6]**

b) Sketch the torque-slip characteristic of a three-phase induction motor. Explain its nature. What is the effect of increasing the rotor resistance on this characteristic? **[6]**

c) Draw and explain the equivalent circuit of a three-phase induction motor. **[6]**

OR

Q2) a) List the methods of speed control of 3-phase induction motor. Explain any one method in brief. **[6]**

b) Derive the expression for torque developed in a three phase induction motor. **[6]**

c) Explain the construction and working principle of a shaded pole motor with neat sketches. **[6]**

P.T.O.

Q3) a) Describe the constructional details of an alternator with the help of suitable diagrams. **[6]**

b) What is a servo motor? Explain construction and working of any one type of servo motors. **[6]**

c) What are the factors deciding size of a motor for an industrial application? **[5]**

OR

Q4) a) Derive an expression for induced emf in an alternator. **[6]**

b) State any two applications each for the following machines: **[6]**

i) Stepper Motor

ii) Servo Motor

iii) Universal Motor

c) What is the duty cycle of a motor? State types of duty cycles for motors. **[5]**

Q5) a) Explain the significance of widespread presence of EHV transmission lines in power systems. **[6]**

b) Compare the DC and AC transmission systems. **[6]**

c) Draw the line diagram of typical HVDC transmission system and explain its operation in details. **[6]**

OR

Q6) a) Draw typical layout of power systems structure involving generation and utilisation of electrical power. **[6]**

b) Classify the types of HVDC links. Discuss the applications of each of these links. **[6]**

c) Mention the voltage levels of following systems found in India: **[6]**

i) Transmission

ii) Sub-transmission and

iii) Distribution

Q7) a) Using the block diagram reduction technique, determine the transfer function C(s)/R(s). **[6]**

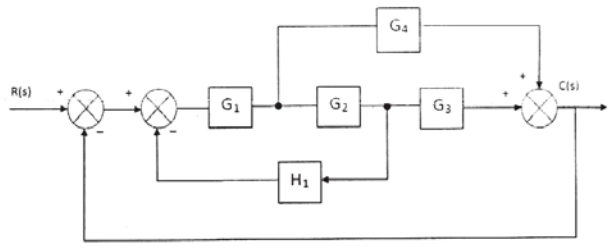

Fig.Q.7 a)

b) Write a short note on tachogenerator. **[6]**

c) State whether the following systems are open loop or closed loop control systems. **[5]**

i) Automatic washing machine

ii) Solar tracking system

iii) Voltage stabilizers

iv) Traffic light system

v) Speed control mechanism used in water turbines at the hydroelectric stations.

OR

Q8) a) Derive the transfer function of a field controlled DC servomotor with usual notations. **[6]**

b) Using mason's gain formula, determine the transfer function C(s)/R(s). **[6]**

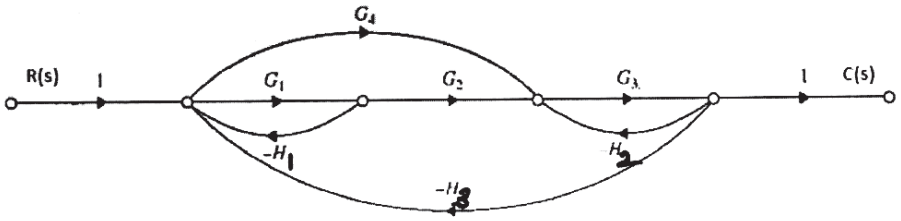

Fig.Q.8 b)

c) Differentiate between translational and rotational systems. **[5]**

Total No. of Questions : 8]

SEAT No. :

PB-3725

[Total No. of Pages : 3

[6261]-135

S.E. (Mechatronics Engineering)

FLUID MECHANICS AND MACHINERY

(2019 Pattern) (Semester - IV) (217548)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

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

i) Boundary Layer

ii) Major Losses & Minor Losses

b) Explain the concepts of pipes that are connected in series, parallel and equivalent pipe with neat sketch. **[8]**

OR

Q2) a) Calculate the pressure gradient along the flow, average velocity and discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2 m/s. **[7]**

b) Explain Displacement thickness, Momentum thickness and Energy thickness with mathematical expression. **[9]**

Q3) a) Write a short note on Buckingham's Pi theorem. **[4]**

b) Determine the dimensions of the quantities given below : **[6]**

i) Velocity

ii) Dynamic Viscosity

iii) Force

P.T.O.

c) The efficiency η of a fan depends on density ρ, ρ dynamics viscosity μ, μ of the fluid, angular velocity ω, ω, diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters. **[8]**

OR

Q4) a) Explain the following dimensionless numbers : **[4]**

i) Euler Number

ii) Weber Number

b) Write a short note on Following : **[6]**

i) Mach's Model Law

ii) Euler's Model law

c) The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft 1, Velocity V, air viscosity μ, μ, air density ρ, ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force. **[8]**

Q5) a) Explain working with constructional details of Francis Turbine. **[8]**

b) Draw velocity triangle of pelton turbine with terminology. **[5]**

c) Write difference between Impulse turbine and reaction turbine. **[5]**

OR

Q6) a) A water turbine has a velocity of 6 m/s at the entrance to the draft tube and a velocity of 1.2 m/s at the exit. For the friction losses of 0.1 m and tail water 5 m below the entrance to the draft tube. Find the pressure head at the entrance. **[8]**

b) Explain working with constructional details of Pelton turbine. **[5]**

c) Write a short note on draft tube. **[5]**

Q7) a) A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450r.p.m against a head of 25m. The diameter and width of the impeller at outlet are 250mm and 50 mm respectively. If the manometric efficiency is 75%. Determine the vane angle at the outlet. **[8]**

b) Draw velocity triangle for centrifugal pump with its terminology. **[5]**

c) Differentiate between positive displacement pump and non positive displacement pump. **[5]**

OR

Q8) a) State the-following for centrifugal pump: **[10]**

i) Suction head

ii) Delivery head

iii) Static head

iv) Manometric head

v) Specific speed

b) Explain the construction and working principle of a centrifugal pump with a figure. **[8]**

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Total No. of Questions : 8]

SEAT No. : ____

PB-3726

[Total No. of Pages : 2

[6261]-136
S.E. (Mechatronics Engineering)
ELECTRICAL MACHINES AND DRIVE
(2019 Pattern) (Semester - IV) (217549)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary***
3) ***Figures to the right indicates full marks***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary***

Q1) a) Write a short note on Permanent Magnet Synchronous Machine. **[9]**

b) For 2200 volt, 440KVA, single phase alternator the armature resistance is 0.5Ω, field current of 40 A, gives an open circuit voltage of 1160 V and circuit current of 200 A. Calculate synchronous impedance and reactance. Also find percent regulation at 0.8 power factor lag **[9]**

OR

Q2) a) With suitable diagram explain the Armature reaction in Synchronous Machine. **[9]**

b) State the similarities and difference between 3 phase Induction Motor and 3 phase Synchronous Motor **[9]**

Q3) a) Explain in detail block diagram of electrical drives **[9]**

b) Explain different selection factor of electrical drive system **[8]**

OR

Q4) a) Explain four quadrant operation of motor driving a hoist load **[9]**

b) Write a short note on Load Torque components **[8]**

P.T.O.

