[6179]-201

S.E. (Civil)

GEOTECHNICAL ENGINEERING

(2019 Pattern) (Semester - IV) (201008)

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.*

Q1) a)   Explain Standard Proctor Compaction Test with neat sketch.   **[6]**

    b)   A concentrated load of 30 kN acts on the surface of homogenous soil mass of large extent. Find the stress intensity at a depth of 8m and horizontal distance of 2.5 m by using Boussinesq's theory. Compare the value with Westergaard's theory.   **[6]**

    c)   Enlist and explain factors affecting compaction.   **[5]**

OR

Q2) a)   Differentiate between Standard proctor Test and Modified Proctor Test. Draw typical compaction curve for both the tests.   **[6]**

    b)   State and explain the terms involved in Boussinesq's point load and circular load equation for vertical stress determination.   **[6]**

    c)   Write a note on Proctor needle test with neat sketch.   **[5]**

Q3) a)   Explain with the help of Mohr circle how shear strength parameters are determined in direct shear test.   **[6]**

    b)   Explain the types of triaxial test according to drainage conditions.   **[6]**

    c)   A vane 75 mm in diameter and 150 mm in height was pressed into clay in a bore hole. The torque was applied and gradually increased to 50 N.m when failure took place. Determine underained shear strength.   **[5]**

OR

Q4) a) A soil has an angle of shearing resistance 18° and cohesion of 30 kN/m^2. If the specimen of this soil is subjected to triaxial compression test, determine the value of cell pressure for failure to occur at a total stress of 300 kN/m^2. Also calculate deviator stress. **[7]**

b) State and explain factors affecting shear strength of cohesive soil. **[6]**

c) Define total and effective stresses. **[4]**

Q5) a) In a cohesionless soil deposit having unit weight of 15 kN/m^3 and angle of internal friction 30°. Determine resultant active and passive earth pressure and their positions, if the height of retaining wall is 10 m. **[6]**

b) Explain step by step procedure for determination of lateral earth pressure graphically by Rebhann's method with neat sketch. **[6]**

c) Discuss how to calculate earth pressure of soil for Backfill with uniform surcharge. **[6]**

OR

Q6) a) Define the various types of earth pressures w.r.t. wall movement with sketches. **[6]**

b) Explain step by step procedure for determination of lateral earth pressure graphically by Culmann's method with neat sketch. **[6]**

c) A smooth backed vertical wall is 6.3 m high and retains a soil with a bulk unit weight of 18 kNm^3 and angle of internal friction 18°. If the soil surface carries a uniformly distributed load of 5 kN/m^2. Determine total active earth pressure and its point of application. **[6]**

Q7) a) Explain classification of slopes based on different criteria. **[6]**

b) What is Taylor's Stability Number? How it can be used to chek the stability of slopes? **[6]**

c) Classify the different modes of failure of finite and infinite slope. **[6]**

OR

Q8) a) Write a note on causes and remedial measures of landslide. **[6]**

b) Explain 'Swedish Slip Circle' method for stability analysis of finite slope. **[6]**

c) Derive the expression for factor of safety for dry infinite slope in sandy soils. **[6]**

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[6179]-202

S.E. (Civil Engineering)
SURVEY
(2019 Pattern) (Semester - IV) (201009)

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 skecthces 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.*
  6) *Use of cell phone is prohibited in examination hall.*

Q1) a) Explain with sketch the method of finding tacheometric constants of multiplying (m) and Additive (c)?   **[5]**

  b) The following observations were made using a tacheometer fitted with an analytic lens, multiplying constant being100.   **[8]**

Instrⁿ. Station	Instrⁿ. Height.	Staff Station	Vertical Angle	Hair Reading	Remark
M	1.215	P	-2°40'	0.985,1.125,1.305	RLof M = 251m
	1.215	Q	+4°20'	0.275,0.785,1.350	

  Find R.L. of point P and Q also find Distance PQ.

  c) State the Uses of contour lines?   **[5]**

OR

Q2) a) A tacheometer with analytic lens. Having the multiplying constant 100 was used and the following observations were made of staff held vertical.   **[8]**

Instrumentsation	H.I.(m)	Vertical Angle	Staff at	Staff Reading
0	1.210	+ 3°20'	A	1.215, 1.755, 2.310
0	1.210	+ 8°30'	B	1.425, 1.815, 2.340

  R.L. of station O is 152.00m calculate the R.L. of A & B, distance and gradient of line AB?

  b) State characteristics of contour maps?   **[4]**

  c) Enlist different indirect methods of contouring? Explain any one method with detailed sketch?   **[6]**

P.T.O.

Q3) a) Write a note on uses and types of transition curves? **[5]**

b) Two straights AB and BC meet at chainage of 950 m. A simple circular curve of 300 m radius joins them. The deflection angle between two straights is 26° 12'00". Tabulate the necessary data to layout the curve by Offset from long chord. Take chord interval as 10 m. **[7]**

c) State different types of curves, Explain compound curve with sketch?**[5]**

OR

Q4) a) Two tangents intersects at a chain age of 1125 m the intersection angle 152°40'00".Calculate all data required to set out curve of radius 250 m by deflection angle method. **[7]**

b) Enlist various methods of setting out curves and explain any one with sketch? **[5]**

c) Draw Simple curve with its components and Notations ? **[5]**

Q5) a) Write a short note on construction survey? **[6]**

b) State the advantages of SBPS (Space Based Positioning System)? **[6]**

c) Explain with sketch the procedure of setting out of tunnel center line?**[6]**

OR

Q6) a) Enlist the names of satellite? Explain any one in details? **[6]**

b) Write a short note on setting out of building on ground? **[6]**

c) State the segments and working of SBPS (Space based Positioning system) **[6]**

Q7) a) State different methods of sounding, State any one method in detail?**[5]**

b) Sate the working principle and uses of total station? **[6]**

c) What are the objectives of geodetic Surveying? **[6]**

OR

Q8) a) Explain triangulation method and trilateration method of geodetic survey? **[6]**

b) Differentiate between Map and Aerial Photographs? **[5]**

c) What are the equipments used in hydrographic survey?Explain any one?**[6]**

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[6179]-203

S.E. (Civil Engineering)
CONCRETE TECHNOLOGY
(2019 Pattern) (Semester - IV) (201010)

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) *Neat diagrams must be drawn whenever 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) Enlist factor affecting the strenght of concrete and explain role of water cement (W/C) ratio in strength of concrete. **[6]**

b) Explain the relation between tensile and compression strength concrete.**[6]**

c) Write short note on: **[6]**

    i) Shrinkage of Concrete

    ii) Creep of Concrete

<p align="center">OR</p>

Q2) a) Calculate the compressive strength of following specimen of concrete.**[6]**

Sr. No.	Specimen and size	Crushing load in kN
i)	Cube 1 : 150 mm X 150 mm X 150 mm	750
ii)	Cube 2 : 150 mm X 150 mm X 150 mm	760
iii)	Cylinder 1 : 150 mm diameter X 300 mm height	525
iv)	Cylinder 2 : 150 mm diameter X 300 mm height	540

b) Explain experimental test to evaluate flexural strenght of concrete. **[6]**

c) Explain the factors affecting the measurement of pulse velocity. **[6]**

<p align="right">*P.T.O.*</p>

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

b) Enlist various methods available for concrete mix design and explain the step by step procedure for concrete mix design by using IS 10262 method. **[9]**

OR

Q4) a) Design a concrete for grade M30 using IS code method for following data: **[12]**

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 12269
Workability	: 50 mm (slump)
Exposure conditions	: Severe (for RCC)
Degree of supervision	: Good
Maximum cement content	: 450 kg/m³
Type of aggregate	: Angular coarse aggregate
Specific gravity of cement	: 3.15
Specific gravity of coarse aggregate and fine aggregate	: 2.65
Water absorption of coarse aggregate	: 0.50%
Water absorption of fine aggregate	: 1.00%
Free surface moisture for coarse aggregate	: Nil
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
10	2.80	78.30	1.4	39.15	40.55	to Table7
4.75	0	8.70	0	4.35	4.35	of IS 383

Fine aggregate : Conforming to grading Zone II of Table 9 of IS 383
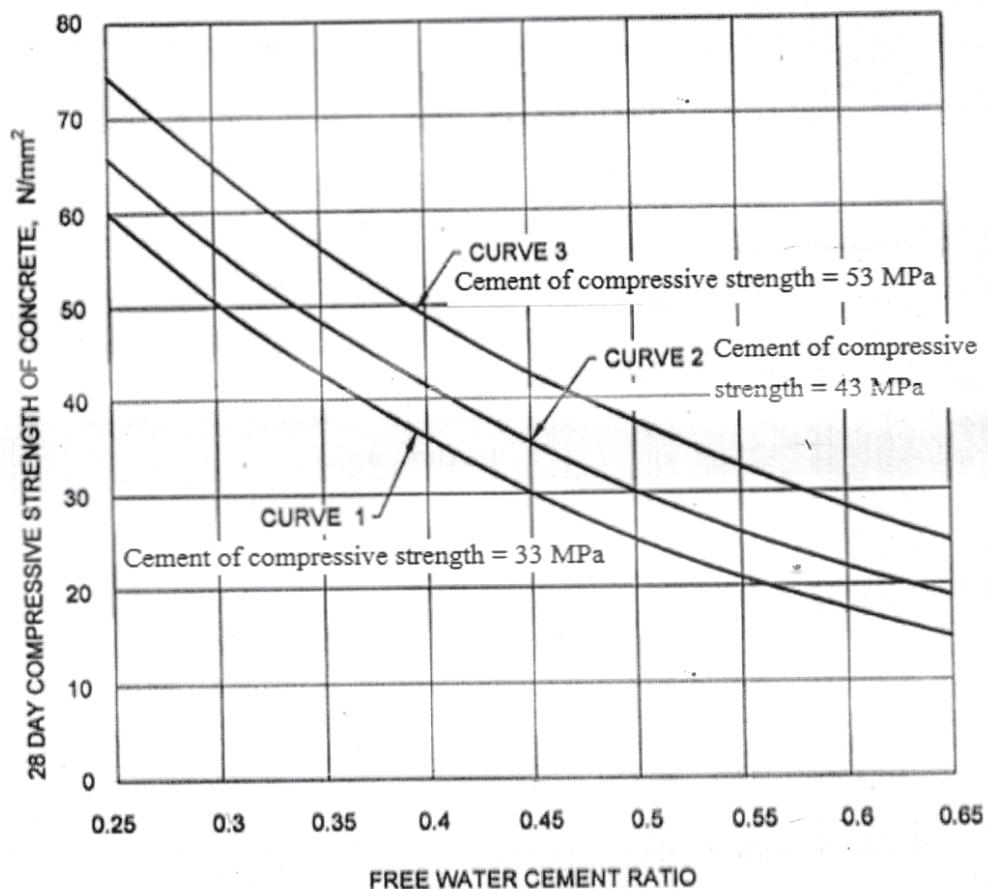
Figure: Relationship between free water cement ratio and 28 days

compressive strengths of concrete

Water content per m³ of concrete for 50 mm slump:

Sr. No.	Nominal maximum size of aggregate (mm)	Maximum water content (kg/m³)
i)	10	208
ii)	20	186
iii)	40	165

Volume of coarse aggregate per unit volume of total aggregate for

water-cement/water-cementitious materials 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/m³)	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) Enlist the factors influencing concrete mix design and explain any one of them. **[5]**

Q5) a) Write short note on. **[6]**

   i) Ready mix concrete

   ii) Roller compacted concrete

   b) What particular precautions one should take while concreting in: **[6]**

   i) Extremely cold weather and

   ii) Extremely hot weather.

   c) Explain underwater concreting by tremie method. **[6]**

OR

Q6) a) Write short note on: **[6]**

   i) Fiber reinforced concrete

   ii) Ferrocement technique

b) Discuss the self compacting concrete (SCC) with its advantages, material and examples of SCC mixes. **[6]**

c) Define lightweight concrete? Classify the various types of lightweight concrete by their method of production. **[6]**

Q7) a) Explain the permeability of concrete. **[5]**

b) Enlist the factors affecting durability of concrete. Explain any two in detail. **[6]**

c) Write short note on: **[6]**

   i) Attack by sea water on concrete

   ii) Chloride attack on concrete

OR

Q8) a) Discuss shotcrete and grouting technique to repair the defects/ cracks of concrete. **[5]**

b) Explain in detail corrosion monitoring techniques for reinforcement and preventive measures against corrosion. **[6]**

c) Discuss the application of fiber reinforced polymer (FRP) and polymer impregnated concrete for the retrofitting of concrete structures. **[6]**

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[6179]-204

S.E. (Civil)

STRUCTURAL ANALYSIS

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

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.*
5) *Use of electronic pocket calculator is allowed.*

Q1) a) Analyze the following beam shown in figure 1 by Slope Deflection Method. Draw BMD. **[12]**
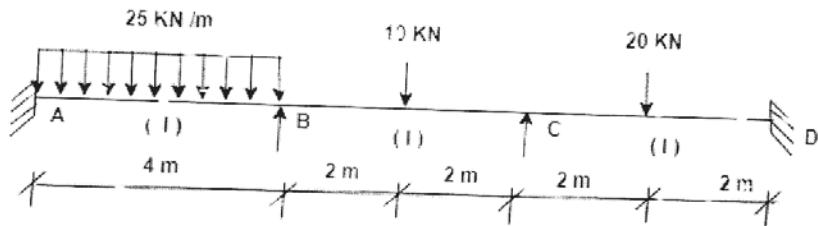
Figure 1

b) Analyze the bent shown in figure 2 by Slope Deflection Model. **[5]**

Figure 2

OR
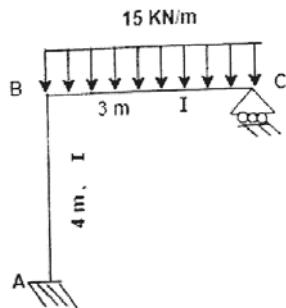
Q2) Analyze the frame shown in figure 3 by Slope Deflection Method. Draw BMD.**[17]**
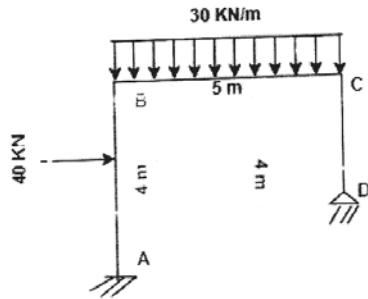
Figure 3

Q3) a) Analyze the beam shown in figure 4 by Moment Distribution Method. Draw BMD. **[10]**
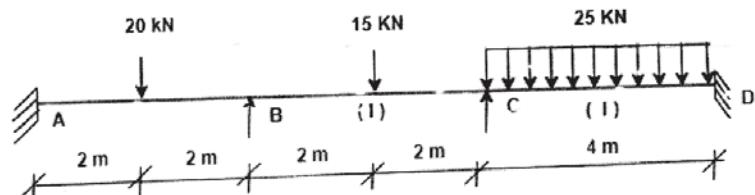
Figure 4

b) Analyze the bent shown in figure 5 by Moment Distribution Method.**[8]**
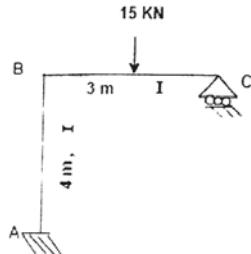
Figure 5

OR

Q4) Analyze the frame shown in figure 6 by Moment Distribution Method. Draw BMD. **[18]**
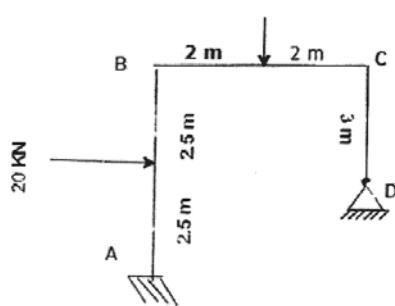

Figure 6

Q5) a)   Analyze the beam shown in figure 7 by Stiffness Matrix Method.   **[12]**
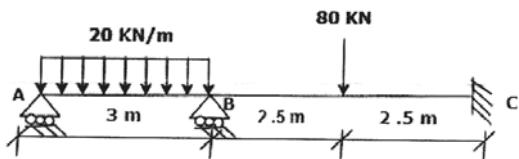
Figure 7

b)   Explain stiffness and flexibility.   **[5]**

OR

*Q6)* Analyze the frame shown in figure 8 by Stiffness Matrix Method.   **[17]**
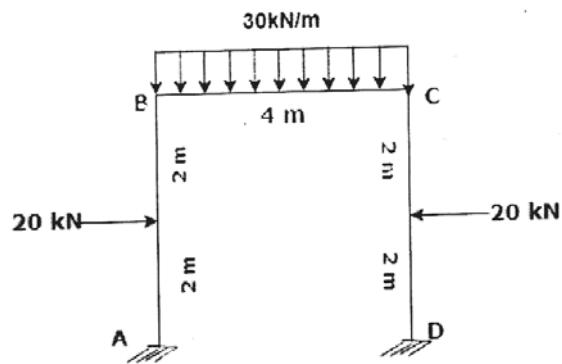
Figure 8

Q7) a)   Write assumptions in plastic theory.   **[5]**

b)   Determine collapse load for the frame as shown in figure 9.   **[13]**
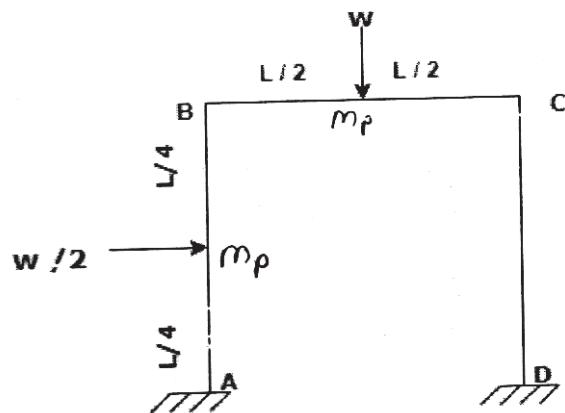