Q5) a) Explain in detail speed control of DC motor using Ward-Leonard drive. **[9]**

b) Explain single phase fully controlled rectifier fed DC motor drive **[9]**

OR

Q6) a) Write a short note on closed loon speed control of DC motor **[9]**

b) Write a short note on step down chopper-controlled DC drives **[9]**

Q7) a) Write a short note closed loop control of Induction motor drives **[10]**

b) Explain variable speed drives of operation of synchronous motor **[7]**

OR

Q8) a) Explain regenerative braking method of Induction motor **[10]**

b) Compare VSI and CSI for Induction motor drive **[7]**

Total No. of Questions : 8]

SEAT No. :

PB-3727

[Total No. of Pages : 2

[6261]-137
S.E.(Mechatronics)
SENSORS AND ACTUATORS
(2019 Pattern) (Semester - IV) (217550)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Explain pressure measurement techniques at Vacuum Pressure Measurement. Explain it with suitable Diagram. **[6]**

b) What are Active and Passive Temperature Transducers? Explain working Principle of Thermocouple. **[6]**

c) How rotameter works? Why rotameter is called as variable area meter? **[6]**

OR

Q2) a) How Microphones Works? Explain Basic Principle of working with real time applications. **[6]**

b) What is basic principle of working ultrasonic flow meter? Compare them with magnetic flow meters. **[6]**

c) Explain working principle of Hall Effect Sensors. What are its applications? **[6]**

Q3) a) Explain how Servo Amplifier works. Mention its applications. **[6]**

b) Write a short note on Velocity Profile optimization in DC Motor. **[5]**

c) Explain Basic Principle of working of Stepper Motors? What are the characteristics features of Stepper Motor? **[6]**

OR

Q4) a) What are Linear Actuators? Explain working of solenoid. **[6]**

b) Explain working of 3-phase Induction motors. **[5]**

c) Write a note on heat dissipation in DC motor. **[6]**

P.T.O

Q5) a) What are the Components of pneumatic and hydraulic systems? **[6]**

b) What is the role of Pumps and Compressor used in Hydraulic and Pneumatic Systems? **[6]**

c) Explain Harmonic Drive in Pneumatic/Hydraulic Systems. **[6]**

OR

Q6) a) Explain Comb Drive in Pneumatic/Hydraulic Systems. **[6]**

b) What are Electroactive Polymers? What are their specific applications? **[6]**

c) What are materials used for artificial muscles? What are the shapes memory alloys? **[6]**

Q7) a) Explain following **[6]**

i) Actuator bandwidth

ii) Frequency Response

b) What are power and energy consideration during actuator selection? **[6]**

c) Write a short note on tradeoffs between force/displacement. **[5]**

OR

Q8) a) What are industrial considerations during actuator selection? **[6]**

b) Write a short note on tradeoffs between torque/speed. **[5]**

c) Write a short note on control system and electronics in Industrial. **[6]**

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PB-3728

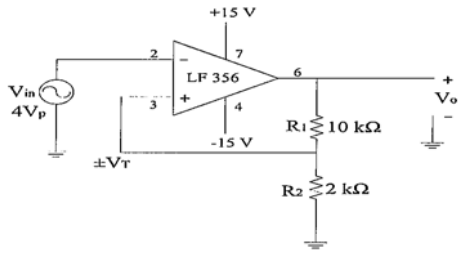
[6261]-138
S.E.(Mechatronics)
APPLICATIONS OF INTEGRATED CIRCUITS
(2019 Pattern) (Semester - IV) (217551)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***

Q1) a) For the Inverting Schmitt trigger shown in fig. below Calculate UTP, LTP and hysteresis width. Draw input and output waveforms. Also comment on Hysteresis loop. **[6]**



b) Explain the peak detector circuit using Op-Amp. **[6]**

c) Draw circuit diagram and input-output waveform of precision half wave & full wave rectifier. **[6]**

OR

Q2) a) Explain Non- inverting Schmitt trigger with its input - output waveform and hysteresis plot. **[6]**

b) Explain in detail working of square wave generator with neat circuit diagram. Draw waveforms of output voltage and capacitor voltage. **[6]**

c) Explain the working of Non-Inverting Comparator. **[6]**

P.T.O

Q3) a) Draw and explain successive approximation A/D converter. **[6]**

b) Explain R/2R ladder DAC in detail. **[6]**

c) Write a short note on Performance parameter of ADC. **[5]**

OR

Q4) a) Explain 2-bit Flash type ADC in detail. **[6]**

b) Explain Performance parameters of DAC. **[5]**

c) Compare different types of ADCs based on their working principle and parameters. **[6]**

Q5) a) Explain the internal block diagram of timer IC 555. **[6]**

b) Explain with neat block diagram, any one application of IC PLL 565 in detail. **[6]**

c) Explain voltage Divider using multiplier IC 534. **[6]**

OR

Q6) a) Explain Voltage controlled Oscillator 566 and write its applications. **[6]**

b) Explain how a missing pulse can be detected using IC 555. **[6]**

c) Draw circuit diagram of waveform generator XR 2206. **[6]**

Q7) a) Write a short note on IC Voltage Regulator. **[6]**

b) Design an adjustable voltage regulator using LM317 for output voltage 1.25V to 15V and draw necessary connection diagram. Assume $R_1 = 240\Omega$ $I_{adj} = 100\mu A$. **[6]**

c) What are the different Switching regulator topologies? Explain any one in detail. **[5]**

OR

Q8) a) Draw and explain the functional diagram of 723 regulator. **[5]**

b) Explain difference between linear regulator and switching regulator. **[6]**

c) Explain the following : **[6]**

i) Regulator IC 7805

ii) Regulator IC LM 337

Total No. of Questions : 8]

SEAT No. : ____

PB3729

[Total No. of Pages : 3

[6261]-139

S.E. (Mechatronics Engineering)

HEAT AND MASS TRANSFER

(2019 Pattern) (Semester - III) (217542)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer 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***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables, slide rule, and electronic pocket calculator is allowed.***
4) ***Figure to the right indicates full marks.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain any one air standard cycle with assumptions used in internal combustion engine analysis with neat diagram. **[8]**

b) Explain Carnot cycle with neat diagram. **[8]**

OR

Q2) a) State the following engine nomenclature with neat sketch **[8]**

i) Stroke

ii) Bore

iii) Swept volume

iv) Clearance volume

b) Draw PV and TS diagram for the following : **[8]**

i) Otto cycle

ii) Diesel cycle

P.T.O.

Q3) a) Derive an expression for Fourier's law of heat conduction for rate of heat transfer flowing through cylinder with neat diagram. **[8]**

b) A steel pipe with 50 mm OD is covered with a 6.4 mm asbestos insulation [k = 0.166 W/mk] followed by a 25 mm layer of fiber-glass insulation [k = 0.0485 W/mK]. The pipe wall temperature is 393 K and outside insulation temperature is 311 K. Calculate the interface temperature between the asbestos and fiber-glass. **[10]**

OR

Q4) a) Derive an expression for Fourier's law of heat conduction for rate of heat transfer flowing through sphere with neat diagram. **[8]**

b) What is the principle of assumption used in the lumped system analysis and when is it applicable? Explain with examples. **[8]**

c) State critical radius of insulation. **[2]**

Q5) a) Explain any three governing laws of heat transfer in radiation. **[9]**

b) Calculate the net radiant heat exchange per m^2 area for two large parallel plates at temperatures of 427°C and 27°C respectively. ε (hot plate) = 0.9 and ε (cold plate) = 0.6. If a polished aluminum shield is placed between them, find the percentage reduction in the heat transfer, ε (shield) = 0.4. **[9]**

OR

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

i) Shape factor

ii) Radiation shield

b) Calculate the heat transfer from a 60 W incandescent bulb at 115°C to ambient air at 25°C. Assume the bulb as a sphere of 50 mm diameter.

Use $Nu = 0.60\ (Gr.Pr)^{1/4}$.

Take properties of air at 70°C as

k = 0.02964 W/mK, $v = 20.02 \times 10^{-6}$ m^2/s, Pr = 0.694 **[8]**

Q7) a) An oil cooler for a lubrication system has to cool 1000 kg/hr of oil (c_p = 2.09 kJ/kg °C) from 80°C to 40°C by using a cooling water flow of 1000 kg/hr at 30°C. Give your choice for a parallel flow or counter flow heat exchanger, with reasons. Calculate the surface area of the heat exchanger, if the overall heat transfer coefficient is 24 W/m^2°C.