Figure 9

OR

**Q8)** a) Determine collapse load for the beam as shown in figure 10. **[6]**
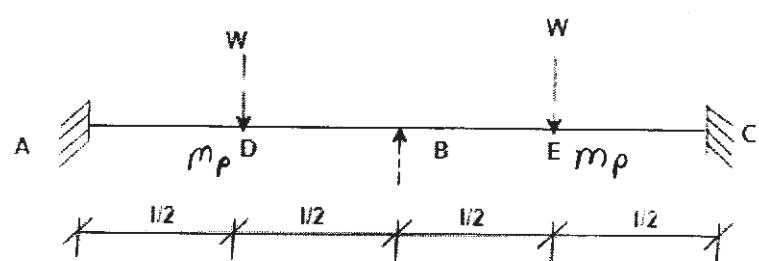
Figure 10

b) Determine shape factor of I-Section Shown in figure 11. **[12]**

Figure 11

✈ ✈ ✈
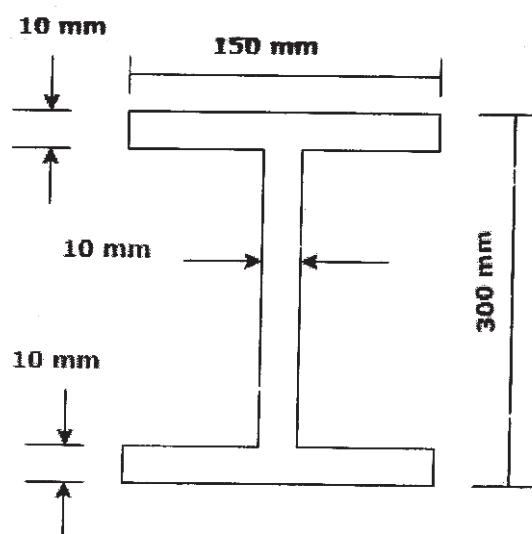
[6179]-205

S.E. (Civil)

PROJECT MANAGEMENT

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

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.*
4) *Use of calculator is allowed in the examination.*
5) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Discuss the objectives of material management. **[5]**
b) Explain the various safety measures to be taken in case of high-rise building construction. **[5]**
c) The annual demand of a construction item by a firm is 6400 units. The unit cost is Rs. 6 and inventory carrying cost per unit per annum is 25% of the average inventory cost. If the cost of procurement is Rs. 75, determine (i) economic order quantity (ii) Number of orders per annum **[7]**

OR

Q2) a) Explain with a neat sketch Site layout for a residential building construction site. **[5]**
b) The construction company has an inventory of 8 items. Following table shows the annual consumption of the items used in a project and their unit cost. Classify them in A,B,C classes. **[12]**

Item No.	Annual Consumption in Unit	Unit Cost (Rs.)
1	12000	3.00
2	22000	2.50
3	1900	1.70
4	45000	2.80
5	3500	1.70
6	60000	1.50
7	9000	2.00
8	32000	3.00

Q3) a) Discuss with sketch Resources Levelling and Resources Smoothing. **[5]**

b) Explain different steps involved in Project Updating in a construction project. **[5]**

c) Discuss the various performance of measurement parameters of Earned value Management. **[8]**

OR

Q4) a) Explain Project Monitoring and discuss any one method of it. **[5]**

b) The following table lists four activities of a construction project along with normal and shortest duration of completing the activity and the cost of reduction per day. The Project overhead costs are Rs. 2000 per week. Find the optimum duration and cost associated with it. Also draw least cost network for following project **[13]**

Activity	Normal duration (weeks)	Normal Cost (Rs.)	Crash Duration (Weeks)	Crash Cost (Rs.)
1-2	4	4000	2	12000
2-3	5	3000	2	7500
2-4	7	3600	5	6000
3-4	4	5000	2	10000

Q5) a) Define the following : **[5]**

i) Cost

ii) Value

iii) Price

iv) Rent

v) Simple Interest

b) Discuss Elasticity of Demand and supply. **[5]**

c) Explain Law of Diminishing Marginal Utility and Law of Substitution. **[7]**

OR

Q6) a)   Discuss the various factors Affecting Price Determination.   **[5]**

b)   State and explain the various Sources of Project Finance.   **[5]**

c)   Explain Supply curve and demand curve with neat diagram.   **[7]**

Q7) a)   List the various types of project appraisal and explain any one in detail.

[6]

b)   A construction company has the resources to implement one of the two projects that have been offered to it. Using NPV suggest the one project the company should accept. The expected returns are 12% per annum.**[12]**

Particulars	Project A	Project B
Initial Investment (Rs.)	4,00,000	3,50,000
Annual Income (Rs.) Year 1	1,50,000	1,00,000
Annual Income Year 2	2,00,000	3,00,000
Annual Income Year 3	80,000	50,000
Annual Income Year 4	1,00,000	90,000
Annual Income Year 5	20,000	60,000

OR

Q8) a)   Explain with figure breakeven analysis.   **[6]**

b)   Discuss role of project management consultant in pre tender and post tender stage.   **[6]**

c)   Differentiate between NPV and IRR.   **[6]**

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[6179]-206

S.E. (Civil Engineering)
BUILDING TECHNOLOGY & ARCHITECTURAL PLANNING
(2019 Pattern) (Semester-III) (201001)

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.
  5) Use of scientific calculator is allowed.

Q1) a) Define flooring. Enlist different types of flooring. Explain marble flooring. **[6]**

b) Enlist different types of roofs. Give the functional requirements of good roofing materials. Draw the sketch of queen post roof truss. **[6]**

c) Explain briefly the following aspects applied to doors and windows. **[5]**
  i) Function or purpose.
  ii) Location
  iii) Size

OR

Q2) a) What is the factor affecting the selection of flooring materials? **[6]**

b) Explain with proper sketch Casement window. **[6]**

c) Enlist types of doors and explain in detail Sliding door. **[5]**

Q3) a) It is proposed to construct a bungalow for a doctor, the following are the requirements for accommodation: **[13]**
  i) A Drawing Hall-25 Sqm.
  ii) Living Room- 25 Sqm.
  iii) Kitchen cum dining room - 15 Sqm.
  iv) Guest Room -20 Sqm.
  v) Children's Room -20 Sqm.
  vi) Master bedroom -20 Sqm.
  vii) Doctors Room - 20 Sqm.

viii) Provide adequate verandah, passage, sanitary units, staircase etc. as per bye- laws. Consider floor to floor height 3.0M, Size of Riser 150mm. The structure planned as G+1 RCC structure and draw line plan for the same.

b) Calculate number of risers and tread in each flight for dog legged stair, floor to floor height is 3.3 m and riser is 150mm. Show with a neat sketch. **[5]**

OR

Q4) a) Write a Short note on Green Building? Enlist various Rating System.**[5]**

b) A line plan of a residential building is shown in following figure 1. Draw detailed floor plan with 1:50 or suitable scale. Use the following data:**[13]**

i) All external wall thickness 230mm

ii) All internal wall thickness 150mm

iii) RCC Frame structure

iv) Floor to floor height -3.2

v) Plinth Height -0.6

vi) Toilet for M.Bed -1 .2 × 2. 1

vii) All dimensions are in meters



Fig.1

Q5) a) It is proposed to constrcut a Computer Training Institute with the following requirements: **[13]**
  i) Reception: 20 Sqm.
  ii) Administrative office: 25 Sqm
  iii) Cabin for head of the institute : 25 Sqm
  iv) Seminar Hall (2Nos) : 60 sqm each
  v) Class room (3 Nos) : 50 Sqm each
  vi) Computer lab(2 Nos): 70 Sqm each
  vii) Store Room: 15 Sqm
  viii) Staff room with attached toilet : 30 Sqm
  ix) All passage : 2 m wide
  x) Sanitary units : as per standards
  xi) Assume any suitable data if necessary
  xii) Draw to scale of 1:50 or suitable - line plan showing location of doors and windows

  b) Enlist the functional requirements and salient features of engineering Student for hostel building. **[5]**

<div align="center">OR</div>

Q6) a) Design a single storey hostel building and draw only line plan with the following data **[13]**
  i) Number of students - 40
  ii) Fifteen rooms are two seated with 7.5 sq. m area per student and ten single seated with 9.5 sq. m area.
  iii) Recreation room approx. area 35 Sqm
  iv) Kitchen-9.5 Sqm
  v) Office space approx. area 12 Sqm
  vi) Store room approx. area 10 Sqm
  vii) Dining - 3 Sqm / student
  viii) Passage -1.8m wide
  ix) Verandah, passage, staircase, W.C. and Bath etc. of suitable size should be provided. Show North direction and mention scale.

  b) Mention the functional requirements with dimensions for a School building. **[5]**

Q7) a) Explain in detail MRTP 1966 and RER.A **[6]**

b) What are different acoustical defects? Explain any one in detail. **[6]**

c) Explain in detail 7/12 abstract and describe different village forms. **[5]**

OR

Q8) a) Elaborate the following terms: **[6]**

    i)   Fire load

    ii)   Disaster Management

    iii)   Evacuation Time

b) Explain 'One Pipe' plumbing system **[6]**

c) Explain need of earthquake resistance structure **[5]**

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[6179]-207

S.E. (Civil)
MECHANICS OF STRUCTURE
(2019 Pattern) (Semester - III) (201002)

*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 in bold to the right, indicate full marks.*
3) *If necessary, assume suitable data and indicate clearly.*
4) *Use of electronic pocket calculator is allowed.*

Q1) a) A cast iron beam has an I-section with top flange 80 mm × 40 mm, web 120 mm × 20 mm and bottom flange 160 mm × 40 mm. If the tensile stress is not to exceed 30 N/mm^2 and compressive stress 90 N/mm^2, what is the maximum uniformly distributed load the beam can carry over a simply supported beam span 6 m, if the larger flange is in tension. **[9]**

b) The unsymmetrical I-section has top flange 80 mm × 20 mm, web 200 mm × 20 mm and bottom flange 160 mm × 40 mm is subjected to shear force of 40kN. Draw shear stress variation diagram across the depth. **[9]**

OR

Q2) a) A simply supported beam is having 3.5 m long span. Find the maximum udl it can carry. Its allowable compressive and tensile stress are 55 Mpa and 30 Mpa respectively. Draw a diagram showing the variation of stress over mid span section of the beam. **[9]**
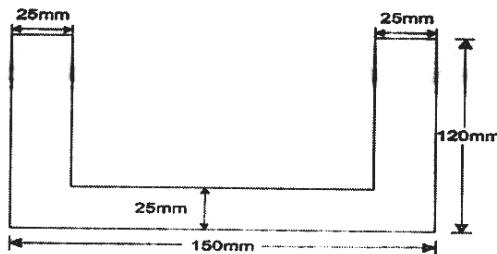
Figure 1

b) A steel beam of I section, 200 mm deep and 160 mm wide has 16 mm thick flange and 10 mm thick web. The beam is subjected to a shear force of 200 kN. Determine the stress distribution over the beam section if'the web of the beam is kept horizontal. **[9]**

P.T.O.

Q3) a) Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in solid shaft of 100mm diameter, 10 m long, transmitting 112.5 kW at 150 rpm. Take G 82 kN/mm². **[9]**

b) The stresses at point in a component are 150 Mpa and 50 Mpa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.**[8]**

OR

Q4) a) A solid shaft is subjected to a torque of 1.6 kN-m. find the necessary diameter of the shaft, if the allowable shear stress is 60 Mpa. The allowable twist is 1° for every 20 diameter length of the shaft. Take C=80 Gpa.**[9]**

b) At a point in a strained material there is tensile stress of 80 N/mm² on a horizontal plane and compressive stress at 40 N/mm² on a vertical plane. There is also a shear stress of 48 N/mm² on each of these planes. Determine the planes of maximum shear stress at the point. Determine also the resultant stress on the planes of maximum shear stress. **[8]**

Q5) a) Determine the buckling load for a strut of tee section, the flange width being 100 mm. overall depth 80 mm and both flange and web 10 mm thick. The strut is 3 m long and is hinged at both ends. Take E = 200 GNm². **[8]**

b) A alloy hollow circular column of 200 mm external and 160 mm internal diameter is 5 m long and fixed at both ends. It is subjected to a load of 120 kN at an eccentricity of 20 mm from the axis. Determine the maximum stress induced in the column section. Take E = 120 Gpa. **[9]**

OR

Q6) a) Find the Euler's crippling load for a hallow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3m and hinged at its both ends. Take E = 205 Gpa. Also determine crippling load by Rankine's formula using yield stress 335 Mpa and constant 1/7500. **[8]**

b) A steel tube of external diameter 109 mm and internal diameter 100 mm is used as a column of length 5 m with both ends hinged. How much axial load can it carry with a factor of safety of 1.75? In case the same load acts with eccentricity of 12 mm, determine the maximum horizontal deflection and the stress in the column. Take E =2 × 10⁵ N/mm². **[9]**

Q7) a) A simply supported beam of 6 m span is subjected to a concentrated load of 18 kN at 4 m from the left support. Calculate : **[9]**

   i) the position and value

   ii) slope at mid span

   iii) deflection at the load point

   Give E = 200 Gpa, I = 15×10^6 mm^4 use Macaulay's method

   b) Determine the vertical deflection using strain energy method of point C in the frame shown in figure 2. Given E = 200 kN/mm^2 and I = 30×10^6 mm^4.**[9]**
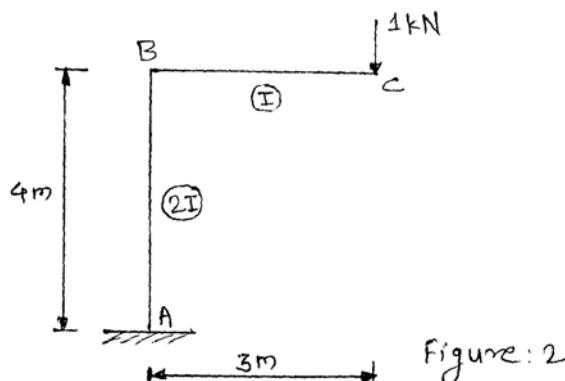
Figure : 2

OR

Q8) a) A cantilever of beam AB of length L and fixed at end A carries UDL of intensity l0kN/m over the entire span 6m and point load at free end 40 kN. Determine Slope at center and deflection at free end B of beam. Use Castingliano's theorem. **[9]**

   b) Determine the horizontal displacement of the joint C of the pin jointed frame as shown in figure 3. The cross section are of AB is 500 mm^2 and AC and BC is 750 mm^2. Assume E = 200 kN/mm^2. **[9]**

Figure : 3

✈ ✈ ✈
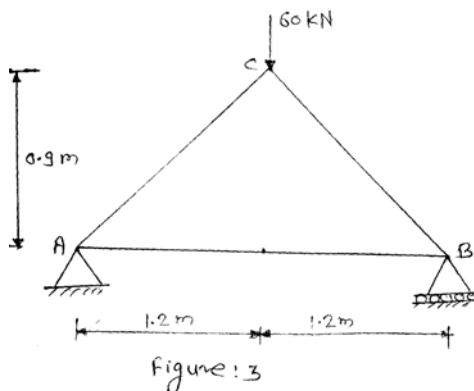
[6179]-208

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, Q.7 or Q.8.*
2) *Answers to the all questions should be written in single answer-book.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.*
6) *Assume suitable data, if necessary.*

Q1) a) Water is flowing through a pipe of diameter 30 cm at a velocity of 4.1 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between two pipes. The viscosity of oil water and oil is given as 0.01 poise and 0.025 poise. Take specific gravity of oil = 0.8. **[5]**

b) Explain with neat sketch the phenomenon of "Boundary Layer Separation". **[6]**

c) Explain with neat sketch various methods to control 'Boundary Layer Separation". **[6]**

<div align="center">OR</div>

Q2) a) Determine the dimensions of the following terms: **[5]**
  i) Discharge
  ii) Force
  iii) Specific weight
  iv) Kinematic viscosity
  v) Dynamic viscosity

b) Explain the following with the help of neat sketch: **[6]**
  i) Laminar boundary layer
  ii) Turbulent boundary layer and
  iii) Laminar sub-layer

c) Explain the Buckingham's π-method of dimensional analysis. **[6]**

Q3) a) A pipe of 110 mm diameter is carrying water. If the velocities at the pipe centre and 30 mm from the pipe centre are 2.1 m/s and 1.6 m/s respectively and flow in the pipe is turbulent. Calculate the shear friction velocity and wall shearing stress. **[6]**

b) Explain in brief "Moody's Diagram" **[5]**

c) Three pipes of lengths 800m, 500m, and 400m and of diameter 500mm, 400mm, and 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1750 m. Find the diameter of the single pipe. **[6]**

OR

Q4) a) A fluid of viscosity 8 poise and specific gravity 1.2 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is 212 N/m^2 . Find: **[6]**

    i) The pressure gradient

    ii) The average velocity and

    iii) Reynolds number of the flow

b) Explain the procedure of Hardy Cross method for the analysis of pipe network. **[6]**

c) Explain in brief the following terms related with flow through pipes: **[5]**

    i) Major losses and

    ii) Minor losses

Q5) a) Define the following terms related with types of open channel flow: **[6]**

    i) Steady flow

    ii) Unsteady flow

    iii) Uniform flow

    iv) Non-uniform flow

    v) Laminar flow

    vi) Turbulent flow

b) Derive the conditions for most economical trapezoidal channel section. **[6]**

c) i) Find the specific energy of flowing water through a rectangular channel of width 5 m when the discharge of 10.1 m³/s and depth of water is 3m. **[3]**

ii) Find the critical depth and critical velocity of the water flowing through a rectangular channel of width 5m, when discharge is 15.5 m³/s. **[3]**

OR

Q6) a) A trapezoidal channel has side slope of 1 horizontal to 2 vertical and slope of its bed is 1 in 1500. The area of the section is 40m². Find the dimensions for the channel sections if it is most economical as shown in Figure 6 a. Take Chezy' s constant as 80. **[6]**
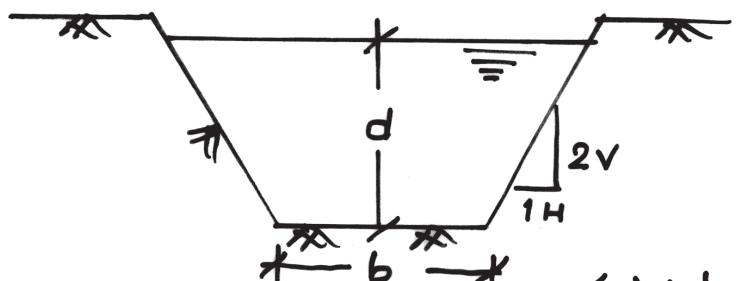
Figure 6 (a)

b) Explain the Specific energy curve and Specific force diagram with neat sketch. **[6]**

c) Explain in brief: **[6]**

i) Classification of Channel

ii) Velocity distribution in open channel.