Take c_p of water = 4.18 kJ/kg °C **[8]**

b) Derive an expression for LMTD for counter flow heat exchanger with neat sketch. **[10]**

OR

Q8) a) Write difference between film condensation and dropwise condensation with examples. **[8]**

b) The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficients on both sides are 650 W/m^2°C, Calculate the area of the heat exchanger. **[10]**

Total No. of Questions : 8]

SEAT No. :

PB3730

[Total No. of Pages : 2

[6261]-140
S.E. (Mechatronics Engineering)
DIGITAL ELECTRONICS
(2019 Pattern) (Semester - III) (217543)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) Draw and explain SR flipflop using NAND gates with Timing diagram. **[9]**

b) Explain with neat diagram working of serial-in serial-out 4-bit shift register. Draw necessary timing diagram. **[9]**

OR

Q2) a) Design a sequence generator to generate a pulse train 110011 using D-Flip-Flop. **[9]**

b) Design MOD-5 synchronous counter using JK-Flip-Flops. **[9]**

Q3) a) What is ASM chart? Give its applications & advantages? **[8]**

b) Draw the ASM chart for the following State Machine. A 2-bit up-counter is to be designed with enable signal 'X'. If X = 0, then counter changes the state as 00-01-10-11-00. If X = 1 the counter remains in the same state. Design the circuit using JK-FF & suitable MUX. **[9]**

OR

Q4) a) Design BCD to Excess - 3 code converter using PAL. **[8]**

b) Implement full adder circuit using suitable PLA. **[9]**

Q5) a) Explain with the help of circuit diagram 2-input TTL NAND gate with Totem pole output driver. Write advantages of Totem-Pole output. **[9]**

b) Draw and explain the circuit diagram of CMOS inverter. Give advantages & disadvantages of CMOS. **[9]**

OR

Q6) a) Draw three input standard TTL NAND gate circuit & explain its operation. Give disadvantages of Totem-Pole output. **[9]**

b) Draw and explain the working of 2-input CMOS NOR gate. Give characteristics of CMOS. **[9]**

P.T.O.

Q7) a) Explain the System Bus, Data Bus, Address Bus, Control Bus. **[8]**

b) Draw & explain the basic building blocks of an ideal microprocessor-based system with the help of neat diagram with its characteristics. **[9]**

OR

Q8) a) Write short note on ALU. Give the applications of Microprocessor. **[8]**

b) Describe semi-conductor memory organization & operation. **[9]**

Total No. of Questions : 8]

SEAT No. : ____

PB3731

[6261]-141

[Total No. of Pages :4

S.E. (Mechatronics Engineering)

ANALYSIS OF MECHANICAL STRUCTURE

(2019 Pattern) (Semester- III) (217544)

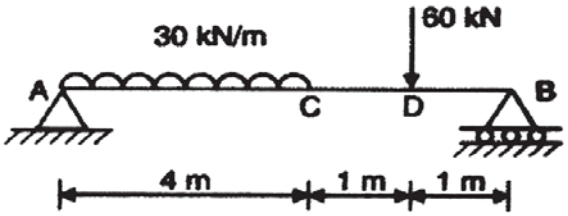
Time : 2½ Hours] ***[Max. Marks : 70***

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

Q1) a) State the assumptions for Simple Bending. **[8]**

b) Determine slope at point 'C' and deflection at points 'C' and 'D' for the beam as shown in fig. Take EI = 4×10^4 kN–m^2. **[10]**



OR

Q2) a) Derive the flexural formula **[8]**

$$\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$$

P.T.O.

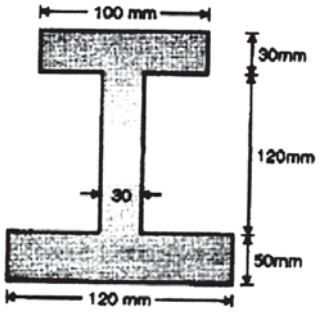
b) A beam simply supported at ends, having cross-section as shown in fig., is loaded with a U.D.L. over its entire span of 8 m, if a maximum permissible bending stress in tension is 30MPa and in compression is 45 MPa. **[10]**

i) Locate NA of the beam from bottom edge.

ii) Find intensity of U.D.L., the beam can carry.

iii) Actual tensile and compressive stress induced.

iv) Plot bending stress distribution diagram.



Q3) a) State torsional formula and explain the terms involved in it. What assumption are made in theory of pure torsion? **[7]**

b) Compare the crippling load given by Euler's and Rankine's formula for a tubular steel strut 2.3 m long having external diameter 38 mm and internal diameter 33 mm. Strut is fixed at one end and hinged at another end. Yield stress for steel 335MPa, E = 205 GPa, $\alpha = \frac{1}{7500}$ **[10]**

OR

Q4) a) i) State the assumptions made in Euler's theory. **[7]**

ii) Define:

1) Crushing Load

2) Crippling Load

3) Slenderness Ratio

b) A hollow marine propeller shaft turning at 110 rom is required to propel a vessel at 12 m/s for the expenditure of 6337.5 kW of shaft power. The efficiency of the propeller being 68%. The diameter ratio of the shaft is to be 2/3 and the direct stress due to the thrust is not to exceed 8 MPa. Calculate **[10]**

i) The shaft diameter

ii) The maximum shearing stress due to the torque.

Q5) a) A machine element is loaded as 75 MPa tensile stress in X-direction, 100 MPa tensile stress in Y-direction and 50 MPa shear stress in anticlokwise direction on x-face. Determine following stresses using graphical method proposed by Mohr. Mohr's circle must be drawn by using suitable scale on graph paper only: **[10]**

i) The principal stresses and their orientation

ii) The maximum shearing stresses and direction of plane on which it occurs.

b) Explain in details Maximum Principal stress theory. **[8]**

OR

Q6) a) A solid circular shaft is subjected to a bending moment of 40kN-m and a torque of 10kN-m. Design the diameter of the shaft according to: **[10]**

i) Maximum principal stress theory.

ii) Maximum shear stress theory.

iii) Maximum strain energy theory.

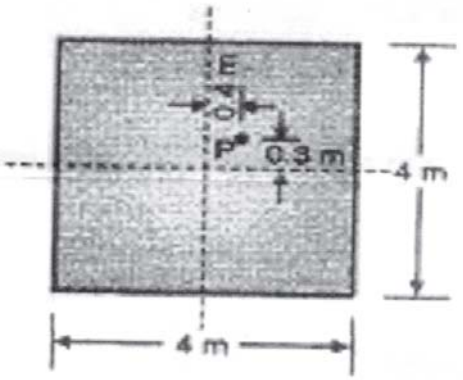
Take μ = 0.25, Stress at elastic limit = 200 N/mm^2 and factor of safety =2.

b) At a point in a strained material, the principal tensile stresses across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Determine normal stress, shear stress and resultant stress on a plane inclined at 20° with major principal plane. Determine also the obliquity. What will be the intensity of stress which acting alone will produce the same maximum strain if Poisson's ratio=1/4. **[8]**

Q7) a) Explain cobined Direct and Bending Stress with: **[7]**

i) Definition
ii) Applications
iii) Symbol
iv) Formula
v) S.I. Unit
vi) Diagrammatic representation