Q7) a) Experiments were conducted in wind tunnel with a wind speed of 50 km/hour on flat plate of size 2m long and 1 m wide. The density of air is 1.16 kg/m³. The coefficients of lift and drag are 0.76 and 0.16 respectively. Determine: **[6]**

i) the lift force

ii) the drag force

iii) the resultant force

iv) direction of resultant force and

v) power exerted by air on the plate

b) Explain Classification of channel bottom slopes with neat sketches. **[6]**

c) Explain with neat sketch:

   i) Karman Vortex Trail **[3]**

   ii) Polar Diagram **[3]**

<div align="center">OR</div>

Q8) a) A rectangular channel is 20 m wide and carries a discharge of 65 m³/s. It is laid at a slope of 0.0001. At a certain section along the channel length, the depth of flow is 2m.How far U/S or D/S will the depth be 2.6m? Take n=0.02. Use direct step method with two steps. Consider the depth increment in the interval of 0.1m.Classify and sketch the profile. **[10]**

b) Explain in brief: **[8]**

   i) Magnus effect

   ii) Types of drag

   iii) Bluff body and

   iv) Streamlined body

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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 Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
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.

a) If $\sum xy = 2638, \bar{x} = 14, \bar{y} = 17, n = 10$, then cov (x, y) is_____ **[2]**

　i)　24.2　　　　　　　　　　　　ii)　25.8

　iii)　23.9　　　　　　　　　　　iv)　20.5

b) If $\bar{F} = r^2\bar{r}$ then $\bar{F}$ is_____ **[2]**

　i)　Constant　　　　　　　　　ii)　Conservative

　iii)　Solenoidal　　　　　　　　iv)　None of these

c) 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]**

　i)　1　　　　　　　　　　　　　ii)　$\dfrac{1}{3}$

　iii)　$\dfrac{3}{2}$　　　　　　　　　iv)　$\dfrac{2}{3}$

d) General solution of PDE $\dfrac{\partial^2 u}{\partial t^2} = 4\dfrac{\partial^2 u}{\partial x^2}$ is___ **[2]**

　i)　$u(x, t) = (C_4 \cos mx + C_5 \sin mx)\, e^{-4m^2 t}$

　ii)　$u(x, t) = (C_1 \cos mx + C_2 \sin mx)\,(C_3 \cos 2mt + C_4 \sin 2mt)$

　iii)　$u(x, y) = (C_1 e^{mx} + C_2 \bar{e}^{mx})\,(C_3 \cos my + C_4 \sin my)$

　iv)　$u(x, y) = (C_1 \cos mx + C_2 \sin mx)\,(C_3 e^{my} + C_4 \bar{e}^{my})$

P.T.O.

e) Coefficient of kurtosis β_2 is given by **[1]**

i) $\dfrac{\mu_4}{\mu_3}$

ii) $\dfrac{\mu_4}{\mu_2^2}$

iii) $\dfrac{\mu_3}{\mu_2^2}$

iv) $\dfrac{\mu_4}{\mu_2^3}$

f) The dot product of two vectors $\bar{a}$ & $\bar{b}$ is defined as $\bar{a}.\bar{b} = $ _____ .**[1]**

i) $ab\ \cos\theta$

ii) $ab\ \sin\theta$

iii) $ab\ \sin\theta\,\hat{n}$

iv) ab

Q2) a) The first four moments of a distribution about value 5 are 2, 20, 40 and 50. From given information find first four central moments. Also find coefficient of skewness and kurtosis. **[5]**

b) Find the coefficient of correlation for the following data. **[5]**

x	y
10	18
14	12
18	24
22	6
26	30
30	36

c) Between 2. p.m and 3.p.m the average number of phone calls per minute coming into company are 2. Find probability that during one particular minute there will be 2 or less calls. **[5]**

OR

Q3) a) Given the following information. **[5]**

	Variable x	Variable y
Arithmetic mean	8.2	12.4
Standard deviation	6.2	20

Coefficient of correlation between x & y is 0.9. Find the libean regression estimate of x, given $y = 10$.

b) On an average a box containing 10 articles is likely to have 2 detectives. If we consider a consignment of 100 boxes, how many of them are expected to have three or less detectives? **[5]**

c) In a normal distribution 10% of items are under 40 and 5% are over 80. Find mean and standard deviation of distribution. [Given : A(1.29) = 0.4, A(1.65) = 0.45] **[5]**

Q4) a) Find the angle between tangents to the curve $\vec{r} = (t^3 + 2)\hat{i} + (4t - 2)\hat{j} + (2t^2 - 6t)\hat{k}$ at t = 0 and t = 2. **[5]**

b) Find the directional derivative of $\phi = x^2y + xyz + z^3$ at (1, 2, –1) along normal to the surface $x^2 + y^2 + z^2 = 9$ at the point (1, 2, 0). **[5]**

c) Show that $\vec{F} = (ye^{xy} \cos z)\hat{i} + (xe^{xy} \cos z)\hat{j} - e^{xy} \sin z\, \hat{k}$ is irrotational. Find corresponding scalar & such that $\vec{F} = \nabla \phi$ **[5]**

OR

Q5) a) If the directional derivative of $\phi = a(x + y) + b(y + z) + c(x + z)$ has maximum value 12 in the direction parallel to y axis. Find a, b and c. **[5]**

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

i) $\nabla \times \left(\dfrac{\vec{a} \times \vec{r}}{r^3} \right) = -\dfrac{\vec{a}}{r^3} + \dfrac{3(\vec{a} . \vec{r})}{r^5}\vec{r}$

ii) $\nabla^4 e^r = e^r + \dfrac{4}{r}e^r$

c) Show that the vector field $f(r)\vec{r}$ is always irrotational and determine $f(r)$ such that the field is solenoidal. **[5]**

Q6) a) Let $\vec{F} = (xy + y^2)\hat{i} + x^2\hat{j}$. Is the work done along $y = x$ and $y = x^2$ from the common starting point (0, 0) to the common and point (1, 1), the same or different? **[5]**

b) Evaluate $\iint\limits_{s} \vec{F} . \hat{n}\, dS$ where $\vec{F} = ax\hat{i} + by\hat{j} + cz\hat{k}$ and S in the surface of the sphere $x^2 + y^2 + z^2 = r^2$. **[5]**

c) Apply stokes theorem to evaluate

$\int\limits_{C} \left[(x + y)dx + (2x - z)dy + (y + z)dz \right]$

where C is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6). **[5]**

OR

Q7) a) Evaluate $\oint_C \left[(3x - y)dx + (2x + y)dy \right]$ applying Green's lemma where C

is the curve $x^2 + y^2 = a^2$. Is the work done the same along the curves C_1 and C_2 where C_1 is the arc of C from $(0, -1)$ to $(0, 1)$ clockwise and C_2 is the arc of C from $(0, -1)$ to $(0, 1)$ anti clockwise. **[5]**

b) Let S be the surface of the sphere $(z + 3)^2 + x^2 + y^2 = 4^2$ cut off by the

plane $z = -2$. Evaluate $\iint_s \nabla \times \overline{F}. \, d\overline{S}$ where

$$\overline{F} = (x + y)\hat{i} + (y + z)\hat{j} + (z + x)\hat{k}$$ **[5]**

c) Find the surface of equi pressure in case of steady motion of a liquid which has velocity potential $\phi = \log (xyz)$ and is under the action of force $\overline{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$. Use the equation

$$\frac{\partial \overline{q}}{\partial t} + \frac{1}{2}\nabla q^2 = -\nabla v - \frac{1}{p}\nabla p$$ assigning appropriate meanings to the

variables. **[5]**

Q8) a) Solve the equation, $\dfrac{\partial^2 y}{\partial t^2} = c^2 \dfrac{\partial^2 y}{\partial x^2}$, where $y(x, t)$ satisfies the following

conditions, **[8]**

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

ii) $y(L, t) = 0 \ \forall t$

iii) $\dfrac{\partial y}{\partial t}\Big|_{t=0} = 0 \ \forall x$

iv) $y(x,0) = a\sin\left(\dfrac{\pi x}{L}\right)$

b) Solve the Laplace equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$, with conditions, **[7]**

i) $u = 0$ as $y \to \infty \forall x$

ii) $u = 0$ at $x = 0 \ \forall y$

iii) $u = 0$ at $x = \pi \ \forall y$

iv) $u = u_0$ at $y = 0, 0 < x < \pi$

OR

Q9) a) A tightly stretched string with fixed ends $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $3x(l - x)$ for each $0 < x < l$. Find the displacement $y(x, t)$. **[8]**

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

    i) u is finite for all l

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

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

    iv) $u(x, 0) = \dfrac{3x}{l} \quad 0 \le x \le l$

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[6179]-210

S.E. (Civil Engineering)
ENGINEERING GEOLOGY
(2019 Pattern) (Semester - III) (207009)

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 and Q.7 or Q.8.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams should be drawn wherever necessary.*

Q1) a) What is fold? Describe parts of fold with neat sketch. **[6]**

b) Describe the types of joints and their significance in civil engineering.**[6]**

c) Write short notes on: **[5]**

    i) Angular unconformity

    ii) Strike and dip of rocks.

OR

Q2) a) Define fault and describe any four types of fault. **[6]**

b) Define unconformity and Describe the types unconformity. **[6]**

c) Describe various types of igneous intrusions. **[5]**

Q3) a) Describe the applications of remote sensing in civil engineering field.**[6]**

b) Describe preliminary geological explorations in civil engineering projects.**[6]**

c) Explain how GIS is an important tool for civil engineers. **[6]**

OR

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

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

c) Compare direct and indirect methods of subsurface geological investigations. **[6]**

Q5) a)   Discuss on favorable geological conditions for reservoir area of dam.**[6]**

   b)   Discuss on tunnel excavated through faulted area.   **[6]**

   c)   What are the geological requirements for the foundation of dam?   **[5]**

<div align="center">OR</div>

Q6) a)   Explain geological investigations required to select site for tunneling.**[6]**

   b)   Explain the suitable and unsuitable dipping strata conditions at dam site.**[6]**

   c)   Discuss on stability of tunnels through limb and axial region of folds.**[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]**

<div align="center">OR</div>

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

   b)   Define earthquake and note on the Seismic zones of India.   **[6]**

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

<div align="center">✪ ✪ ✪</div>

[6179]-211

S.E. (Electrical Engineering)
POWER SYSTEM - I
(2019 Pattern) (Semester - IV) (203145)

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) What are the Main components of overhead lines? **[4]**

b) Explain in brief what are different types of line supports hence state requirements of line supports? **[6]**

c) A 3-phase transmission line is being supported by three disc insulators. The potential across top unit and middle unit are 8 kV and 11kV respectively. Calculate: **[8]**
     i) The ratio of capacitance between pin and earth to the self-capacitance of each unit
     ii) The line Voltage.
     iii) String efficiency.

<div align="center">OR</div>

Q2) a) What is String Efficiency?

                                                [4]

b) Describe the advantages & applications of Pin type & Suspension type insulator? **[6]**

c) Each line of a 3-phase system is suspended by string of three similar insulators if the voltage across line unit is 17.5 kV, calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. **[8]**

Q3) a) Define the G.M.D. for inductance calculation? **[3]**

b) Explain in details the Skin effect & Proximity effect? **[6]**

c) Derive an expression for the inductance of three phase overhead transmission line with symmetrical & unsymmetrical spacing with transposition. **[8]**

<div align="center">OR</div>

Q4) a) Define the G.M.R. for inductance calculation? **[3]**

b) What are bundled conductors? Discuss the advantages of bundled conductors when used for overhead lines. **[6]**

c) Derive an expression for Internal & External flux linkages due to single current carrying conductor. **[8]**

Q5) a) What do you mean by Electric Potential? **[4]**

b) Derive the expression for capacitance of single phase transmission line considering effect of earth. **[6]**

c) Derive an expression for the Capacitance of three phase overhead transmission line with symmetrical & unsymmetrical spacing with transposition. **[8]**

OR

Q6) a) What is the need of transposition for Capacitance calculation? **[4]**

b) Derive an expression for the capacitance to neutral of a three phase line with equilateral spacing. **[6]**

c) Explain the concept of G.M.D. & G.M.R. for Capacitance calculation?**[8]**

Q7) a) Classify the transmission line based on length & voltage level. **[3]**

b) Derive the expression for ABCD constants of medium transmission line considering nominal $'\pi'$ model of the line. **[6]**

c) Define generalised circuit constants of transmission line, write general relationship between sending end and receiving end quantities hence state properties of transmission lines from ABCD constants. **[8]**

OR

Q8) a) What do you mean by Ferranti Effect? **[3]**

b) Derive an expression for voltage regulation of short transmission line.**[6]**

c) Draw neat circuit diagram and phasor diagram of following transmission line models. **[8]**

i) Medium transmission line Nominal 'T' model.

ii) Medium transmission line Nominal $'\pi'$ model.

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[6179]-212

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

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 diagram must be drawn wherever necessary.*
4) *Assume suitable data, if necessary.*
5) *Use of Non-Programmable calculator is allowed.*

Q1) a)   Related to DC machine winding define the following terms.   **[4]**
- i)   Pole Pitch
- ii)   Coil Pitch
- iii) Conductor
- iv)   Back Pitch

b)   An 8-pole armature has 96 slots with 8 conductors per slot. It is driven at 600 rpm.   **[6]**

   The useful flux per pole is 10mWb. Calculate the induced e.m.f. in the armature winding when
- i)   Lap connected and
- ii)   Wave connected.

c)   Draw and explain the connection diagram of DC shunt, and DC series motors. Write their current and voltage equations.   **[8]**

<div align="center">OR</div>

Q2) a)   State the significance of back emf. Write down its equation.   **[4]**

b)   Derive the EMF equation of the DC generator by usual notations. State clearly the meaning of each term used in derivation. Write the EMF equation for LAP winding and WAVE winding.   **[6]**

c)   A 200V, 4 pole, lap wound, DC shunt motor has 800 conductors of armature winding. Armature and field winding resistances are 0.5ohm and 200ohm respectively. The motors take 21Amp & flux per pole is 30mWb. Find the speed and torque developed.   **[8]**

Q3) a) Draw the following characteristics of a series motor- **[3]**
   i) Torque Vs. armature current
   ii) Speed Vs armature current
   iii) Speed Vs Torque

b) A 500V, 6 pole, DC shunt motor has armature and field winding resistance of 0.5ohm and 250ohm respectively. It draws a full load current 20 A from the supply. If rotational losses are 900W calculate the efficiency motor. **[6]**

c) Draw and explain the three-point starter used for the DC motor. Write the function of the HOLD ON coil and OVERLOAD coil. **[8]**

OR

Q4) a) Write a short note on the functions of interpoles in DC machines. **[3]**

b) List the various speed control methods of the DC shunt motor. Explain any one with a suitable diagram. **[6]**

c) A 250V DC shunt motor has an armature resistance of 0.5ohm and field resistance of l25ohm. It drives a load at 1000 rpm and draws a current of 25Amp. Calculate the armature current drawn and speed of the motor if field resistance is increased up to 150ohms and load is kept constant.**[8]**

Q5) a) Draw the power flow diagram of the 3-ph Induction motor. **[4]**

b) Compare squirrel cage induction motor with slip ring induction motor (6 points). **[6]**

c) Derive Torque equation of 3 3-phase induction motor by usual notations. Also find. Full load torque, Starting torque, and Condition for maximum torque. **[8]**

OR

Q6) a) With a suitable diagram explain the constructional details of the 3-phase slip ring induction motor. **[4]**

b) Draw and explain the torque slip characteristics of the 3-phase induction motor. Mark the starting torque, pull-out torque, maximum torque, and full load torque in the same. **[6]**

c) A 3-phase induction motor having 6 pole star connected stator winding runs on 240V, 50Hz supply. The rotor resistance and standstill reactance are 0.12 ohms and 0.85 ohms per phase. The ratio of the stator to rotor turns is 1:8. Full load slip is 4%.Calculate the developed torque at full load, maximum torque, and speed at maximum torque. **[8]**

Q7) a) Draw the phasor diagram of a 3-phase induction motor. **[3]**

b) State the types of starters used for induction motors. Explain the rotor resistance starter with a suitable diagram. **[6]**

c) What data is required to plot the circle diagram of the 3-phase induction motor? Plot the circle diagram of the 3-phase induction motor and indicate the following quantities in it. **[8]**

    i) No Load Current,

    ii) No load Power Factor angle,

    iii) Constant loss,

    iv) Stator copper loss,

    v) Rotor copper Loss,

    vi) Torque line,

    vii) Output line,

    viii) Full load current

<div align="center">OR</div>

Q8) a) Name the various tests carried out on 3-phase induction motors as per IS 325 and IS 4029. **[3]**

b) Compare a three-phase induction motor with a three-phase transformer. **[6]**

c) With a suitable circuit diagram explain the No load and Blocked rotor test carried out on a 3-phase induction motor. What information is obtained from these tests? **[8]**

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S.E. (Electrical Engineering)
NETWORK ANALYSIS
(2019 Pattern) (Semester - IV) (203147)

Time : 2 ½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or 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) Derive the expressions for voltage across resistance and voltage across inductor in series RL circuit connected to a d.c. voltage V for t > 0. Assume that initial current through inductor is zero. **[5]**

b) In the network shown in Fig. 1, switch is closed at t = 0. Before closing the switch capacitor was in uncharged state. Find the values of

$$i(0^+), \frac{di(0^+)}{dt}, \frac{d^2i(0^+)}{dt}.$$ **[6]**
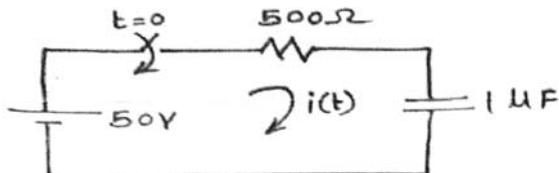
Fig. 1

c) For the network shown in Fig. 2, steady state is reached with switch closed. The switch is opened at t = 0. Obtain expressions for $i_L(t)$ for t>0. **[6]**


Fig. 2

OR
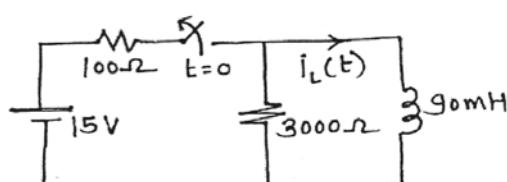
Q2) a) Derive the expressions for voltage across resistance and voltage across capacitor in series RC circuit connected to a d.c. voltage V for t > 0. Assume that initial voltage across capacitor is zero. **[5]**

b) In the network shown in Fig. 3. switch is closed at t=0. Assume initial current of inductor to be zero. Find the values of **[6]**

$$i(0^+), \frac{di(0^+)}{dt}, \frac{d^2i(0^+)}{dt}.$$
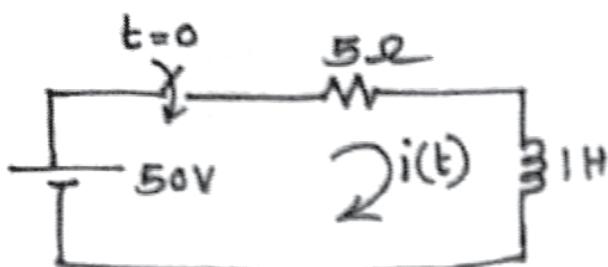
Fig.3

c) The switch in the circuit shown in Fig. 4 is moved from position 1 to 2 at t = 0. Find expression for $V_c(t)$ for t > 0. **[6]**
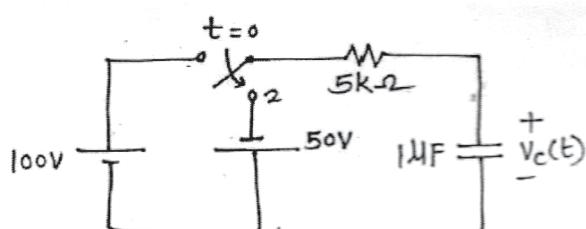

Fig. 4

Q3) a) Express following functions mathematically along with waveforms: **[6]**

i) Step function. Unit Step function. Delayed Unit Step function

ii) Ramp function. Unit Ramp function. Delayed Unit Ramp function

b) In the network shown in Fig. 5, switch is moved from position a to b at t = 0. Just before this switching the initial conditions were $i(0^-) = 2$ A and $V_c(0^-) = 2$ V. Find the expression for current i(t) using Laplace Transform method. Assume $R = 3\,\Omega, L = 1\,H, C = 0.5\,\mu F, V_1 = 5\,V$. **[6]**
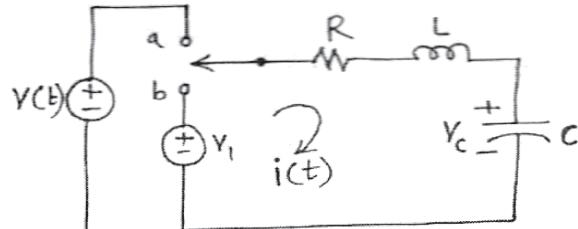
Fig. 5

c) In the network shown in Fig. 6, switch is moved from position 1 to 2 at

t = 0. Find $i(t), \dfrac{di(t)}{dt}, \dfrac{d^2i(t)}{dt^2}$ at t = 0⁺ by Laplace Transform approach.

[6]
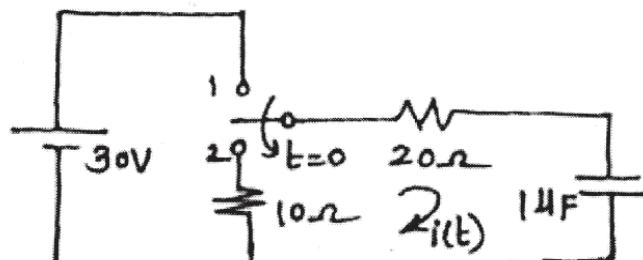
Fig. 6

OR

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

b) In the network shown in Fig. 7, the switch is moved from position a to b at t = 0. Determine expression for i(t) using Laplace Transform approach.

[6]
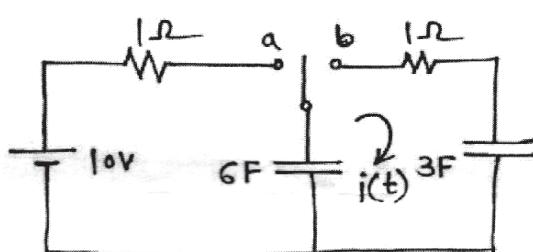

Fig. 7

c) In the network shown in Fig. 8, switch is moved from position 1 to 2 at t = 0. Find expression for i(t) by Laplace Transform approach. **[6]**
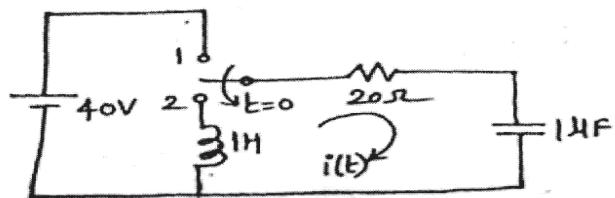
Fig. 8

Q5) a) Design constant K low pass filter having cut-off frequency 1kHz and design impedance 400Ω in both the T and π configurations. **[5]**

b) Find Z parameters of the network shown in Fig.9. **[6]**
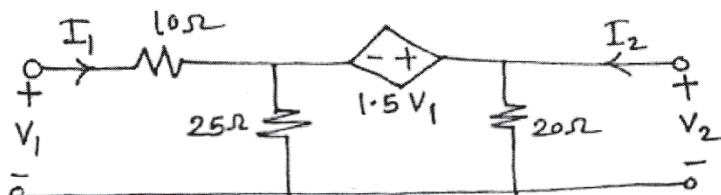
Fig. 9

c) Derive 'h' parameters in terms of 'Z' parameters for a two port network. **[6]**

OR

Q6) a) Design constant k high pass filter having cut-off frequency 1000 Hz and design impedance 1000Ω in both the T and π configurations. **[5]**

b) Find Y parameters of the network shown in Fig. 10. **[6]**
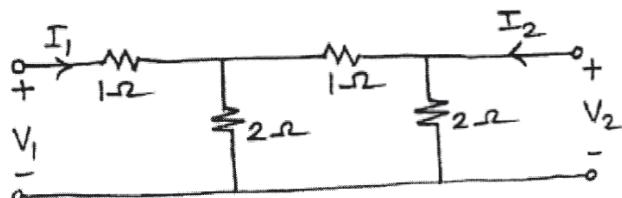
Fig. 10

c) Derive 'Z' parameters in terms of 'Y' parameters for a two port network. **[6]**

Q7) a) Define various network functions of a two port network. **[6]**

   b) Determine Driving Point Admittance function $Y_{11}(s)$ for the network in Fig. 11 and hence draw pole zero plot of $Y_{11}(s)$. **[6]**
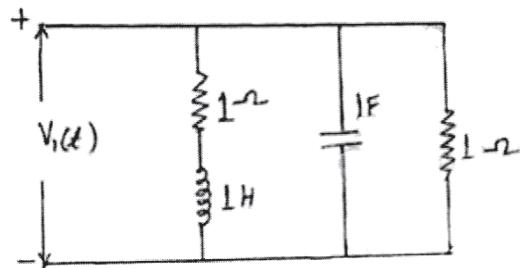
Fig. 11

   c) Plot Poles and Zeros for the network function $V(s) = \dfrac{s+20}{s(s+10)}$ and obtain time domain response. **[6]**

OR

Q8) a) State restrictions on Poles and Zeros locations for transfer functions and driving point function. **[6]**

   b) Determine Driving Point Impedance function $Z_{11}(s)$ and Driving Point Admittance function $Y_{11}(s)$ for the network in Fig. 12. **[6]**
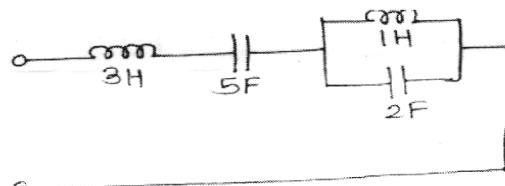
Fig. 12

   c) Plot Poles and Zeros for the network function $I(s) = \dfrac{10(s+2)}{s(s+5)}$ and obtain time domain response. **[6]**

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

Q1) a) Derive and explain Lagrange's Interpolation method. What are its application? **[6]**

b) Determine by Newtons divided difference interpolation method the percentage number of patients over 40 years, using following data. **[6]**

Age over (x years)	30	35	45	55
% number of (y) patients	148	96	68	34

c) Using central difference formula find the value of y at x=25 from the following table **[6]**

x	20	24	28	32
y	24	32	35	40

OR

Q2) a) Derive expression for Newton's Forward difference interpolation formula for equidistant points (x_0, y_0), (x_1, y_1)...........(x_n, y_n) **[6]**

b) The day - wise total solar radiation (in MJ/m²-day) is collected in the month of May which is required for experimentation. Use the appropriate interpolation Method to find solar radiation corresponding to 8th day. **[6]**

Day	1	3	5	7	9
total solar radiation (in MJ/m²-day)	15.25	25.42	28.57	27.86	26.43

c) The following table shows the viscosity of an oil as a function of temperature. Use Lagrange's interpolation formula to find viscosity of oil at a temperature of 140º **[6]**

Temp (⁰)	110	130	160	190
Viscosity	10.8	8.1	5.5	4.8

Q3) a) Derive formula for numerical differentiation of first order using Newton's forward interpolation technique. **[6]**

b) Evaluate the first and second derivative of √x at x = 15 from the following data **[6]**

x	15	17	19	21	23
√x	3.873	4.123	4.354	4.583	4.796

c) Determine the integration using simpsons $\frac{3}{8}$ th rule. Take h=0.1 $\int_0^1 \frac{1}{1+x^2} dx$ **[5]**

OR

Q4) a) Derive Trapezoidal rule for numerical integration as a special case of Newton's Cote formula **[6]**

b) A river is 80 m wide. The depth d in meters at a distance x meters from one bank is given in the following table **[6]**

X(m)	0	10	20	30	40	50	60	70	80
D(m)	0	4	7	8	12	15	14	8	3

Find approximately the area of cross section by

1) Trapezoidal rule

2) Simpson's 1/3rd rule

c) Compute $\int_0^1 \int_0^1 e^{x+y} \, dxdy$ by taking step sizes for both x and y are 0.5 using

Trapezoidal Rule **[5]**

Q5) a) Explain Gauss - Seidel method for solution of linear simultaneous equation. (Numerical is not expected) **[6]**

b) Using Jacobi iterative method solve the following system of linear simultaneous equations. [6] Take x (0) = y(0) = z(0) = 0 perform 5 iterations.

$3x + y + z = 2$

$x + 4y + 2z = -5$

$x + 2y + 5z = 2$ **[6]**

c) State the advantages of Iterative methods over Direct method and Compare Gauss Elimination method and Gauss Jordan method. **[6]**

OR

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Q6) a) Determine inverse of the following matrix using Jordan method. **[6]**

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

b) Explain Gauss Elimination Method for solution of linear algebraic equations. (problem solving is not expected) **[6]**

c) Solve the following equations by using Gauss seidel method correct up 1 to 4 decimal places and show 3 iterations. **[6]**

$10x_1 + 2x_2 + x_3 = 9$
$x_1 + 10x_2 - x_3 = -22$
$2x_1 + 3x_2 + 10x_3 = 2$
using initial conditions $x_1 = x_2 \, x_3 = 0$

Q7) a) Explain Taylor series method for the solution of ordinary differential equation. **[6]**

b) Find the value of $x = 0.1$ for the equation $\dfrac{dy}{dx} = 1 + xy$ and $y(0) = 1$.

Take step size $h = 0.1$ by Taylor series method. **[6]**

c) Apply Euler's method to find y(1. 1). Given $\dfrac{dy}{dx} = xy$, $y(1) = 5$. Show 5 iterations. **[5]**

OR

Q8) a) Derive the formula for Euler's method to solve $\dfrac{dy}{dx} = f(x,y)$ also show graphically effect of reduction in step size in the Euler method. **[6]**

b) A resistance of 100 ohm and inductance of 0.5 Henry are connected in series with a battery of 15V. If i(0)=0, find the current flowing through the inductor at 0.001 sec using 4th order Runge Kutta method. Take interval of 0.001 sec. **[6]**

c) Find $y(0.1)$ for $y'=x^2+y$, $x0 = 0$, $y0 = 0.94$, with step length 0.1 using Modified Euler method. **[5]**

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[6179]-215

S.E. (Electrical Engineering)
FUNDAMENTALS OF MICROCONTROLLER AND APPLICATIONS
(2019 Pattern) (Semester - IV) (203149)

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

Q1) a) Write Short note on Data Types in C. **[4]**

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

c) Write a C program to generate square wave of 50Hz frequency with 50 % duty cycle on pin 2.3. Assume XTAL = 11.0592MHz & use timer 0 in mode 1. **[8]**

OR

Q2) a) Explain Timer mode 0 & mode 1 of 8051 Microcontroller. **[4]**

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

c) Write C Program to toggle bit P1.5 of port P1,50000 times. **[8]**

Q3) a) Explain Interrupt Priority Register of 8051 Microcontroller. **[3]**

b) Explain interrupt structure of 8051 microcontroller with neat diagram. **[6]**

c) With the help of neat diagram explain interfacing of ADC 0809 with 8051 microcontrollers. **[8]**

OR

Q4) a) Explain the SOC, EOC & OF pin of ADC 0809. **[3]**

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

c) Write a program to turn off LED for connected to Port 0 when interrupt 0 occurs and turn it on when interrupt 1 occurs. **[8]**

Q5) a) Explain Steps to transfer Data Serially in 8051 microcontroller. **[4]**

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

c) Write program to transfer letter 'T' serially 10 times at baud rate of 4800. Use serial port in mode 1. XTAL = 12MHz. **[8]**

OR

Q6) a) Explain Steps to receive Data Serially in 8051 microcontroller. **[4]**

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

c) Explain Serial port structure of 8051 microcontroller. **[8]**

Q7) a) What is Step Angle ? Calculate the steps required to complete one revolution for 1.2 degree step angle stepper motor. **[3]**

b) Explain LED interfacing with 8051 microcontroller. **[6]**

c) With the help of block diagram explain Power measurement using 8051. **[8]**

OR

Q8) a) What are the applications of relay? **[3]**

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

c) Draw interfacing diagram of a stepper motor with 8051 and write program to rotate stepper motor 360 Degree in anticlockwise direction with step angle of 1.8 degree. **[8]**

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S.E. (Electrical Engineering)
POWER GENERATION TECHNOLOGIES
(2019 Pattern) (Semester-III) (203141)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q5 or Q6, Q.7 or Q.8.*
2) *Figures to the right side indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Assume suitable data if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) Explain the function of following component: Surge Tank. **[4]**

     b) Differentiate between Francis turbine & Kaplan turbine. **[6]**

     c) Explain the working of Pelton turbine with neat diagram in hydro power plant. **[8]**

OR

Q2) a) Explain the function of following component: Spillways. **[4]**

     b) Explain hydrograph and Flow Duration Curve with example. **[6]**

     c) Explain schematic arrangement of hydro power plant. **[8]**

Q3) a) What is the impact of tower height on wind power plant? **[3]**

     b) Comparison between Horizontal axis and Vertical axis wind turbine. **[6]**

     c) Draw the power converter topology for doubly fed induction generator in wind turbine and describe the working principle in brief. **[8]**

OR

Q4) a) Write a short note on Wind Turbine Economics. **[3]**

     b) Draw the wind turbine characteristics. Explain the features of horizontal axis and vertical axis wind turbine. **[6]**

     c) Derive the relation for power in wind and describe the environmental impact of wind turbine. **[8]**

Q5) a) Explain the term: Solar constant. [4]

b) Explain the methods of measurement of solar radiation. [6]

c) Explain the impact of temperature and insulation on I-V curves of PV cells. [8]

<div align="center">OR</div>

Q6) a) Explain the term: Concentration ratio. [4]

b) Explain the shading impact on I-V curves of PV cells. [6]

c) With the help of diagram explain the main concept of solar thermal power plant. [8]

Q7) a) Advantages of biomass power generation. [3]

b) Explain stand alone, hybrid stand alone& grid connected renewable energy systems. [6]

c) Write note on Ocean thermal energy conversion. Also, write its environmental consideration. [8]

<div align="center">OR</div>

Q8) a) What are the site selection criteria of fuel cell? [3]

b) What is geothermal energy? Explain with sketch how it can be harnessed to generate electricity? [6]

c) Explain the fuel cell with neat diagram, How are they used for energy storage requirements. [8]

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S.E. (Electrical)

MATERIAL SCIENCE

(2019 Pattern) (Semester - III) (203142)

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) Explain thermal classification of solid insulating materials. Hence write properties and applications of any two materials from Class E type. **[6]**

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

i) Pressboard

ii) Varnish

c) Explain properties of good liquid insulating material along with their examples. **[5]**

OR

Q2) a) Classify insulating materials as per their physical state, structure of material and mode of manufacturing along with their examples. **[6]**

b) State the properties and applications of - **[5]**

i) Air

ii) Askarel

c) Explain properties of insulating materials which are used in rotating machines and transformers. **[6]**

P.T.O.