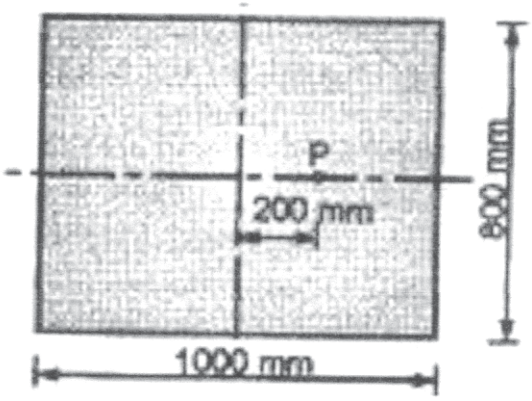
b) Determine the stress resultant at four corners of column subjected to eccentric load of P = 600 kN shown in fig. **[10]**



OR

Q8) a) Explain core of section. Hence obtain core of section for hollow rectangular column of external and internal size 'B×D' and 'b×d' respectively. **[7]**

b) A column support load of 400kN is shown in fig. Find the stresses at the corner of the column at its base. **[10]**



Total No. of Questions : 8]

SEAT No. :

PB-3732

[Total No. of Pages : 2

[6261]-142
S.E. (Mechatronics)
ENGINEERING MATERIAL
(2019 Pattern) (Semester - III) (217541)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Qi or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) What is solidification of pure metals, solidification of alloys? **[6]**

b) What are types of phase diagram? **[6]**

c) Write a note on "Iron-carbon equilibrium diagrams in detail with emphasis in the invariant reactions" **[6]**

OR

Q2) a) What are solid Solutions? What are their types? **[6]**

b) Explain Humerothery rule for substitutional solid solutions. **[6]**

c) What do you understand by "Nucleation & crystal growth"? **[6]**

Q3) a) Write a short note on Hardening and Tempering. **[6]**

b) What is sub-zero treatment? Is hardenability good or bad? Justify. **[5]**

c) ClassifS' surface hardening. Explain any one with figure. **[6]**

OR

Q4) a) What are Time temperature transformation diagrams & continuous cooling. **[6]**

b) What is Retained austenite? Discuss their effects in short. **[5]**

c) Explain necessity of Heat treatment. List out and explain steps in annealing process in **[6]**

P.T.O.

Q5) a) Classify alloy steel. Explain the effect of alloying elements in alloy steel. **[6]**

b) What is Designation of carbon steel and alloy steels as per IS, AISI, SAE Standards? **[6]**

c) Write a short note on Microstructure and property relationship of various ferrous Materials. **[6]**

OR

Q6) a) Write down the classification of Carbon steel. List out the properties of carbon steel and their corresponding industrial application. **[6]**

b) What are details of composition in Stainless steel and tool steel? What are their application. **[6]**

c) What are various types of Cast Iron? Explain industrial application of White CI, Gray CI, SG CI. **[6]**

Q7) a) What are copper and its alloys? List down applications of any three alloys in details. **[6]**

b) Write a short note on Nickel and its alloys. Where they could be incorporated in practical life? **[5]**

c) What is age hardening? Classify & the Bearing alloys. **[6]**

OR

Q8) a) Write down the classification of Non-ferrous Metals. Explain their composition. **[6]**

b) What are Aluminum and its alloys? List down applications of any three alloys in details. **[5]**

c) What are materials used additive manufacturing? Write down their desired properties **[6]**

Total No. of Questions : 8]

SEAT No. :

PB3733

[Total No. of Pages :3

[6261]-143
S.E.(Instrumentation & Control Engineering)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (206268)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Draw neat labeled diagrams wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data if necessary.***
5) ***Use of non-programmable calculators/Log table is allowed.***

Q1) a) Apply the signal flow graph technique to determine the closed-loop gain of the system shown in Figure 1. **[9]**

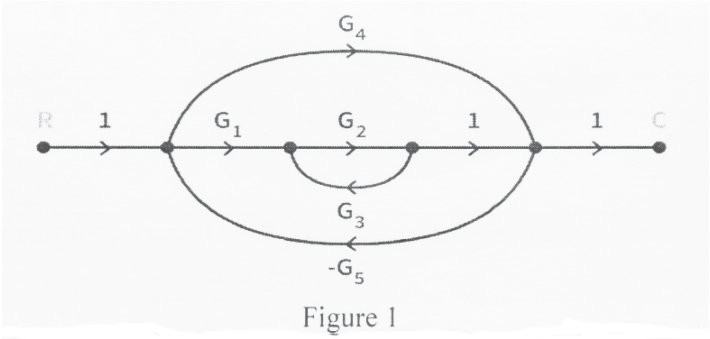


Figure 1

b) Differentiate between block diagram and signal flow graph techniques. **[8]**

OR

Q2) a) Use block diagram reduction rules for the system shown in Figure3 to determine the transfer function *C(s)/R(s).* **[9]**

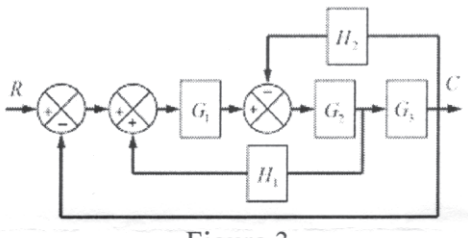


Figure 3

P.T.O.

b) Determine the transfer function $\frac{C(s)}{R(s)}$ of the system show in the Figure4. **[8]**

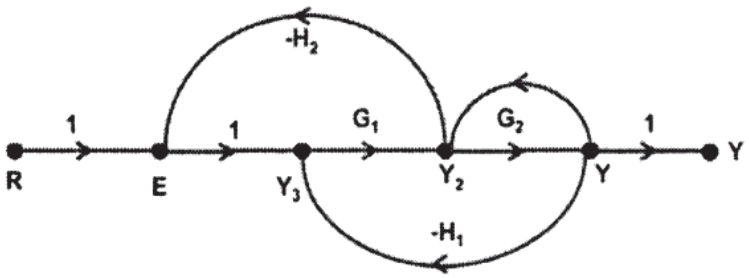


Figure 4

Q3) a) Derive the step response of first order system with $\frac{C(s)}{R(s)} = \frac{1}{Ts+1}$ **[8]**

b) A unity feedback control system is described by open loop transfer function.

$$G(s) = \frac{K}{s(s+10)}$$

Determine the value of *K* so that the system will have a damping ratio of 0.5. For this value of *K*,determine settling time, peak overshoot and peak time. **[10]**

OR

Q4) a) A feedback control system is described as

$$G(s) = \frac{50}{s(s+2)(s+5)}, H(s) = \frac{1}{s}$$

For unit step input, determine the steady-state error constants and errors. **[8]**

b) A unity feedback control system has forward path transfer function given by

$$G(s) = 8 / s(s+6)$$

Find the output c(t) when the system is subject to a step of 2 units. **[10]**

Q5) a) Determine the range of K such that feedback control system having characteristics equation $s(s^2+s+1)(s+4)+K=0$ will be stable. **[8]**

b) Draw the root locus plot for a system having open-loop transfer function as **[10]**

$$G(s)H(s) = \frac{K}{s(s+2)(s+5)}$$

OR

Q6) a) Define **[8]**

i) BIBO Stability

ii) Asymptotic Stability

b) Draw the root locus plot for a system having open-loop transfer function as **[10]**

$$G(s)H(s) = \frac{K}{s^2 + 10s + 100}$$

Q7) a) Draw the polar plot for the transfer function **[7]**

$$G(s) = \frac{10}{s(s+1)}$$

b) Sketch the bode plot for the open-loop transfer function for unity feedback system and assess stability **[10]**

$$G(s) = \frac{50}{(s+1)(s+2)}$$

OR

Q8) a) Sketch the polar for $G(s) = \frac{1}{s(1+sT)}$ **[7]**

b) Define the following: **[10]**

i) Gain Margin

ii) Phase Margin

iii) Gain cross over frequency

iv) Phase cross over frequency

v) Stability conditions based on gain and phase cross over frequency

Total No. of Questions : 8]

SEAT No. :

PB-4445

[Total No. of Pages : 2

[6261]-144R

S.E. (Instrumentation & Control)

DIGITAL ELECTRONICS

(2019 Pattern) (Semester - IV) (206269)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Attempt Q.No.1 or 2, Q.No.3 or 4, Q.No.5 or 6, Q.No.7 or 8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Design and explain 1:4 DEMUX with block diagram, truth-table, equation and logic diagram. **[9]**

b) Design full subtractor circuit by using K Map. **[9]**

OR

Q2) a) Design and explain full adder circuit with logic table, k-map, logic equation and logic diagram. **[9]**

b) Design and explain BCD to 7-segment decoder driver IC 7447 along with display. **[9]**

Q3) a) Convert T flipflop to D flip-flop. **[8]**

b) Write short note on types of memory devices used in Digital Circuits. **[9]**

OR

Q4) a) Design the Conversion of D flip-flop into T-type flip-flop with excitation table, k-map and logic diagram. **[8]**

b) What is limitation of SR flip-flop? Describe how this limitation is overcome in JK Flip-flop. **[9]**

P.T.O.