Q3) a) Define with units - [6]

    i) Magnetic field strength

    ii) Magnetic permeability of free space

    iii) Magnetic susceptibility

  b) With necessary diagram, classify magnetic materials on the basis of magnetic dipole moment and magnetic permeability. [6]

  c) Draw and explain magnetization curve for a ferromagnetic material and hence define with units - [6]

    i) Coercive force

    ii) Residual Flux Density

<div align="center">OR</div>

Q4) a) In a magnetic material, hysteresis loss is 140 W when maximum flux density of 1.1 tesla and frequency is 40 Hz. What would be hysteresis loss if flux density is decreased to 0.9 tesla and frequency is increased to 60 Hz? Assume that hysteresis loss is proportional to $(B_m)^{1.7}$. PI check the solution. [6]

  b) Compare Soft Magnetic Materials and Hard Magnetic Materials. [6]

  c) Write short note on ferrites and their applications. [6]

Q5) a) Define resistivity of the material along with its unit. Hence explain factors affecting resistivity of the material. [6]

  b) With the neat diagram, explain principle of working of thermal bimetal. Give its examples and applications. [6]

  c) Describe properties and applications of Copper and Nichrome. [5]

<div align="center">OR</div>

Q6) a)   What do you mean by alloy? Hence explain properties and applications of copper alloys. **[6]**

b)   State properties and applications of materials used for solders. **[5]**

c)   With the neat diagram, explain principle of working of thermocouple. Give its examples with temperature ranges and its applications. **[6]**

Q7) a)   Describe with neat diagrams - Carbon clusters. **[6]**

b)   Explain with neat diagram - Single Electron Transistor (SET). **[6]**

c)   Write a short note on - C_{60}. **[6]**

OR

Q8) a)   Describe with neat diagram - Nano wires. **[6]**

b)   Describe with neat diagrams - Boron Nano Tubes. **[6]**

c)   Explain Nano materials used in Batteries and Photovoltaic Cells. **[6]**

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S.E. Electrical
ANALOG & DIGITAL ELECTRONICS
(2019 Pattern) (Semester-III) (203143)

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

Q1) a)   Write a short note on sequential memories (Definition, Characteristics, Examples). **[6]**

    b)   Explain Programmable Array Logic in detail. **[6]**

    c)   What is semiconductor memory? Enlist advantages of it. **[5]**

OR

Q2) a)   Describe in detail Read only memory (ROM). **[6]**

    b)   Write a short note on FPGA. **[6]**

    c)   What is DRAM? What are its advantages and disadvantages? **[5]**

Q3) a)   Explain how sine wave is generated by using Op-amp. **[6]**

    b)   Draw neat diagram of Op Amp as a Schmitt trigger and explain its working. **[6]**

    c)   Define the characteristics of practical OPAMP. **[6]**

OR

Q4) a)   With neat pin diagram explain function of each pin of IC 741. **[6]**

    b)   Explain working of OPAMP as instrumentation amplifier. **[6]**

    c)   Draw input and output waveforms of Op Amp as a Zero crossing Detector. Explain its working. **[6]**

P.T.O.

Q5) a) Explain functioning of LM 317 as a voltage regulator. **[6]**

b) With neat diagram explain working of IC 555 as a Monostable Multivibrator. **[6]**

c) Draw and explain frequency response of high pass filter. **[5]**

<div align="center">OR</div>

Q6) a) With neat diagram explain working of IC 555 as a Astable Multivibrator. **[6]**

b) Draw and explain frequency response characteristic of ideal and practical Low Pass Filter. **[6]**

c) What is voltage regulator? Write any two applications of voltage regulator. **[5]**

Q7) a) Compare single phase Half Wave Rectifier and single phase Full Wave Rectifier. **[6]**

b) With the help of circuit diagram and relevant waveforms, explain the operation of a 3-phase bridge rectifier with resistive load. **[6]**

c) Define following terms **[6]**
   i) Form factor
   ii) Ripple factor
   iii) TUF

<div align="center">OR</div>

Q8) a) Explain working of single phase half wave rectifier with RL load. Draw output waveforms. **[6]**

b) State values of output Performance parameters of single phase full wave bridge rectifier. **[6]**
   i) DC output voltage
   ii) DC output current
   iii) Output DC power.
   iv) Rectification Efficiency
   v) Form Factor
   vi) PIV

c) Explain in detail the working of center tapped rectifier connected to the R load. **[6]**

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S.E. Electrical

Electrical Measurements & Instrumentation

(2019 Pattern) (Semester - III)(203144)

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) What are the different methods to measure power in three phase circuits? Explain any one method in detail. **[6]**

   b) State and explain errors in dynamometer type wattmeter. **[6]**

   c) A wattmeter reads 4.5 kW when its current coil is connected in the 'R' phase and its voltage coil is connected between 'R' phase and neutral of a symmetrical 3 phase system supplying a balance load of 20 A at 415V. What will be the reading of the wattmeter if the current coil remains unchanged and voltage coil is connected between 'B' and 'Y' phases? The phase sequence is RYB. **[6]**

<div align="center">OR</div>

Q2) a) With neat diagram, explain construction and working of a dynamometer type wattmeter. **[6]**

   b) When two wattmeter method is used for measurement of power in a three phase balanced circuit, comment upon the readings of the two wattmeter under following conditions. **[6]**

      i)   when the power factor is unity

      ii) when the power factor is zero

   c) Two wattmeter's connected to measure the power supplied to a 3 phase, 500 V circuit indicate the total input to be 10 kW. The power factor is 0.3 lagging. Find the reading on each wattmeter. **[6]**

Q3) a) Draw neat diagram of induction type energy meter, label all the parts and explain its construction and working. **[9]**

b) A single phase energy meter is supplying power to a resistive load at 240 V, 4.4 A for a period of 5 hours. **[8]**

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

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

<div align="center">OR</div>

Q4) a) Explain with neat diagram and necessary phasor diagrams, how single-phase energy meter can be calibrated at different power factors. **[6]**

b) With a block diagram explain working of single phase static energy meter. **[6]**

c) An energy meter is designed to make 100 revolutions of disc for one unit of energy. Calculate the number of revolutions made by it when connected to load carrying 40A at 230V and 0.4 power factor for an hour. If it actually makes 360 revolutions, find the percentage error and also state that whether meter is fast or slow. **[5]**

Q5) a) Give detailed classification of transducers along with examples of each type. **[6]**

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

c) Draw a block diagram of DSO. Explain functions of each block. **[6]**

<div align="center">OR</div>

Q6) a) Define pressure? What is the classification of pressure? State the various methods of measurement for each type. **[6]**

b) With a suitable diagram explain working of inductive transducres. **[6]**

c)   Explain the following terms associated with CRO   **[6]**

   i)   Volts / division

   ii)   Invert

   iii) X position

   iv)   Y position

   v)   XY mode

   vi)   Times / division

Q7) a)   Define strain. What are the types of strain gauge? Explain wire strain gauge.   **[6]**

   b)   Explain Capacitive method for level measurement with suitable diagram.   **[6]**

   c)   With neat diagram, explain construction and working of LVDT.   **[5]**

                                        OR

Q8) a)   Draw and Explain Ultrasonic method for level measurement.   **[6]**

   b)   What is LVDT, Draw and explain output characteristics of LVDT.   **[6]**

   c)   Describe the construction of foil type strain gauges and explain their advantages over wire wound strain gauge.   **[5]**

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[6179]-220

S.E. (Electrical)

ENGINEERING MATHEMATICS-III
(2019 Pattern) (Semester-III) (207006)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
  1)   Question 1 is compulsory.
  2)   Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q9.
  3)   Neat diagrams must be drawn wherever necessary.
  4)   Black Figures to the right indicate full marks.
  5)   Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  6)   Assume suitable data if necessary.

Q1) Choose the correct option.

  a)   If $U(k) = \begin{cases} 0 & k < 0 \\ 1 & k \geq 0 \end{cases}$ the $z\{U(k)\}$ is given by   **[2]**

  i) $\dfrac{-z}{z-1}, |z| > |$ ii) $\dfrac{1}{z-1}, |z| > |$

  iii) $\dfrac{z}{z-1}, |z| > |$ iv) $\dfrac{2}{z-1}, |z| > |$

  b)   If $f(x)$ defined in the interval $-\infty < x < \infty$ is an even function, then fourier cosine transform of $f(x)$ is,   **[1]**

  i) $F_c(\lambda) = \int_0^\infty f(u) \cos \lambda u \, du$ ii) $F_c(\lambda) = \int_{-\infty}^\infty f(u) \cos \lambda u \, du$

  iii) $F_c(\lambda) = \dfrac{\pi}{2} \int_0^\infty f(u) \cos \lambda u \, du$ iv) $F_c(\lambda) = \int_0^\infty f(u) \sin \lambda u \, du$

  c)   Standard deviation of four numbers 9,11,13,15, is,   **[2]**
  i)   2   ii)   4
  iii) $\sqrt{6}$ iv) $\sqrt{5}$

  d)   Mean of Binomial Distribution with parameters n &p is,_____   **[1]**
  i) nq ii) $n^2 p$
  iii) npq iv) np

e) For constant vector $\bar{a}$, $\nabla \times (\bar{a} \times \bar{r}) = $ _____   **[2]**

    i) $3\bar{a}$ ii) $\bar{a}$

    iii)   0   iv) $2\bar{a}$

f) Residue of $\dfrac{z+1}{z^2+1}$ at the pole $z = i$ is,   **[2]**

    i) $\dfrac{i-1}{2i}$ ii) $\dfrac{1-i}{2}$

    iii) $\dfrac{1+i}{2i}$ iv) $\dfrac{1-i}{2i}$

Q2) a) Attempt any one   **[4]**

    i)   Find z transform of $f(k) = \left(\dfrac{1}{4}\right)^{|k|}$, for all k

    ii)   Find inverse z-transform of $f(z) = \dfrac{1}{(z-2)(z-3)}, |z| > 3$

  b) Obtain $f(k)$; given that   **[6]**

$$f(k+1) + \frac{1}{2} f(k) = \left(\frac{1}{2}\right)^k, k \geq 0, f(0) = 0$$

  c) Find the fourier cosine transform of the function.   **[5]**

$$f(x) = \begin{cases} \cos x & 0 \leq x \leq a \\ 0 & x > a \end{cases}$$

<div align="center">OR</div>

Q3) a) Attempt any one.   **[5]**

    i)   Find z transform of $f(k) = 4^k \sin(2k+3)$, $k \geq 0$

    ii)   Find inverse z transform of $f(z) = \dfrac{z(z+1)}{z^2 - 2z + 1}$, $|z| > |$

  b) Find fourier cosine transform of   **[5]**

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

  c) Solve the following integral equation   **[5]**

$$\int_0^\infty f(x) \sin \lambda x \, dx = \begin{cases} 1 & 0 \leq \lambda < 1 \\ 2 & 1 \leq \lambda < 2 \\ 0 & \lambda \geq 2 \end{cases}$$

Q4) a) The first four moments of a distribution about the value 2 are –1.1, 89, –110 and 23,300. Obtain the first four central moments, β_1 and β_2.**[5]**

b) Obtain the correlation coefficient for the following data. **[5]**

x	3	4	6	8	10
y	10	7	8	8	6

c) A fair coin is tossed 5 times. What is the probability of getting at least two tails? **[5]**

OR

Q5) a) Obtain the line of regression of *y* on *x* for the following data. **[5]**

x	3	4	6	8	10
y	2	4	5	7	8

b) The number of accidents per week on a highway follows a poisson distribution with mean 0.5. Find the probability that during a week there will be at the most one accident. **[5]**

c) The lifetime of an article has a normal distribution with mean 400 hours and standard deviation 50 hours. Assuming normal distribution, find the expected number of articles out of 2,000 whose life time lies between 335 hours to 465 hours. **[5]**

[Given : $z = 1.3$, $A = 0.4032$]

Q6) a) Find the directional derivative of $\phi = 3 \log (x + y + z)$ at (1, 1, 1) in the direction of tangent to the curve $x = b \sin t$, $y = b \cos t$, $z = bt$. at $t = 0$. **[5]**

b) If the vector field. $\overline{F} = (x + 2y + az)\overline{i} + (bx - 3y - z)\overline{j} + (4x + cy + 2z)\overline{k}$

is irrotational find *a*, *b*, *c* and determine ϕ such that $\overline{F} = \nabla\phi$. **[5]**

c) If $\overline{F} = (2xy + 3z^2)\overline{i} + (x^2 + 4yz)\overline{j} + (2y^2 + 6xz)\overline{k}$, evaluate $\int_c \overline{F} \cdot d\overline{r}$

where C is the curve $x = t$, $y = t^2$, $z = t^3$. joining (0, 0, 0) and (1, 1, 1). **[5]**

OR

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Q7) a) Find the directional derivative of $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ towards the point $(2, 1, -1)$. **[5]**

b) Prove (any one) **[5]**

i) $\nabla^4 e^r = e^r + \dfrac{4}{r} e^r$

ii) $\nabla\left(\bar{a} \cdot \nabla \dfrac{1}{r}\right) = \dfrac{3(\bar{a}, \bar{r})\bar{r}}{r^5} - \dfrac{\bar{a}}{r^3}$.

c) Using Green's theorem evaluate $\displaystyle\int_c \bar{F} \cdot d\bar{r}$ where $\bar{F} = (3y\bar{i} + 2x\bar{j})$ and c is the boundary of region bounded by $y = 0$, $y = \sin x$, $x = 0$, $x = \pi$. **[5]**

Q8) a) If $u = x^3 + 3y^2 x$, find it's harmonic conjugate v. Also find $f(z) = u + iv$ in terms of z. **[5]**

b) Evaluate $\displaystyle\oint_c \dfrac{2z^2 + z + 5}{\left(z - \dfrac{1}{2}\right)^2} dz$,where 'C' is the ellipse $\dfrac{x^2}{4} + \dfrac{y^2}{9} = 1$. **[5]**

c) Find the bilinear transformation, which sends the points $1, i, -1$ from z-plane into the points $i, 0, -i$, of the w–plane. **[5]**

OR

Q9) a) Determine k such that the function $f(z) = e^x \cos y + i e^x \sin ky$ is analytic. **[5]**

b) Applying residue theorem evaluate $\displaystyle\oint_c \dfrac{z + 2}{z^2 + 1} dz$ where 'C' is the curve $\left|z - i\right| = \dfrac{1}{2}$. **[5]**

c) Find the map of the straight line $y = x$ under the transformation $w = \dfrac{z - 1}{z + 1}$. **[5]**

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S.E. (Electronics/ E & TC/EC)
SIGNALS AND SYSTEMS
### (2019 Pattern) (Semester - IV) (204191)
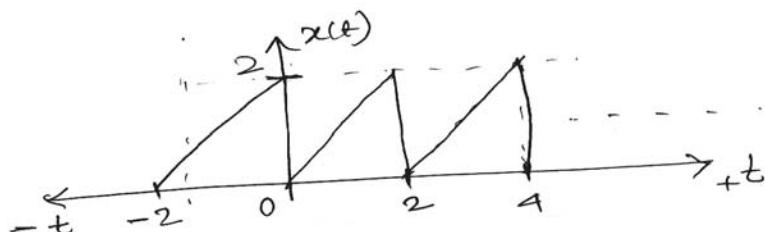
Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
    1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
   *2) Assume suitable data, if required.*
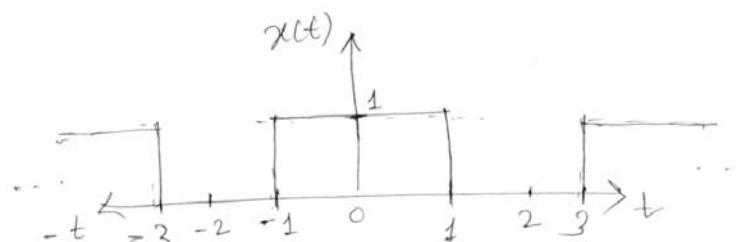
Q1) a) Find the Exponential Fouries series for the periodic signal shown in fig. below. **[8]**

     b) State the following properties of CT Fouries Series. **[6]**

         i) Linearity

         ii) Time Integration

         iii) Convolution

     c) Write short note on Basis function. **[4]**

OR

**Q2)** a) Determine the Trignometric Fourier series for the Periodic signal given below. **[8]**
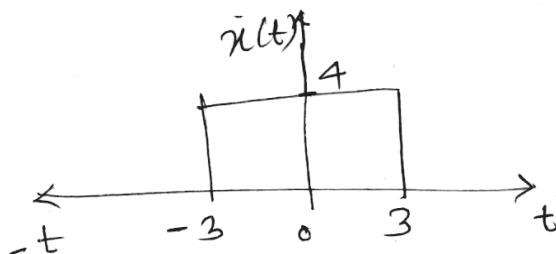
     b) Check whether the two signals sin(wt) and sin(2 wt) are orthogonal to each other. **[6]**

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

P.T.O.
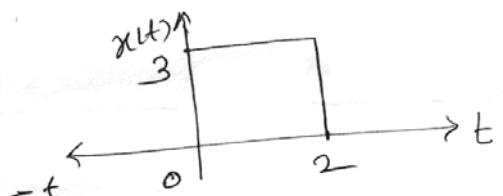
Q3) a) Determine the Fourier Transform of $x(t) = e^{-2t}. u(t)$. Also, plot magnitude and phase spectrum. **[8]**

b) State the convolution property. Find the Fourier Transform of $x(t) = \delta(t-1) * e^{-t} u(t)$ **[6]**

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

OR

Q4) a) Find the Fourier Transform of signal given below. **[8]**

i) $\cos(w_0 t)$

ii) $\sin(w_0 t)$

b) Define Frequency Differentiation property. Using the same property, Find Fourier Transform of $x(t) = t.e^{-2t}. u(t)$. **[6]**

c) Find the Fourier Transform of following signal. **[3]**

Q5) a) Find the Laplace Transform of $x(t) = e^{-4|t|}$. Also sketch ROC for the same. **[8]**

b) Find the Laplace Transform of following signals using properties. **[6]**

i) $x(t) = t^2. e^{-t}. u(t)$

ii) $x(t) = e^{-t}. \cos(t). u(t)$

c) Find the Laplace Transform of the signal given below. **[4]**

OR

Q6) a) Find the Inverse Laplace Transform of $X(s) = \dfrac{-5s - 7}{(s+1)\ (s-1)\ (s+2)}$ with

ROC specified $-2 < \sigma < -1$. **[8]**

b) Find the Initial value and find value of given $X(s) = \dfrac{6s + 5}{s(2s + 5)}$. **[6]**

c) Define ROC. List the properties of ROC. **[4]**

Q7) a) Define the following **[9]**
   i) Probability
   ii) Conditional Probability
   iii) Bayes Theorem
   iv) CDF
   v) PDF
   vi) Mean
   vii) Mean Square Value
   viii) Variance
   ix) Standard Deviation.

b) PDF of a random variable is given as $f_X(x) = e^{-x}\, u(x)$ **[8]**
   Find
   i) CDF
   ii) $P(X \le 1)$
   iii) $P(1 \le X \le 2)$
   iv) $P(X > 2)$

OR

Q8) a) Define Properties of probabilities. And Find the probability P(A), P(B), P(C), P(A∩B), P(A∩C), P(A∪B), P(A∪C), P(B∩C) in an experiment consists of observing the sum of the numbers showing up when two dice are thrown. Event A = {sum = 7}, B = {8 < sum < 11}, C = {10 < sum}. **[9]**

b) PDF of a random variable is given as **[8]**

$$f_X(x) = \begin{cases} \dfrac{1}{a} & |x| \le a \\ 0 & \text{otherwise} \end{cases}$$

Find
   i) Mean
   ii) Mean Square Value
   iii) Variance
   iv) Standard Deviation.

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S.E. (Electronics/E & TC)
CONTROL SYSTEMS
(2019 Pattern) (Semester - IV) (204192)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve question 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) Investigate the stability of the system using Routh Hurwitz criterion **[8]**

$$G(s) = \frac{100}{S^4 + 6S^3 + 30S^2 + 60S + 100}$$

    b) The O.L.T.F of unity gain negative feedback system given **[10]**

$$G(S) = \frac{k}{s\,(s+4)(s^2+s+1)}.$$

        i) Calculate the range of k for system to be in stable state when stability of closed loop system is concerned.

        ii) Calculate the value of k for system to become marginally stable, also calculate the frequency of natural oscillation.

<div align="center">OR</div>

Q2) a) The closed loop transfer function of the system is given as

$$G(S) = \frac{s+2}{s^3 - 3s^2 + 4s - 2},$$ Determine the stability of system. **[8]**

    b) A unity feedback transfer function has forward path gain

$$G(S) = \frac{k}{s(s+2)}$$ Plot a root locus. **[10]**

Q3) a) If $G(S)H(S) = \dfrac{24}{s(S+2)(S+12)}$, Construct the Bode plot and Calculate gain crossover frequency, Phase Crossover frequency. **[9]**

b) Draw the Polar plot for given transfer function. $G(S)H(S) = \dfrac{5}{s(s+2)}$.**[8]**

OR

Q4) a) For unity feedback system with open loop transfer $G(S) = \dfrac{100}{S(S+9)}$. Determine damping factor, undamped natural frequency, resonant peak, and resonant frequency. **[9]**

b) Define and explain **[8]**

   i) Bandwidth

   ii) Gain margin

   iii) Phase margin

   iv) Gain cross-over frequency

   v) Phase cross over frequency.

Q5) a) A feedback system with transfer function $G(S) = \dfrac{S^2+3S+3}{S^3+2S^2+3S+1}$ Construct a state model for the system. **[9]**

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

$$A = \begin{bmatrix} -2 & 1 & 0 \\ 1 & -3 & 2 \\ 10 & 0 & -8 \end{bmatrix} B = \begin{bmatrix} 0 \\ 0.1 \\ 1 \end{bmatrix} C = [1\ 0\ 1]\ D = [0]$$

OR

Q6) a) Explain advantages and disadvantages of Conventional Control Theory.**[9]**

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

Q7) a) What do you mean by On-Off control? Explain with suitable example.**[9]**

b) What do you mean dead zone? Explain with suitable example. **[8]**

OR

Q8) a) How IoT helps in Industrial Automation? What are the essentials of an Industrial IoT solution? Give two examples of Industrial IoT . **[9]**

b) Write short note on digital control system over analog control system.**[8]**

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S.E. (Electronics/E&TC/E&CE)
PRINCIPLES OF COMMUNICATION SYSTEMS
(2019 Pattern) (Semester - IV) (204193)

Time : 2 ½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

   1)   *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6 , Q7 or Q8.*

   2)   *Assume suitable data if necessary.*

Q1) a)   Define Angle modulation. Describe with block diagram relationship between Phase modulation & frequency modulation.   **[6]**

     b)   The equation for an FM wave is $x(t) = 10 \sin [5.7 \times 10^8 \, t + 5 \sin 12 \times 10^3 \, t]$ Calculate :   **[6]**

        i)   Carrier frequency

        ii)   Modulating frequency

        iii) Modulation index

        iv) Frequency deviation

        v)   Power dissipated in $100\,\Omega$

     c)   With neat block diagram explain FM generation by Armstrong's Indirect method.   **[6]**

<div align="center">OR</div>

Q2) a)   Compare Frequency modulation & Phase modulation System.   **[6]**

     b)   Describe direct method of generation of FM wave with diagram.   **[6]**

     c)   Explain balanced slope detector with diagram & characteristics.   **[6]**

Q3) a)   Describe generation of flat top samples with circuit diagram & waveform.   **[6]**

     b)   What is aperture effect? How to reduce aperture effect.   **[5]**

     c)   Compare Pulse Amplitude modulation with Pulse position modulation.   **[6]**

<div align="center">OR</div>

Q4) a) Discuss generation of Pulse Amplitude modulation with block diagram & waveform. **[6]**

b) Explain demodulation of PWM signal with block diagram. **[6]**

c) State transmission B.W. of PAM signal & also state advantages, disadvantages & applications of PAM signal. **[5]**

Q5) a) Discuss with block schematic, transmitter & receiver for DPCM (Differential pulse code modulation). **[6]**

b) Draw block diagram of Delta modulation system & comment on draw back of Delta modulation. **[6]**

c) Define term quantization error. State types of quantization & explain uniform quantization with its characteristics. **[6]**

OR

Q6) a) Explain generation & reconstruction of PCM signal. **[6]**

b) Describe Adaptive delta modulation technique & state its advantages. **[6]**

c) Compare PCM with DM. **[6]**

Q7) a) For the given sequence 110011101, sketch the waveform using the following data formats. **[5]**

i) Unipolar RZ

ii) Polar NRZ

iii) Alternate Mark Inversion

iv) Split Phase Manchester

v) Bipolar NRZ

b) Describe AT & T hierarchy with diagram. **[6]**

c) State types of Synchronization & explain any one in detail. **[6]**

OR

Q8) a) Explain spectral features of Line codes. **[6]**

b) Discuss quasi synchronous multiplexing & state its advantages. **[5]**

c) What is necessity of equalization in Digital transmission? Explain Adaptive equalization. **[6]**

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S.E. (Electronics / Electronics & Computer/E&TC)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - IV) (204194)

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) What is a friend function? What are the merits and demerits of using the friend function?   **[6]**

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

   c) Which is operator overloading? Write steps to overload << & >> operators.   **[6]**

OR

Q2) 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) Give a programming example that overloads == operator with its use.**[6]**

Q3) a) What is inheritance? How to inherit a base class as protected? Explain it in Multiple base classes.   **[6]**

   b) What is containment? Explain with the help of String. Date and Employee class. Objects of Date and String classes are data members of Employee Class.   **[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 arises in multiple inheritance? How it can be overcome. Explain with example. **[5]**

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(),tellp(), 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) What is the difference between opening a file with constructor function and opening a file with open () function. **[5]**

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

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[6179]-225

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)   Solve 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)   Given equation is $\dfrac{dy}{dx} = x + y$ with initial condition $x=0$, $y=1$ and step size $h=0.2$. By Euler's formula y_1 at $x=0.2$ is equal to 1.2 first approximation at $y_1^{(1)}$ at $x=0.2$ calculated by modified Euler's formula is given by _____ **[2]**

   i)   1.24   ii)   1.26

   iii) 1.22   iv)   1.28

b)   If $f(x) = x^2 - 2$, $h=1$, first backward difference $\nabla f(x)$ is given by _____**[1]**

   i) $2x-1$ ii) $3x+2$

   iii) $x-5$ iv) $2x-5$

c)   The divergence of vector field $\overline{F} = x^2 y\overline{i} + y^2 \overline{j} + z^2 x\overline{k}$ at a point $(1,2,1)$ is _____ **[2]**

   i)   5   ii)   8

   iii) 10   iv)   12

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

    i)   1   ii) $\dfrac{1}{3}$

    iii) $\dfrac{3}{2}$ iv) $\dfrac{2}{3}$

e) If f(z) is analytic on and within a closed curve C then by cauchy's integral theorem $\oint_c f(z)$ is _____ **[1]**

    i) $2\pi i$ ii) πi

    iii)   0   iv)   1

f) If $f(z) = \dfrac{Sin\,\pi z^2 + cos\,\pi z^2}{(z-1)^2(z-2)}dz$ then residue of f(z) at the pole z=2 is

_____ **[2]**

    i)   0   ii) -1

    iii)   1   iv) π

Q2) a) Find polynomial passing through the points by using newton's forward difference formula. Hence find $\dfrac{dy}{dx}$ at 1.5. **[5]**

x	0	2	4	6	8
y	5	29	125	341	725

b) Evaluate $\int_0^3 \dfrac{dx}{1+x}$ with 7 ordinates by using Simpson's $\left(\dfrac{3}{8}\right)^{th}$ rule **[5]**

c) Use modified Euler's Method to solve $\dfrac{dy}{dx} = x - y^2, y(0) = 1$ to calculate x=0.2 take h=0.2 **[5]**

OR

[6179]-225   2

Q3) a) Find f (5) by using Lagrange's interpolation formula given that **[5]**
$f(1) = 2, f(2) = 4, f(3) = 8, f(4)=16, f(7)=128$

b) Find area bounded by curve $f(x)$ and x-axis and $x=7.47$ to $x=7.52$ from the following data using trapezoidal rule. **[5]**

x	7.47	7.48	7.49	7.50	7.51	7.52
y	1.92	1.95	1.98	2.01	2.03	2.06

c) Using fouth order Runge Kutta method solve equation $\dfrac{dy}{dx} = \sqrt{x+y}$ with $y(0)=1$ and find $y(0.2)$ taking h=0.2. **[5]**

Q4) a) Find the directional derivative, of $\phi = e^{2x} \cdot \cos(yz)$ at $(0,0,0)$ in the direction tangent to the curve $x=a \sin t$, $y = a \cos t$, $z = $ at $t = \dfrac{\pi}{4}$ **[5]**

b) Show that $\overline{F} = r^2 \overline{r}$ is conservative and obtain the scalar potential associated with it. **[5]**

c) Show that $\nabla^2 f(r) = \dfrac{d^2 f}{dr^2} + \dfrac{2}{r}\dfrac{df}{dr}$ **[5]**

OR

Q5) a) If the directional derivative of $\phi = axy + byz + czx$ at $(1,1,1)$ has maximum magnitude 4 in a direction parallel to X-axis, find the values of a,b,c **[5]**

b) Show that $\overline{F} = \dfrac{\overline{a} \times \overline{r}}{r^n}$ is solenoidal. **[5]**

c) Show that $\nabla^4 e^r = e^r + \dfrac{4}{r}e^r$ **[5]**

Q6) a) Evaluate $\displaystyle\int_c \overline{F}.d\overline{r}$ for $\overline{F} = (2x + y)\overline{i} + (3y - x)\overline{j}$ and C is the straight line joining the points (0,0) and (3,2) **[5]**

b) By using Gauss divergence theorem. Find the value of $\displaystyle\iint_s \dfrac{x\overline{i} + y\overline{j} + z\overline{k}}{r^2}.d\overline{s}$ where s is the surface of sphere $x^2 + y^2 + z^2 = a^2$ **[5]**

c) Evaluate $\iint_s (\nabla \times \overline{F}).\hat{n}\,ds$ where s is the curved surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane z=2 where $\overline{F} = 3(x - y)\overline{i} + 2xz\overline{j} + xy\overline{k}$ [5]

OR

Q7) a) Using Green's theorem, find the value of $\int_C (xy - x^2)dx + x^2 dy$ along the curve C formed by $y = 0$, $x = 1$, $y=x$ [5]

b) Show that $\iiint_v \dfrac{2}{r}dv = \iint_s \dfrac{\overline{r}.\hat{n}}{r}ds$ [5]

c) Evaluate by $\int_C \overline{F}.d\overline{r}$ by using stoke's theorem for $\overline{F} = 4y\overline{i} - 4x\overline{j} + 3\overline{k}$ where s is a disk of radius 1 lying on the plane $z = 1$ and C is the boundary of the disk. [5]

Q8) a) If $v = -\dfrac{y}{x^2 + y^2}$ then find u such that $f(z) = u + iv$ is analytic. [5]

b) Evaluate $\oint_C \dfrac{z^2 + 2z}{(z+1)(z^2 - 9)}dz$, where 'C' is the circle $|z–3|=5$ by cauchy's Residue theorem. [5]

c) Find the bilinear transformation, which maps the points $0, –1, i$ of the Z-plane on to the points $2, \infty, \dfrac{1}{2}(5 + i)$ of the w-plane. [5]

OR

Q9) a) If $u = 3x^2 – 3y^2 + 2y$ then find v such that $f(z)$ is analytic. [5]

b) Evaluate $\oint_C \dfrac{4z^2 + z}{z^2 - 1}dz$, where 'C' is the circle $|z - 1| = \dfrac{1}{2}$, by Cauchy's-Integral formula. [5]

c) Show that the map $w = \dfrac{2z + 3}{z - 4}$ transforms the circle $x^2 + y^2 – 4x = 0$ in to the straight line 4u+3=0. [5]

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[6179]-226

S.E. (Electronics/E & TC)
ELECTRONICS CIRCUITS
(2019 Pattern) (Semester - III) (204181)

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 required.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Explain the IC 317 voltage regulator with diagram and write its output voltage equation. **[6]**

b) IC Voltage Regulator using IC 317, Calculate the variable output voltages, assume R1 = 240 Ω, R2 = 5KΩ (pot) and Iadj = 100 uA. **[6]**

c) Explain concept of Switch Mode Power Supply (SMPS) and list type of SMPS. **[6]**

OR

Q2) a) Draw and explain the concept of Current boosting in Voltage regulator.**[6]**

b) IC Voltage Regulator using IC 317, Calculate values of R2 for the output voltage 5v to 10v, assume R1 = 240 Ω and Iadj = 100 μA. **[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) PSRR (Power Supply Rejection Ratio)

c) Explain the concept of Current mirror circuit. **[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 Inverting Schmitt trigger circuit using OP AMP. Write the equation of V_{UTP} and $V_{LTP.}$ **[6]**

OR

Q6) a) Compare open loop and close loop comparator 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 Instrumentation using three 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

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S.E. Electronics (Electronics & Telecommunication Engg.)/(Computer Engg.)
DIGITAL CIRCUITS
(2019 Pattern) (Semester-III) (204182)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Solve Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
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 binary subtraction using l's compliment and two's compliment method with example. **[6]**

     b) Design and explain 3-bit parity generator circuit. **[6]**

     c) Implement 1:8 demux using 1:4 demux. **[6]**

OR

Q2) a) Design and explain 2-bit comparator circuit using logic gates. **[6]**

     b) Implement 16:1 Mux using 4:1 Mux. **[6]**

     c) Explain Look ahead carry generator circuit. **[6]**
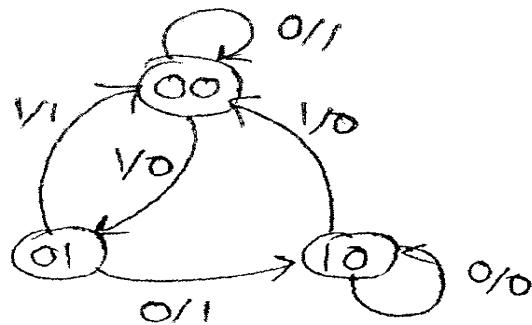
Q3) a) Explain working of SR Flip flop with neat Block diagram and truth table. **[6]**

     b) Convert JK flip flop into D flip flop. **[6]**

     c) Design and implement 2-bit synchronous counter using T flip flop. **[5]**

OR

Q4) a) Explain working of JK Flip flop with neat Block diagram and truth table. **[6]**

     b) Convert SR flip flop into T flip flop. **[6]**

     c) Write short note on Shift registers. **[5]**

Q5) a) Design the sequential circuit for the given state diagram using T flip flop.