Q5) a) Draw and explain 3 bit synchronous counter. **[9]**

b) Draw and explain 3 bit ring counter. **[9]**

OR

Q6) a) What is modulus of counter? Design and discuss MOD 10 synchronous up-counter using logic diagram. **[9]**

b) Design and explain 6 to 15 UP counter using IC 74193. **[9]**

Q7) a) Write short note on PLDs. **[9]**

b) Describe the operation of TTL logic circuit working as NAND gate. **[8]**

OR

Q8) a) Classify logic families. Compare in details TTL with CMOS. **[8]**

b) Implement Digital clock by using counter ICs. **[9]**

▽▽▽▽

Total No. of Questions : 8]

SEAT No. :

PB-3735

[Total No. of Pages : 2

[6261]-145
S.E. (Instrumentation & Control Engineering)
PROCESS LOOP ELEMENTS
(2019 Pattern) (Semester - IV) (206270)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right indicates full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume Suitable data if necessary.***

Q1) a) Enlist limitations and represent equation of P, I and D control action and state the suitable solution to overcome the limitations of P, I and D control action. **[9]**

b) Classify continuous control modes used in process control system and explain PID controller with suitable example. **[9]**

OR

Q2) a) Define error and explain reset windup, rate before reset, bumpless transfer in detail. **[9]**

b) Enlist discontinuous control modes used in process control system and explain ON- OFF and Multipostion control modes with suitable example. **[9]**

Q3) a) Illustrate Ziegler Nichols close loop tuning method in detail. **[8]**

b) Derive an expression for. digital PID velocity algorithm and state the merit of velocity algorithm. **[9]**

OR

Q4) a) Illustrate process reaction curve tuning method in detail. **[8]**

b) Derive an expression for digital PID position algorithm and state the limitation of position algorithm. **[9]**

P.T.O.

Q5) a) Explain control valve characteristics with neat sketch in brief. **[9]**

b) Explain final control element in brief and explain gate and needle control valve in detail with neat sketch. **[9]**

OR

Q6) a) Explain cavitation in brief and suggest the suitable method used to reduce it. **[9]**

b) What is the necessity of sizing in control valve, list the selection criteria's for control valve and explain **[9]**

i) Rangeability,

ii) Valve Capacity,

iii) Valve stem,

iv) Turndown ratio.

Q7) a) State the significance of volume boosters and explain volume booster in brief. **[8]**

b) Specify the need of positioners, state its application, types and discuss effect of positioner on performance of control valve. **[9]**

OR

Q8) a) List types of actuators, explain any one with neat sketch and state its advantages, disadvantages and applications **[8]**

b) Specify the significance of pressure boosters and elaborate pressure booster in brief. **[9]**

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PB-3736

[6261]-146
S.E.(Instrumentation)
SIGNALS AND SYSTEMS
(2019 Pattern) (Semester - IV) (206271)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks***
4) ***Use of Logarithmic tables, electronic Pocket calculator and steam table is allowed.***
5) ***Assume suitable data if necessary***

Q1) a) Find the Fourier series coefficients for the following signal. **[10]**

$$x(t)=\sin\left(10\pi t+\frac{\pi}{6}\right)$$

b) Derive Fourier series coefficient for even symmetric signal. **[7]**

OR

Q2) a) Determine the exponential form of Fourier series of the waveform as shown in fig. **[9]**

b) State and prove Linear and Time shifting Properties of Fourier series. **[8]**

Q3) a) State and prove following properties of Fourier transform. **[8]**

i) Time scaling

ii) time reversal

b) Obtain Fourier transform of single sided exponential signal. **[10]**

OR

Q4) a) Find Fourier transform of unit step signal. **[8]**

b) Determine Fourier transform of **[10]**

$x(t) = 1 - t^2 ; |t| < 1$

$= 0; |t| > 0$

P.T.O

Q5) a) Find the convolution of following signals using Laplace transform. **[8]**

$x_1 = \cos(2t)\ u(t)$, $x_2 = e^{-5t}\ u(t)$

b) Find inverse Laplace transform of following: **[10]**

i) $$X(s)=\frac{s+7}{(s+5)(s+3)(s+4)}$$

ii) $$X(s)=\frac{10(s+1)}{(s^2+4s+3)}$$

OR

Q6) a) State and prove and two properties of Laplace Transform. **[8]**

b) Determine inverse Laplace Transform for following differential equational **[10]**

$$\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+4y(t)=6x(t)$$

Assuming y(0) 3, x(0) = 4 and $\frac{dy(0)}{dt}=0, \frac{dx(0)}{dt}=0$

Q7) a) State Axioms of Probability. **[3]**

b) State any six theorems on probability. **[6]**

c) Readings of certain temperature sensor after applying same temperature 10 times is given in table. Find the average, mean, standard deviation and variance. **[8]**

Sample No	1	2	3	4	5	6	7	8	9	10
Glucose level	110	109.5	111	110.3	110.4	110	110.1	109.9	110.2	110

OR

Q8) a) A box contains 5 yellow, 8 white, and 14 green balls. If 3 balls are drawn at random without replacement, determine the probability that **[9]**

i) all 3 are yellow

ii) all 3 are green

iii) 2 are white and 1 is green

iv) at least 1 is white

v) 1 of each colour is drawn

b) Explain random variables and it's classification with example. **[8]**

Total No. of Questions : 8]

SEAT No. : ____

PB3737

[6261]-147

[Total No. of Pages :2

S.E. (Instrumentation and Control)

DATA STRUCTURES

(2019 Pattern) (Semester- IV) (206272)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right, indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data, if necessary.***

Q1) a) What are the advantages and disadvantages of Abstract Data Type? **[9]**

b) Write a note on array and its operations. **[8]**

OR

Q2) a) Write a Python program to create a matrix, add a row in it and delete a row from it. **[9]**

b) Write functions to find number of elements in a list, add elements of second list to first list, print a section of list and remove an element from a list. **[8]**

Q3) a) What is a set data type in Python? With examples explain operations on sets. **[10]**

b) Write a note on multidimensional array and index computation. **[8]**

OR

Q4) a) Write a Python program to create two sets X and Y, their union and intersection. **[9]**

b) How to create a map using Python list? How to remove a key value pair from a map? What is the use of the function contains (key) in map? **[9]**

P.T.O.