[9]

b) Design and implement circuit using D flip flop to detect the following binary sequence 110. [8]

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) Write short note on state reduction with suitable example. [8]

Q7) a) Explain the block diagram of memory unit? [9]

b) Explain FPGA architecture. [9]

OR

Q8) a) Design and implement Full Subtractor using PAL? [9]

b) Explain CPLD architecture. [9]

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[6179]-228

S.E. (Electronics /E&TC)
ELECTRICAL CIRCUITS
(2019 Pattern) (Semester - III) (204183)
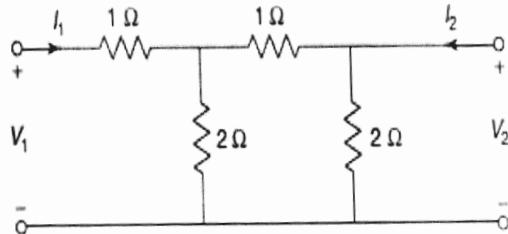
Time : 2 ½ Hours]   *[Max. Marks : 70*

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 logarithmic tables slide rule, Mollier charts, and electronic pocket calculator and steam tables are allowed.*

5) *Assume suitable data if necessary*

Q1) a) Define Z-Parameters and draw its equivalent Circuit. Why Z-parameters are called open circuit parameters?   **[9]**

   b) Find Z-parameters for the network shown below.   **[8]**
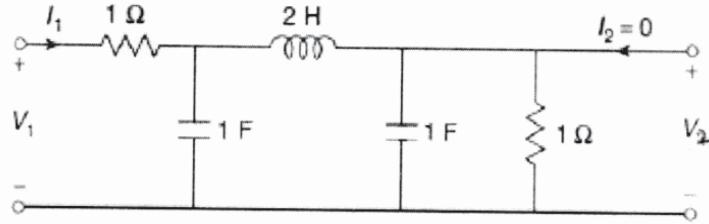
Example -9.4 pg 9.6 Ravish

OR

Q2) a) Explain following network functions with necessary equation for two port network: **[9]**

   i)   Driving point impendence

   ii) Driving point admittance

   iii) Voltage ratio transfer function

b) Determine the voltage transfer function V_2/V_1 for the network shown in Fig. **[8]**

Example 8.12 Pg 8.9 Ravish

Q3) a) Draw a neat sketch of DC generator. State the function of each part. **[6]**

b) Derive the e.m.f. equation of DC machine. State clearly the meaning and units of the symbols used. **[6]**

c) A four pole lap wound DC motor has 540 conductors. Its speed is1000 rpm. Flux per pole is 25 mwb connected to 230 V Dc supply. **[6]**

Armature resistance is 0.8 Ω

Calculate :

i) Induced emf

ii) Armature Current

iii) Armature Torque

Ex. 4.21.3 pg 4-32

OR

Q4) a) Derive the torque equation of for DC motor. Draw the torque-current, speed-current and torque-speed characteristics of shunt motor. **[10]**

b) Explain the methods of speed control of DC series motor with neat circuit diagram. **[8]**

Q5) a) Explain working principle of Induction motor and concept of rotating magnetic field. **[6]**

b) Explain difference between squirrel cage induction motor and slip ring induction motor. **[6]**

c) A four pole three phase. 50 Hz induction motor has star connected rotor. The rotor has a resistance of per phase and reactance of per phase. The induced e.m.f. between the slip rings is 100V. If the full load speed is 1460 rpm. Calculate: **[6]**

  i) The slip

  ii) e.m.f. induced in the rotor in each phase

  iii) Rotor reactance per phase

  iv) The rotor power factor

  Ex. 5.7.8 Pg. 5.17

OR

Q6) a) List out various starters used for three phase induction motor and explain DOL starter in detail. **[10]**

  b) Discuss briefly different methods of speed control of three phase induction motors with neat diagrams. **[8]**

Q7) a) Explain construction of brushless DC motor. Draw and explain torque-speed characteristics. **[9]**

  b) What are different types of stepper motors. Explain the operation of variable reluctance motor. **[8]**

OR

Q8) a) Explain the block diagram of Electric vehicles State advantages and limitations Unit6. **[10]**

  b) Compare brushless DC motor with conventional DS motor. **[7]**

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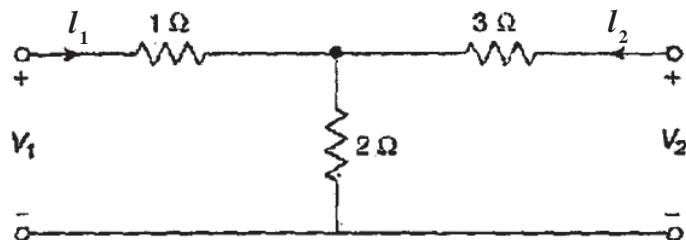
[6179]-228A

S.E. (Electronics/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 and Q7 or Q8.
  2)   Figures to the right side indicate full marks.
  3)   Assume suitable data, if necessary.
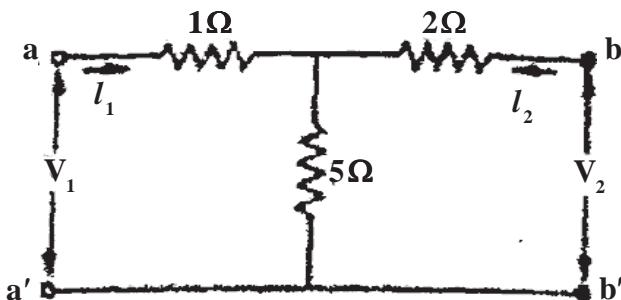
Q1) a)   Give the basic definitions of Y parameters. Why they are called as short
          circuit admittance parameters?   **[6]**

   b)   Find the Y parameters for the network shown below: **[6]**

   c)   Define basic h- parameters and give the significance of each parameter.**[6]**

                                    OR

Q2) a)   Define the ABCD parameters and write the applications for the same.**[6]**

   b)   Find the transmission parameters of the circuit given below.   **[6]**

   c)   What do you mean by the reciprocal network? Derive the condition for
          reciprocity for Y parameters.   **[6]**

Q3) a) Sketch the neat constructional diagram of DC machine. List the various parts stating the function of each part. **[6]**

b) Explain the various methods of speed control of DC series motor. **[6]**

c) Draw the neat diagram and explain the operation of three point starter. **[5]**

OR

Q4) a) Derive the torque equation of DC motor. **[6]**

b) Explain the various types of DC motors with their circuit diagrams and voltage-current equations. **[6]**

c) Draw and explain the various characteristics of DC shunt motor. **[5]**

Q5) a) Explain the construction and working of three phase induction motor. **[6]**

b) Explain the v/f method of controlling the speed of three phase induction motor. **[6]**

c) Explain the power flow diagram of an induction motor. **[6]**

OR

Q6) a) Describe the principle of operation of single phase split phase type induction motor with torque speed characteristics. **[6]**

b) The rotor of six pole, 440 V, 50 Hz, three phase induction motor, has power input of 60 KW. The frequency of rotor emf is 1.5 KHz. Calculate; **[6]**

     i) Rotor copper loss

     ii) Gross mechanical power developed

     iii) Rotor resistance per phase if the rotor current per phase is 58 Ampere

c) With the help of diagram explain the DOL starter. **[6]**

Q7) a) Explain the block diagram of electric vehicle. State its advantages and limitations. **[6]**

b) Which are the different types of batteries used for Electric vehicles? Explain any one in details. **[6]**

c) What are the limitations of Lithium-Ion batteries? **[5]**

OR

Q8) a) Explain the construction of brushless DC motor. Draw and explain the torque-speed characteristics. **[6]**

b) What is step angle in the stepper motor State the expression for it. **[6]**

c) Compare variable reluctance motor with permanent magnet stepper motor. **[5]**

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[6179]-229

S.E. (E & TC/Electronics)
DATA STRUCTURES
### (2019 Pattern) (Semester-III) (204184)

Time : 2½ Hours]   *[Max. Marks : 70*
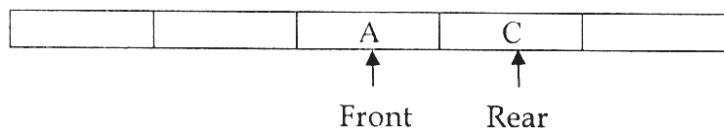
Instructions to the candidates:

   1)   *Neat diagrams must be drawn wherever necessary.*

   2)   *Figures to the right indicate full marks.*

   3)   *Assume suitable data, if necessary.*

Q1) a)   Write a 'C' function to Push and POP elements from a stack of characters using an array. **[6]**

    b)   Convert the following infix expression to postfix using stack (show all the steps properly): a+b*(c/d$a)/b **[5]**

    c)   Consider following circular queue of characters and size 5. **[6]**

Front point to A and Rear Points to C. Show the circular queue contents as per the following operations at every step.

    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.

OR

Q2) a) Compare Stack and Queue. **[4]**

b) What are the applications of Stack. Represent stack for decimal to binary conversion:$(56)_{10}$ to $(---)_2$ **[3]**

c) Define Queue. What are conditions for 'Queue empty' and 'Queue full' when queue is implemented using Array? Explain. **[6]**

d) Write a 'C' function for deletion in a queue using an array. **[4]**

Q3) a) Compare circular linked list with singly linked in terms of pros and cons.**[6]**

b) What is a singly linked list? Write C function for inserting a node at a given location into a singly linked list. **[6]**

c) Explain the disadvantages of polynomial representation using an array. Represent the following polynomial using a singly linked list. **[6]**

$23x^9 + 18x^7 + 41x^6 + 16x^4 + 3$

OR

Q4) a) What is a doubly linked list? Write a 'C' function for Inserting a number at the end of the doubly linked list. **[6]**

b) Write a 'C' function for Inserting a number at the front of the circular linked list. **[5]**

c) Compare linked representation and array representation with reference to the following aspects: **[3]**

    i) Accessing any element randomly

    ii) Insertion & deletion of an element

    iii) Utilization of memory.

d) Write a short note on the Circular Linked list. **[4]**

Q5) a) Define the following terms with respect to Trees: **[5]**

    i) Root

    ii) Subtree

    iii) Level of node

    iv) Depth of Tree

    v) Siblings

b) Write a recursive 'C' function for inorder, preorder, postorder traversal? **[6]**

c) Construct the Binary Search Tree (BST) from the following data:

5,2,8,4,1,9,7

Also show preorder, postorder and inorder traversal for the same. **[6]**

OR

Q6) a) Define a tree. Explain with a suitable example how a binary tree can be represented using an array. **[5]**

b) Write an algorithm to implement non-recursive in-order traversal of binary search tree. **[6]**

c) The postorder and inorder traversal of a binary tree are given below. Is it possible to obtain a unique binary tree from these traversals? If yes, obtain the tree, if not give justification. **[6]**

Inorder Traversal : D B F E G A H I C

Postorder Traversal : D F G E B I H C A

Q7) a) Define Graph. Explain types of Graph. **[6]**

b) Compare DFS and BFS. **[6]**

c) Find the minimal spanning tree of the following graph using Prim's algorithm. Show all the steps. **[6]**
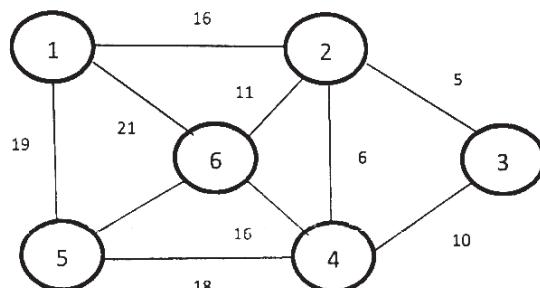

Fig. 1

OR

Q8) a) Define with an example: **[6]**

i) Path

ii) Cycle

iii) Connected graph

b) Define indegree and outdegree of a vertex in graph. Find the indegree and outdegree of following graph. **[6]**


Fig 2

c) Represent the following graph using the adjacency matrix and adjacency list. **[6]**


Fig. 3

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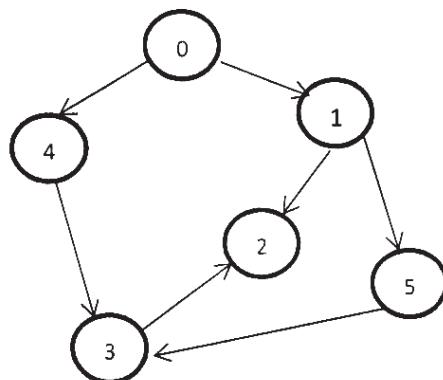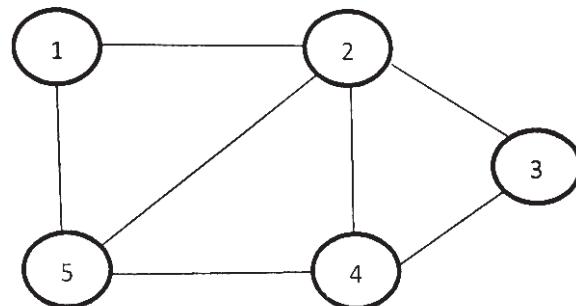
[6179]-229A
S.E. (E & TC/Electronics)
DATA STRUCTURES
(2019 Pattern) (Semester - III) (204184)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and 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) Write a 'C' function to Push and POP elements from a stack of characters using an array. **[6]**

b) What are the disadvantages of the linear queue? Suggest a suitable method to overcome them. **[6]**

c) Convert the given infix expression to a postfix expression using stack : (a^b)*c–d/d **[5]**

Note : ^=Exponent operator.

OR

Q2) a) Identify the expression and convert them into the remaining two forms :

[6]

i) AB + C * DE – FG + + $

ii) – A / B * C $ DE

Note $ = Exponent operator

b) Write a 'C' function to insert and delete element from queue using an array. **[6]**

c) Define Queue. What are conditions for 'Queue empty' and 'Queue full' when queue is implemented using Array? Explain. **[5]**

P.T.O.

Q3) a Explain traversal operations in a singly linked list. **[6]**

b) A doubly linked list with numbers to be created. Write node structure and a 'C' function to create a double linked list. **[6]**

c) Draw and explain the circular linked list. State the limitations of a singly linked list. **[6]**

OR

Q4) a) Write limitations of arrays over linked list? Represent the following polynomial using a singly linked list. **[6]**

$23x^9 + 18x^7 + 41x^6 + 16x^4 + 3$

b) What is a singly linked list? Write C function for inserting a node at a given location into a singly linked list. **[6]**

c) Write a 'C' function for Inserting a number at the front of the circular linked list. **[6]**

Q5) a) Write are cursive 'C' function for inorder and preorder traversal of Binary Search Tree. **[6]**

b) Explain with suitable example how binary tree can be represented using :
   i) Array
   ii) Linked List

[6]

c) Write an algorithm to insert an element in a binary search tree implemented using linked representation. **[5]**

OR

Q6) a) Construct the Binary Search Tree (BST) from the following data : **[6]**

5, 2, 8, 4, 1, 9, 7

Also show preorder, postorder and inorder traversal for the same.

b) Explain basic concept of AVL tree. Also explain four rotations in AVL tree.

[6]

c) Define the following terms with respect to Trees : **[5]**
   i)   Root
   ii) Subtree
   iii) Level of node
   iv) Depth of Tree
   v)   Siblings

Q7) a) Represent the following graph using the adjacency matrix and adjacency list. **[6]**
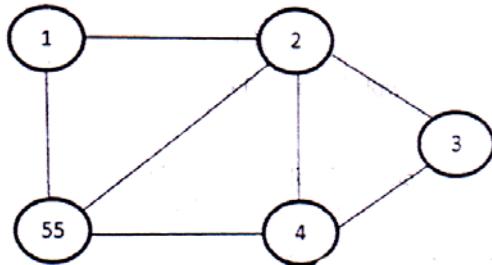

Fig. 1

b) Define indegree and outdegree of a vertex in graph. Find the indegree and outdegree of following graph. **[6]**
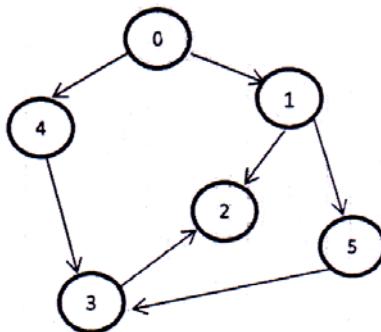

Fig. 2

c) Define with an examples : **[6]**

i) Undirected Graph

ii) Directed Graph

iii) Weighted Graph

OR

Q8) a) Find out Minimum spanning Tree of the following graph (figure 3) using Kruskal's algorithm. **[6]**
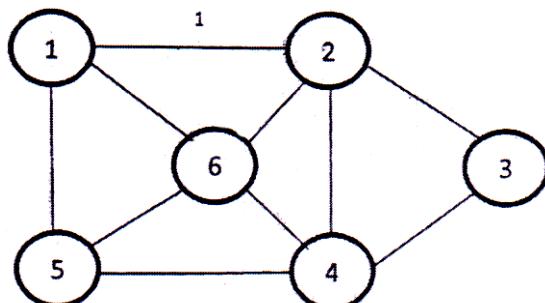

Fig. 3

b) Explain with suitable example, DFS and BFS traversal of a graph. **[6]**

c) Find the shortest path from node 'a' to all nodes in the graph shown in fig. 4 using Dijkstra's algorithm. **[6]**
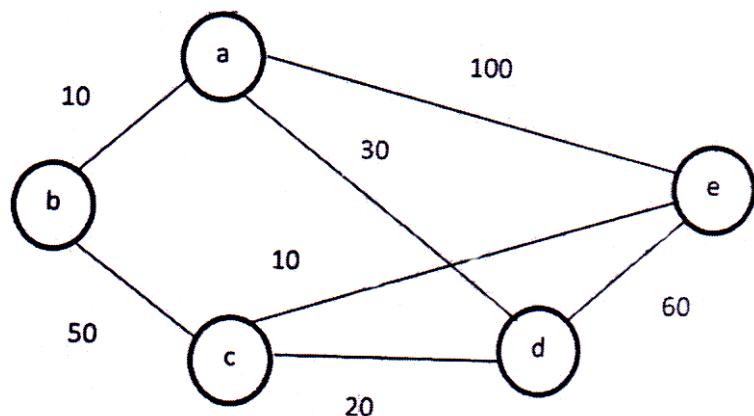

Fig. 4

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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 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 pascal's features for programming in the large. **[8]**

    b) Explain in detail about **[10]**

       i)   Abstraction

       ii)   Modularity

OR

Q2) a) Explain the key features of procedure oriented programming language.**[8]**

    b) Explain the concept of encapsulation in detail with example. **[10]**

Q3) a) Explain in detail why Java is platform independant programming language? **[8]**

    b) Explain about **[9]**

       i)   Primitive data types in Java

       ii)   Non-primitive data types in Java

OR

Q4) a) Explain the process of building and running Java application programs.**[8]**

    b) Explain about different Java string class methods. **[9]**

Q5) a) How to create object for 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 command line arguments in Java with suitable example.**[8]**

b) Explain in detail about packages in Java with suitable example. **[10]**

Q7) a) Compare any eight differences between Java applet and Java application program. **[8]**

b) Explain use of following keywords in Java **[9]**

    i) throw

    ii) throws

    iii) finally

OR

Q8) a) Explain in detail about applet architecture. **[8]**

b) Write a program for use of multiple catch blocks in Java. **[9]**

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[6179]-231

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 side indicate full marks.*

3)   *Assume suitable data, if necessary.*

Q1) a)   Draw and explain architecture of Batch 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	06
P2	05	02
P3	01	08
P4	00	03
P5	04	04

c)   What is CPU scheduling? Explain important CPU Scheduling terminologies. Explain Round Robin (RR) Scheduling in detail.   **[8]**

OR

Q2) a)   Compare process and thread on six points.   **[6]**

b)   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	03	01
	P2	01	04
	P3	04	02
	P4	00	06
	P5	02	03

c) What is Process? Draw process state transition diagram in operating system and explain different process states in detail. **[8]**

Q3) a) Explain the terms shared memory and message passing for IPC. Give the difference between shared memory and message passing. **[8]**

b) What is Process synchronization? Explain Critical Section in detail. Explain various solutions the Critical Section problem in brief. **[8]**

OR

Q4) a) Write a note on : **[8]**
   i) Readers - Writer's problem
   ii) Producer consumer problem

b) Consider the following snapshot of a system with five processes P1, P2, P3, P4 and P5 and three resources R1, R2, R3 and R4. Find out the safe sequence for the execution of the following processes using banker's algorithm. **[8]**

Processes	Allocation				Max				Available			
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P_1	0	0	1	2	0	0	1	2	2	1	0	0
P_2	2	0	0	0	2	7	5	0				
P_3	0	0	3	4	6	6	5	0				
P_4	2	3	5	4	4	3	5	6				
P_5	0	3	3	2	0	6	5	2				

Q5) a) Give the classification of Memory management Techniques. Explain Contiguous memory management schemes in detail. **[8]**

b) Consider a reference string: 4, 7, 6, 1,7, 6, 1, 2, 7, 2. The number of frames is 3. Find out the number of page faults respective to : **[8]**
   i) FIFO Page Replacement Algorithm
   ii) LRU Page Replacement Algorithm

Q6) a) What is Fragmentation? Explain Internal fragmentation and External fragmentation and differentiate between them. **[8]**

b) Explain the techniques of managing memory using first fit, best fit and worst fit with suitable example. **[8]**

Q7) a) Explain disk scheduling concept. Why is disk scheduling needed? Explain important terms related to disk scheduling. **[6]**

b) Explain single-level directory and two-level directory structure with suitable diagram. **[6]**

c) Enlist the different levels of RAID. Explain any one level RAID. **[6]**

OR

Q8) a) Consider the following disk request sequence for a disk with 100 tracks 43, 52, 24, 65, 70, 48, 16, 61. Head pointer is starting at 20 and moving in left direction. Find the number of head movements (total seek length) in cylinders using FCFS scheduling. **[6]**

b) Differentiate between Programmed I/O and Interrupt Driven I/O. **[6]**

c) What is I/O buffering? Explain any two types of I/O buffering. **[6]**

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[6179]-232

S.E. (Electronic 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 side indicate full marks.