Q5) a) Compare Python list and linked list. Explain the following code in Python. **[9]**

```
def traversal(head):
    curNode = head
    while curNode is not None:
        print curNode.data
        curNode = curNode.next
```

b) Illustrate with examples bubble sort. **[8]**

OR

Q6) a) Write a note on BAG abstract data type. **[8]**

b) How to build a linked list using a Tail Reference? How to append a node using tail reference? **[9]**

Q7) a) What is a queue in Python? A queue is implemented using a circular array. Describe with the help of suitable figures, addition of new item and removing an item from this queue. **[10]**

b) Write a note on stack implementation using a Python list. **[8]**

OR

Q8) a) Convert the following expression from Infix to Postfix expression.

(A + B) * (C – D) **[8]**

b) What are infix and postfix expressions? How to convert an infix expression into a postfix expression? **[10]**

Total No. of Questions : 8]

SEAT No. : ____

PB3738

[Total No. of Pages : 2

[6261]-148

S.E. (Instrumentation & Control)

SENSORS AND TRANSDUCERS

(2019 Pattern) (Semester - III) (206261)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicates full marks.***
4) ***Assume suitable data if necessary.***

Q1) a) Describe the construction and working principle of Capacitive (Delta cell) pressure measurement transducers? Draw a construction diagram and circuit diagram of it? **[8]**

b) Explore the functioning of a McLeod vacuum gauge instrument? Draw the diagram and explain principle of operation? Give the mathematical statement for it? **[9]**

OR

Q2) a) Discuss the mechanics of manometer as differential pressure sensors and how it converts differential pressurc to height (h)? Explain with suitable diagram? State the formula? **[8]**

b) Explain the working principle of piezoelectric pressure sensor? Draw the diagram? State the formula for it? **[9]**

Q3) a) State and explain the thermoelectric laws: law of intermediate temperature and law of intermediate metals? Draw the related diagrams? **[8]**

b) Compare and contrast the thermistor with resistance temperature detector (RTD)? Mathematically prove that thermistors are at least ten times more sensitive than the RTD? **[9]**

OR

P.T.O.

Q4) a) What are the fundamental principles / laws behind the operation of a total radiation pyrometer, and how does it convert temperature into an electrical voltage? Explain the working? Give the related formula? **[8]**

b) How does the Bimetallic thermometer sensor works, and what are its characteristics that make it suitable for measuring temperature? Give any two applications of it? Draw diagram of it? **[9]**

Q5) a) Explain the obstruction type methods used for measuring fluid flow in industrial processes? On which principle it works? Draw appropriate diagrams for at least one obstruction type flow transducer and state mathematical equations to support your answer? **[9]**

b) What is the principle behind the operation of Rotameter? Why it is called variable area meter? Explain working with suitable diagrams and mathematical equations? **[9]**

OR

Q6) a) How does an electromagnetic flow meter works, and what are the key advantages and limitations of using this type of flow meter in industrial applications? Draw the diagram of it? What is the formula for measurement of flow? **[9]**

b) Draw a diagram of vortex shedding flow measuring instrument? State the formula for vortex frequency? Enlist the other sensors installed on this instrument and state functions of each? **[9]**

Q7) a) Explain the working of bubbler or purge method for measurement of liquid level? What are its limitations? Explain how density of liquid is measured using the same principle? Draw appropriate diagrams to support your answer? **[9]**

b) Define humidity? What is the unit of humidity measurement? Draw and explain the working of the resistive type humidity sensor? **[9]**

OR

Q8) a) Define term Viscosity? How does Cone and Plate type viscometer work, and what types of fluids are they suitable for measuring? Draw diagram? **[9]**

b) Write a note on conductivity sensors? Draw a diagram of conductivity cell and circuit diagram for measurement of liquid conductivity? **[9]**

Total No. of Questions : 8] **SEAT No. :**

PB3739 **[Total No. of Pages : 2**

[6261]-149
S.E. (Instrumentation and Control)
LINEAR INTEGRATED CIRCUITS
(2019 Pattern) (Semester - III) (206262)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) Draw neat diagram of three input summing amplifier and derive the equation for output voltage. **[9]**

b) Write short note on an Isolation Amplifier. **[8]**

OR

Q2) a) Draw neat diagram of practical integrator and derive the output equation. **[9]**

b) What is loading effect? How it can be avoided with on - inverting op - amp. **[8]**

Q3) a) Explain with suitable circuit diagram operation of schmitt trigger. Draw proper output wave forms. **[9]**

b) Design Wien bridge oscillator using operational amplifier for output frequency of 5KHz. Draw circuit diagram. Assume suitable data.. **[9]**

OR

Q4) a) Draw neat diagram of R-C phase shift oscillator and explain operation. **[9]**

b) Explain with suitable circuit diagram inverting comparator. Draw proper output wave forms. **[9]**

P.T.O.

Q5) a) Draw the pin diagram of timer IC555 and explain function of each pin. **[9]**

b) Describe the operation of voltage controlled oscillator with neat block diagram. **[8]**

OR

Q6) a) Explain operation of PLL with suitable block diagram. **[8]**

b) Design monostable multivibrator using timer 555 pulse width of 5 seconds. Draw circuit diagram. **[9]**

Q7) a) Compare active filters and passive filters. Draw the ideal frequency response for high pass, low pass, band pass and band reject filters. **[9]**

b) Design first order Low pass filter for f_H = 10KHz. And pass band gain of 2. Draw circuit diagram. **[9]**

OR

Q8) a) Design second order high pass filter for f_L = 1 KHz. Draw circuit diagram. **[9]**

b) Draw and explain neat circuit diagram to generate + 12V DC supply using IC7812. **[9]**

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Total No. of Questions : 8]

SEAT No. :

PB3740

[Total No. of Pages :2

[6261]-150

S.E. (Instrumentation and Control)

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2019 Pattern) (Semester- III) (206263)

Time : 2½ Hours] *[Max. Marks : 70*

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) How a Lissajous pattern is used for the measurement of frequency and phase? **[8]**

b) Draw the constructional diagram of CRT and explain its working. **[10]**

OR

Q2) a) With suitable waveforms, explain ALT and CHOP modes in dual trace CRO. **[8]**

b) Explain the functions of Sample and Hold circuit, Control Logic, and Memory in DSO. **[6]**

c) Describe the measurement of AC voltage using CRO. **[4]**

Q3) a) Derive the equations for general AC bridge at balanced condition. **[8]**

b) Explain D factor. State relation between Q and D factor. **[4]**

c) A Wheatstone bridge uses arms R2=565 ohms and R4=1525 ohms. Calculate the bridge sensitivity if the bridge is operated at 5 V and the null detector is having voltage sensitivity of 10 mm/V. **[5]**

OR

P.T.O.

Q4) a) Differentiate between Maxwell Inductance capacitance bridge and Hay bridge. **[6]**

b) A Wheatstone bridge uses R1=820 ohms, R2=2160 ohms, R3=385 ohms and R4= 4755 ohms. A galvanometer having resistance of 120 ohms is used as null detector. Calculate the current through galvanometer. **[8]**

c) A Wien bridge uses R1=782 ohms, R2=1200 ohms, C1=0.047 μF and C2=0.22 μF. Determine the supply frequency. **[3]**

Q5) a) For R–2R DAC, Rf=R=1200 ohms. If the reference voltage is 10 volts, calculate the analog output voltage for digital input $(10110111)_2$. **[4]**

b) Draw the block diagram of general digital instrument and explain function of each block. **[8]**

c) Explain any three specification of DAC. **[6]**

OR

Q6) a) Explain the functions of the following in 8-bit SAR type ADC- **[8]**

i) Comparator

ii) 8-bit SAR

iii) 8-bit DAC

iv) Latch

b) Draw general block diagram of digital multimeter and describe the measurement of unknown resistance. **[6]**

c) Calculate the conversion time for 10-bit dual slope integrating type ADC which uses a clock of 1 MHz. Number of pulses counted for certain input is 228. **[4]**

Q7) a) Describe the galvanometric type chart recorder with neat diagram. Enlist the types of tracing system. **[9]**

b) Explain in detail the architecture of virtual instrumentation with neat block diagram. **[8]**

OR

Q8) a) Briefly explain the advantages of Virtual Instruments over traditional instruments. **[9]**

b) Differentiate between strip chart recorder and X-Y recorder. **[8]**

Total No. of Questions : 8]

SEAT No. :

PB-3741

[Total No. of Pages : 2

[6261]-151
S.E. (Instrumentation & Control)
CONTROL SYSTEM COMPONENTS
(2019 Pattern) (Semester - III) (206264)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answers Qi or Q2; Q3 or Q4; Q5 or Q6; Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume Suitable data jf necessary.***

Q1) a) Explain in brief any one type of Pneumatic, Hydraulic & Electrical systems. **[6]**

b) Explain any one type of Pneumatic cylinder (Double rod, Tandem). **[6]**

c) What are the Special types of valves? Illustrate any one in details. **[6]**

OR

Q2) a) Differentiate between Bleed & Non bleed type of Pneumatic Relays. **[6]**

b) What is Direction control and Speed regulation in Pneumatic Circuits? Explain. **[6]**

c) What are Pneumatic valves? Explain any one direction-controlled valves and flow control valve. **[6]**

Q3) a) What is meant by Hydraulic components? Define the Actuator in terms of cylinder & motor. **[6]**

b) List out the different Hydraulic Circuits. Differentiate between the same. **[6]**

c) Explain in brief the Meter in circuit. **[5]**

OR

Q4) a) Give the definition for Hydraulic pumps? List out the name and explain any one in brief. **[6]**

b) Explain any one hydraulic circuit from the given: reciprocating, speed control. **[6]**

c) Explain in brief the Meter out circuit. **[5]**

P.T.O.

Q5) a) Write down Construction, working, characteristics, specifications and applications of SCR **[6]**

b) Write down Construction, working, characteristics, specifications and applications of MOSFET, IGBT **[6]**

c) Write down Construction, working, characteristics, specifications and applications of TRIAC **[6]**

OR

Q6) a) Write down Construction, working, characteristics, specifications and applications of UJT **[6]**

b) Write down Construction, working, characteristics, specifications and applications of DIAC **[6]**

c) Differentiate between SCR, UJT,TRIAC, DIAC **[6]**

Q7) a) List out the auxiliary components and safety measures, eAplain in brief anyone **[6]**

b) What is a Flow totalizer? Illustrate the same with example **[6]**

c) How are the Hazardous Area & Material classified in terms of NEC standards. Explain. **[5]**

OR

Q8) a) Explain the Sealing, & Immersion in case of the safety measures **[6]**

b) What is Isolation in terms of Series & Shunt Protective elements. Illustrate with example of the same **[6]**

c) What is Encapsulation and how it is related with Zener barrier? **[5]**

Total No. of Questions : 9]

SEAT No. : ____

PB-3742

[Total No. of Pages : 4

[6261]-152
S.E. (Instrumentation Engineering)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207008)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Question No.1 is compulsory.***
2) ***Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicates full marks.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) 20% of bolts produced by machine are defective. The probability that out of three bolts chosen at random one is defective, **[1]**

i) 0.384 ii) 0.9728

iii) 0.5069 iv) 0.6325

b) Unit vector along the line equally inclined with co-ordinate axes is, **[1]**

i) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$ ii) $\frac{1}{\sqrt{3}}(\hat{i}-\hat{j}-\hat{k})$

iii) $\frac{\hat{i}+\hat{j}+\hat{k}}{3}$ iv) $\frac{-\hat{i}+\hat{j}-\hat{k}}{\sqrt{3}}$

c) Out of 2000 families with 4 children each, the number of families you would expect to have no girl. is, ($p = q = ½$) **[2]**

i) 300 ii) 150

iii) 125 iv) 200

d) $\nabla \cdot (r^n \bar{r})$ is equal to **[2]**

i) $(n + 3)r^n$ ii) $3r^n + \frac{n}{r^{-n-2}}$

iii) $(n - 3)r^n$ iv) $(n + 3)r^n$

P.T.O.

e) The poles of $f(z)=\dfrac{4z^2+z}{z^2+1}$ are **[2]**

i) $z=\pm i$ ii) $z=\pm 1$

iii) $z=0,\ 0$ iv) $z\neq 1,\ 2$

f) The fourier transform F(λ) of $f(x)=\begin{cases}\cos x & ,\ x>0\\ 0 & ,\ x<0\end{cases}$ is **[2]**

i) $\dfrac{i\lambda}{1-\lambda^2}$ ii) $-\dfrac{i\lambda}{1-\lambda^2}$

iii) $-\dfrac{i\lambda}{1+\lambda^2}$ iv) $\dfrac{i\lambda}{1+\lambda^2}$

Q2) a) Find Fourier sine transform of **[5]**

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

b) Find z transform of $f(k) = k.5^k$, $k \geq 0$. **[5]**

c) Solve the difference equation **[5]**

$$12f(k+2)-7f(k+1)+f(k)=0, k\ge 0, f(0)=0, f(1)=3$$

OR

Q3) a) Find the inverse z-transform of $\mathrm{F}(z)=\dfrac{10z}{(z-1)(z-2)}$ by inversion integral method. **[5]**

b) Solve the integral equation. **[5]**

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

c) Find the Fourier integral representation of the function **[5]**

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

OR

Q4) a) First four moments about the value 2 are 1, 16, –40 and 100. Find first four moments about mean, coefficient of skewness and kurtosis. **[5]**

b) Find correlation coefficient for following distribution **[5]**

x	3	1	5	2	4
y	8	9	3	6	4

c) The probability of a man hitting the target is ¼. If he fires 6 times, find the probability that he hits the target at least twice. **[5]**

OR

Q5) a) Calculate arithmatic mean and standard deviation of following distribution,

x	1	2	3	4	5
y	6	2	10	4	8

. **[5]**

b) The average number of misprints per page of a book is 1.5. Assuming the distribution of number of misprint to be poisson, find, the probability that, **[5]**

i) book is free from misprints

ii) number of pages containing at most one misprint if the book contains 900 pages.

c) Suppose heights of students follows normal distribution with mean 190 cm and variance 81 cm^2. In a school of 1000 students how many would you expect to have height above 208 cm? **[5]**

[Given : A (2) = 0.4772]

Q6) a) Find directional derivative of $\phi = xy^2 + yz^3$ at (2, –1, 1) along the line

$$\frac{x-2}{1} = \frac{y+1}{2} = \frac{x-1}{2}.$$ **[5]**

b) Show that the vector field. **[5]**

$\overline{F} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$ is

irrotational and find the scalar field such that $\overline{F} = \nabla\phi$

c) If $\overline{F} = (2xy + 3z^2)\hat{i} + (x^2 + 4yz)\hat{j} + (2y^2 + 6xz)\hat{k}$ evaluate $\int_c \overline{F} \cdot d\overline{r}$,

where c is the curve $x = t$, $y = t^2$, $z = t^3$ joining the points (0, 0, 0) and (1, 1, 1). **[5]**

OR

Q7) a) Find directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, –1, 2) towards the point $\hat{i} + \hat{j} - \hat{k}$. **[5]**

b) Show that (any one) : **[5]**

i) $$\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^3} \right) = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$$

ii) $$\nabla^2 [\nabla \cdot (\bar{r} / r^2)] = 2 / r^4$$

c) Using Green's theorem Evaluate $\oint_c \bar{F} \cdot d\bar{r}$ where $\bar{F} = x^2 \hat{i} + xy \hat{j}$ and c is closed curve enclosed by $y = x^2$ and the line $y = x$. **[5]**

Q8) a) If $v = 4xy(x^2 - y^2)$ then find 'u' such that $f(z) = u + iv$ is analytic and also find $f(z)$ in terms of z. **[5]**

b) Evaluate $\oint_c \frac{3z+4}{z(2z+1)} dz$, where '$c$' is $|z - 1| = 3$. **[5]**

c) Find the bilinear transformation which maps the point 1, i, –1 of the z-plane onto the points 0, 1, ∞ of w-plane. **[5]**

OR

Q9) a) If $u = x^2 - y^2 - y$ then find 'v' such that $f(z) = u + iv$ is analytic and also find $f(z)$ in terms of z. **[5]**

b) Evaluate : $\oint_c \frac{z^3 - 5}{(z+1)^2(z-2)} dz$, where c is $|z| = 3$. **[5]**

c) Find map of $x = 2y$ under the transformation $w = \frac{2z-1}{2z+1}$. **[5]**

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Total No. of Questions : 8]

SEAT No. :

PB-4923

[Total No. of Pages : 2

[6261]-155
S.E. (Mechanical / Automobile)
ENGINEERING METALLURGY
(2015 Pattern) (Semester - II) (202049)

Time : 2½ 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***
2) ***Figures to right in brackets indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn, wherever necessary.***

Q1) a) What is Gibbs Phase Rule? Explain its importance **[4]**

b) Define the following: **[4]**

i) Phase

ii) Variable

iii) Alloy

iv) Solid solution

c) Draw cooling curve of Pure metal and comment on its solidification. **[4]**

OR

Q2) a) Enlist the steps in the preparation of specimen for optical microscopy? **[4]**

b) What is Macroscopy? What information is obtained by macroscopic studies of components? **[4]**

c) Write a short note on Spark Test. **[4]**

Q3) a) What are the advantages of cast iron over steels? **[4]**

b) Compare Gray Cast Iron & White Cast Iron with respect to composition, microstructure, application. **[4]**

c) Why is heat treatment of steels done? Explain with Examples. **[4]**

OR

P.T.O.

Q4) a) Draw neat and labeled Iron carbon equilibrium diagram. **[4]**

b) Compare Induction hardening and Flame hardening. **[4]**

c) Draw TTT curve and show CCT Curve superimposed on TTT Curve **[4]**

Q5) a) What are the advantages of Alloy Steels over Plain Carbon Steels? **[4]**

b) Explain Sensitization and Weld Decay. **[4]**

c) What are stainless steels? Give typical composition and two uses of the various types of stainless steels? **[5]**

OR

Q6) a) Explain the Indian Standard used for the Designation of Steels. Give 2 examples. **[4]**

b) What do you mean by AISI 1040 & FE-4l0K. **[4]**

c) What is High Speed Steel? State and explain the important properties of the two types of high speed steels. **[5]**

Q7) a) Explain classification of Cu base alloys based on the percentage of Cu and Zn? Explain role of Zn in brasses. **[6]**

b) What is Season Cracking of Brasses. **[4]**

c) Write a short note on Bearing Materials. **[3]**

OR

Q8) a) List the important properties of Nickel and name the important Nickel alloys. **[6]**

b) Give typical composition, property and application for the following (any two): **[4]**

i) Elinvar

ii) Sn-based babbits

iii) Admiralty brass

iv) Gun Metal

c) What are the requirements of bearing materials ? explain with suitable example. **[3]**

Total No. of Questions : 8]

SEAT No. :

PB4959

[Total No. of Pages :3

[6261]-200
S.E. (Computer Engineering/IT)
ENGINEERING MATHEMATICS - III
(2015 Pattern) (Semester - II) (207003)

Time : 2½ Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answers 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) ***Your answers will be valued as a wholt***
4) ***Figures to the right indicate full marks.***
5) ***Assume Suitable data if necessary.***

Q1) a) Solve any two of the following: **[8]**

i) $\left(D^2+4\right)y = e^{-2x}\sin 2x$

ii) $\left(D^2+1\right)y = \sec x$ (use method of variation of parameters)

iii) $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = x^5$

b) Solve the following integral equations. **[4]**

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

OR

Q2) a) An inductor of 0.5 henries is connected in series with a resister of 6 ohms, a capacitor of 0.02 Farads, a generator having alternative voltage given by 24 sin 10t , t>0 and switch k. Set up differential eq^n this circuit & find charge at time t. **[4]**

b) Solve any one of the following **[4]**

i) Find $Z\{3^k\}k \geq 0$.

ii) Find $z^{-1}\left\{\frac{z}{(z-1)\{z-2\}}\right\},\ |z|>|,\ k \geq 0$

c) Solve the difference equation **[4]**

$$y_{k+2} - 3y_{k+1} + 2y_k = 0$$

Where $y_o = 0,\ y_1 = 1$ for $k \geq 0$

P.T.O.

Q3) a) The first four moments of a distribtion about the value 6 are –2, 1, 3 and 7. Obtain the first four central moments, β_1 & β_2.

b) Fit a straight line of the form $y = ax + b$ to the following data by the least squares method:

x	1	2	3	5	7	8
y	2	-1	1	0	4	2

c) There is a small probability of $\frac{1}{1000}$ for any computer produced to be defective. Determine in a sample of 2000 computers, the probability that there are

i) no defectives , and

ii) 2 defectives.

[12]

OR

Q4) a) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.

[Given: at z = 0.496 area = 0.19
at z = 1.405 area = 0.42]

b) In a certain factory producing cycle tyres there is a small chance of 1 in 500 tyres to be defective. The tyres are supplied in lots of 10. Using poission distribution, calculate the approximate number of lots containing no defective, one defective and two defective tyres, respectivety, in a consignment of 10,000 lots.

c) The following reqression equations were obtained from a correlation table $y = 0.516\,x + 33.73$, $x = 0.512\,y + 32.52$

Find the value of

i) The correlation coefficient

ii) The mean of x's and

iii) The mean of y's.

[12]

Q5) a) Find D.D of $\phi = xy^2 + yz^3$ at $(2,-1,1)$ along the line $2(x-2) = (4+1) = z-1$. **[4]**

b) Show that $\overline{F} = (2xy + z^3)\bar{i} + x^2\bar{j} + 3xz^2\bar{x}$ is irrotational & hence find its scalor potential ϕ *s.t* $\overline{F} = \nabla\phi$. **[4]**

c) Find work done, moving particle along the line joining pts $(0,0,0)$ to $(2,1,1)$ Under force $\overline{F} = (2y+3)\bar{i} + xz\overline{J} + (yz - x)\bar{k}$. **[5]**

Q6) a) Find the angle between the normal to the surface $xy = z^2$ at $(1,4,2)$ & $(-3,-3,3)$ **[4]**

b) Prove that (any one) **[4]**

i) $\nabla^4 e^r = \left(1 + \frac{4}{r}\right) e^r$

ii) $\nabla^2 \left(\frac{\bar{a}.\bar{b}}{r}\right) = 0$

c) Find the circulation of $\bar{F}$ around the curve C where $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$ & C is the curve $C : x^2 + y^2 = a^2$ & $z = 0$. **[5]**

Q7) a) If $v = \frac{-y}{x^2 + y}$, find u such that u+iv is analytic function. **[4]**

b) Evaluate $\oint_c \frac{z+4}{z^2+2z+5} dz$ where C is a circle $|z - 2i| = \frac{3}{2}$ **[5]**

c) Find the bilinear transformation which maps $0, -1, \infty$ of $z-$plane onto $-1, -(2+i), i$ of w plane. **[4]**

OR

Q8) a) Find the condition on a, b, c & d under which $u = ax^3 + bx^2y + cxy^2 + dy^3$ is harmonic function. **[4]**

b) Evaluate $\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$ using cauchy's theorem. **[5]**

c) Find the image of st. line $y = x$ under the transformation $w = \frac{z-1}{z+1}$. **[4]**