　　3)　Draw neat diagram wherever necessary.

　　4)　Assume suitable data, if required.

Q1) a)　Draw and explain the block diagram of an adjustable three terminal regulator and justify function of each block.　　**[6]**

　　b)　Explain how current boosting is achieved in three terminal voltage regulators.　　**[6]**

　　c)　Explain the basic principle of switching regulator.　　**[5]**

OR
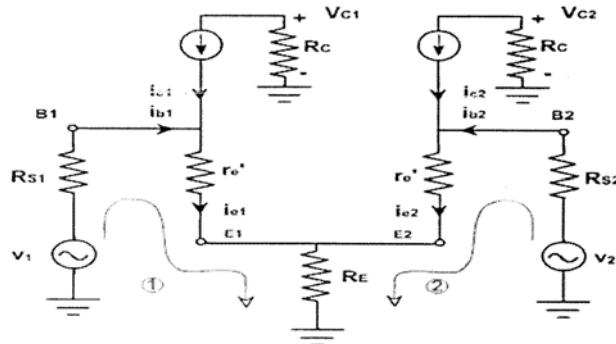
Q2) a)　Determine the range over which the output voltage can be varied in LM317 voltage regulator if values of R_1 = 240 Ω and R_2 is taken as 5 KΩ potentiometer. Assume Iadj = 100 μA. Draw the typical connection diagram.　　**[5]**

　　b)　Draw practical voltage regulator using LM317 and justify each component.**[6]**

　　c)　Explain low dropout regulator with neat diagram in detail.　　**[6]**

P.T.O.
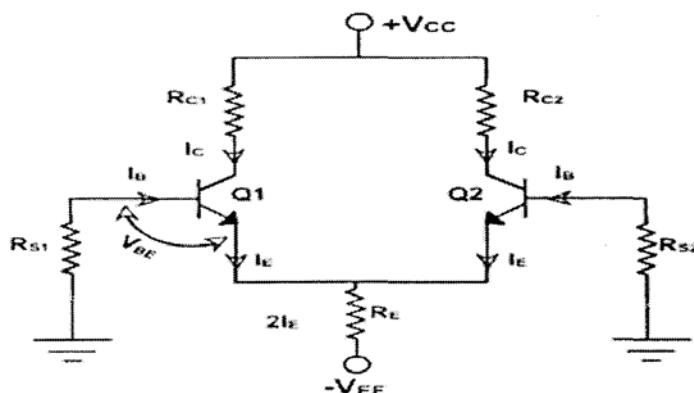
Q3) a)   Compare Voltage series & voltage shunt feedback amplifiers?   **[6]**

   b)   The following specifications are given for the dual input, balanced - output differential amplifier: RC1=RC2=Rc = 2.2 kΩ, RB = RB1 = RB2 = 4.7 kΩ, Rsl = Rs2 = Rin = 50Ω, +VC1= −VC2= 10V, −VEE = −10 V, βdc =100 andVBE = 0.715V.   **[6]**

      i)   Determine the voltage gain.

      ii)   Determine the output resistance.

      iii)   Determine the input resistance

   c)   Explain different configurations of differential amplifier in detail.   **[6]**

<div align="center">OR</div>

Q4) a)   Explain Current mirror circuit with neat diagram.   **[6]**

   b)   The following specifications are given for the dual input, balanced- output differential amplifier of figure on next page:
   $RC_1 = RC_2 = Rc = 2.2$ KΩ, RB = 4.7 KΩ, $Rs_1 = Rs_2 = Rin = 50$ Ω , + VCC = 10 V, − VEE = −10 V, βdc = 100 and VBE = 0.715V.   **[6]**
   Determine the operating points (ICQ and VCEQ) of the two transistors.

   c)   Define Op-amp. Draw and explain block diagram of an Op-amp.   **[6]**

Q5) a) Discuss with circuit diagram operation of negative Schmitt trigger. **[7]**

b) Comparison between inverting and Non inverting amplifier. **[5]**

c) Draw circuit diagram of a differentiator circuit. Derive an expression for the output voltage. **[5]**

OR

Q6) a) Discuss with circuit diagram operation of square wave generator. **[7]**

b) Draw circuit diagram of an integrator circuit. Derive an expression for the output voltage. **[5]**

c) Explain Instrumentation amplifier operation with neat diagram. **[5]**

Q7) a) What is the operating principle of PLL? Explain its one application. **[6]**

b) Draw and explain circuit diagram of voltage-to-current (Grounded load) converter. **[6]**

c) Compare the three ADC techniques. Explain the operation of successive approximation type ADC with neat block diagram **[6]**

OR

Q8) a) What is the operating principle of DAC? Explain its one type. **[6]**

b) Draw and explain circuit diagram of current-to-voltage converter with application. **[6]**

c) Calculate the output frequency fo, lock range Δf_L and capture range Δf_c of PLL IC 565 if external resistor R1 = 12 KΩ, external capacitor connected to pin no. 9 C1=0.01uF, filter capacitor C2 at pin no.7 = 10uF. **[6]**

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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) Solve 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.

4) Use of non-programmable scientific calculator is allowed.

Q1) a) What is queue? Explain insertion and deletion operation in queue with suitable example.   **[6]**

b) Write an algorithm for evaluating a postfix expression using stack.**[6]**

c) Evaluate following postfix expression with the help of stack.   **[5]**

5 3 + 6 2/*3 5*+

OR

Q2) a) Write necessary C functions, PUSH and POP, to implement STACK of integers using array.   **[6]**

b) Compare stacks and queues.   **[6]**

c) Explain the concept of circular queue with an example.   **[5]**

Q3) a) Compare SLL with DLL?   **[6]**

b) Write a C function to insert a node into a singly linked list.   **[6]**

c) Differentiate between static and dynamic memory allocation. Name and explain in brief dynamic memory allocation functions.   **[6]**

OR

Q4) a) Compare array and linked list. Declare in 'C' a node structure for doubly linked list. **[6]**

b) Write a function in C to delete a node in SLL. **[6]**

c) Represent the following polynomials using linked list. **[6]**

   i) $25x^5 + 15x^4 + 5x^3 + 2x^2 + 100$

   ii) $16x^8 + 9x^4 + 5x^2 + 2x$

Q5) a) Define the following terms with suitable example. **[6]**

   i)   Strictly binary tree

   ii) AVL tree

   iii) Skewed binary tree

b) Construct a binary search tree for the following set of elements. **[6]**

   5,2,8,4,1,9,7
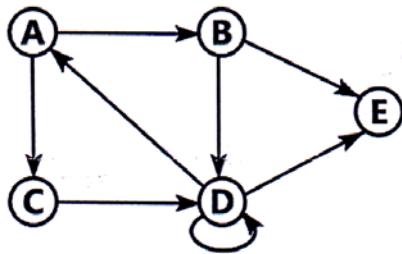
   Traverse the resulting binary search tree in post-order manner.

c) What is threaded binary search tree. Explain with suitable example. **[5]**
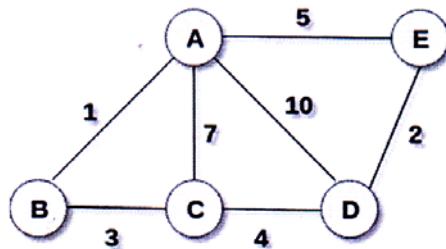
OR

Q6) a) From the given traversal construct the binary tree. **[6]**

   Inorder : D B F E A G C L J H K

   Postorder : D F E B G L J K H C A

b) Explain with suitable example how binary tree can be represented using **[6]**

   i)   Array

   ii) Linked List.

c) Construct a binary search tree for the following data. **[5]**

   SNOOPY, TOM, JERRY, MICKY, MOUSE, BUGS, BUNNY, WINNIE

Q7) a) What do you mean by adjacency matrix and adjacency list. Give the adjacency matrix and adjacency list of the following graph. **[6]**
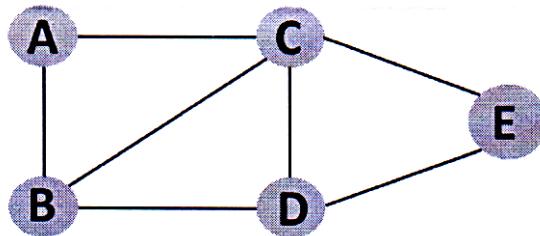
b) Construct a minimum spanning tree for the following graph using Kruskal's Algorithm. **[6]**


c) Explain Dijkstra's shortest path algorithm with suitable example. **[6]**

OR

Q8) a) Write an algorithm for depth first search technique. **[6]**

b) Perform depth first search algorithm on the following graph. **[6]**

c) Define with example. **[6]**

i) Connected Graph

ii) Weighted Graph

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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)   Figures to the right side indicate full marks.
  3)   Assume suitable data, if necessary.
  4)   Neat diagrams must be drawn wherever necessary.

Q1) a)   Compare memory mapped I/O with I/O mapped I/O.   **[5]**

   b)   What are data transfer modes of DMA? Explain any two in detail.   **[6]**

   c)   Explain different types of interrupts in computer systems?   **[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)   How multiple interrupts are handled in the computer systems?   **[6]**

Q3) a)   Draw and explain the instruction format of 8086 processor in details.**[5]**

   b)   Explain different addressing modes with example. Discuss drawback or relative addressing mode.   **[6]**

   c)   Explain the following addressing modes with one example each: **[6]**

      i)   Displacement Addressing

      ii)   Register Indirect

OR

Q4) a)   What is machine instruction? Explain types of instruction.   **[5]**

   b)   List the features of 8086 microprocessors.   **[6]**

   c)   What are the elements of machine instruction? Explain.   **[6]**

Q5) a) Explain hardware organization and execution of 4 stage instruction 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) Explain the following instruction execution phases with suitable example: **[7]**

    i) Fetch the instruction

    ii) Fetch the operand

    iii) Execute the instruction

Q7) a) Write micro-operations and control signals for ADD (R3), R1 instruction for single bus organization of CPU. **[5]**

b) What are the different design methods for Hardwired control units? Explain any one. **[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 and explain control sequence for ADD (R3), R1. **[6]**

c) Explain in detail state table design method for hardwired control design.**[7]**

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S.E. (Computer/IT)/(Computer Science & Design Engg.)/(AI & ML)
ENGINEERING MATHEMATICS-III
(2019 Pattern) (Semester-IV) (207003)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

  1)   *Question 1 is compulsory.*

  2)   *Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 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.*

Q1) Write the correct option for the following multiple choice questions.

  a)   For a given set of bivariate data, $\bar{x} = 2$, $\bar{y} = -3$. The regression coefficient of y on x is -4. Using the regression equation of y on x, the most probable value of y when $x = 1$ is _____.   **[2]**

  i) -1 ii)   1

  iii) -2 iv)   2

  b)   If probability density function $f(x)$ of a continuous random variable x is

  $f(x) = \dfrac{x}{8}$ for $0 \le x \le 4$, then $p(x \le 3) = $ _____.   **[2]**

  i)   0   ii) $\dfrac{3}{4}$

  iii) $\dfrac{9}{16}$ iv)   1

  c)   Lagrange's polynomial through the points   **[2]**

x	0	1	2
y	4	5	12

  is given by _____.

  i) $y = 4x^2 - 3x + 4$ ii) $y = x^2 + 4$

  iii) $y = 2x^2 - x + 4$ iv) $y = 3x^2 - 2x + 4$

d)   Using Gauss elimination method, the solution of system of equations
$$x + \frac{1}{4}y + \frac{1}{4}z = 1, \ \frac{15}{4}y - \frac{9}{4}z = 3, \ \frac{5}{4}y - \frac{19}{4}z = 3 \ \text{is} \ \underline{\hspace{1cm}}.$$ **[2]**

i) $x = 1, \ y = \frac{1}{2}, \ z = \frac{-1}{2}$ ii) $x = \frac{1}{2}, \ y = 1, \ z = \frac{1}{2}$

iii) $x = 2, \ y = \frac{1}{2}, \ z = 2$ iv) $x = 1, \ y = 2, \ z = 3$

e)   The first four central moments of a distribution are 0, 0.453, 0.06 and 0.502. The coefficient of Kurtosis β_2 is _____.   **[1]**

i)   0.0387   ii)   2.4463

iii)   25.8221   iv)   0.4088

f)   If $f(x)$ is a continuous function on $[a,b]$ and $f(a)f(b) < 0$, then to find a root of $f(x) = 0$, initial approximation x_0 by bisection method is _____.**[1]**

i) $x_0 = \frac{a-b}{2}$ ii) $x_0 = \frac{f(a) + f(b)}{2}$

iii) $x_0 = \frac{a+b}{2}$ iv) $x_0 = \frac{a-b}{a+b}$

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, β_1 and β_2.   **[5]**

b)   Fit a straight line of the form $y = a + bx$ to the following data by the least square method.   **[5]**

x	−2	1	3	6	8	9
y	17	14	12	9	7	6

c)   For a bivariate data, the regression equation of y on x is $8x–10y = –66$ and the regression equation of x on y is $40x – 18y = 214$. Find the mean values of x and y. Also, find the correlation coefficient between x and y.   **[5]**

OR

Q3) a)   Following are the runs scored by two batsmen in 5 cricket matches. Which batsman is more consistent in scoring runs?   **[5]**

Score by (x) Batsman A	38	47	34	18	33
Score by (y) Batsman B	37	35	41	27	35

b) Fit a parabola of the form $y = a + bx + cx^2$. Using the least square method to the following data. **[5]**

x	-2	-1	0	1	2
y	-2	5	8	7	2

c) Find the correlation coefficient between age in years (x) and glucose level (y) from the data of 5 people as follows. **[5]**

x	43	22	25	42	58
y	99	65	79	75	87

Q4) a) A fair die is tossed once. Random variable x denote the digit that appears as top face. Find the expectation $E(x)$. **[5]**

b) The number of breakdowns of a computer in a week is a poisson variable with $\lambda = np = 0.3$. What is the probability that the computer will operate. **[5]**

i) With no breakdown

ii) At most one breakdown in a week.

c) In a certain city 4000 lamps are installed. If the lamps have average life of 1500 burning hours. Assuming normal distribution. **[5]**

i) How many lamps will fail in first 1400 hours?

ii) How many lamps will last beyond 1600 hours?

[Given : $z = 1$, A $= 0.3413$]

OR

Q5) a) Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both kings if **[5]**

i) The first card drawn is replaced

ii) The first card drawn is not replaced

b) A certain factory turning cotter pins knows that 2% of its product is defective. If it sells cotter pins and gurantees that not more than 5 pins will be defective in a box of 100 pins. Find the approximate probability that a box will fail to meet the guranteed quality. **[5]**

c) A bank utilizes four 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	Number of Customers
1	150
2	250
3	170
4	230

Test whether the customers are uniformly distributed over the windows.

[Given : $\chi^2_{3,0.05} = 7.815$] [Use 5% level of significance]

Q6) a) Find the root of the equation $x^3 - 4x + 1 = 0$ lying in the interval $\left(0, \dfrac{1}{2}\right)$ by

Bisection method correct upto 3 decimal places (Five iterations only) **[5]**

b) Find the root of the equation $x^2 - 12 = 0$ lying between (3, 4) by Newton-Raphson method correct upto 3 decimal places. **[5]**

c) Solve by Gauss-Seidel method the system of equations. **[5]**

$5x - y = 9$

$-x + 5y - z = 4$

$-y + 5z = -6$

Take initial solution as $\left(\dfrac{9}{5}, \dfrac{4}{5}, \dfrac{6}{5}\right)$ write numerical calculations correct upto three decimal places.

OR

Q7) a) Solve by Gauss elimination method, **[5]**

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16$

b) Solve by Jacobi's iteration method, **[5]**

$20x_1 + x_2 - 2x_3 = 17$

$3x_1 + 20x_2 - x_3 = -18$

$2x_1 - 3x_2 + 20x_3 = 25$

Write numerical calculations correct upto 3 decimal places.

c) Use Regula-Falsi method to find real root of the equation $e^x - 4x = 0$ lying

between $\left(0, \dfrac{1}{2}\right)$, correct to three decimal places. **[5]**

Q8) a) Using Newton's forward interpolation formula, find the population in the year 1895 from given data, **[5]**

$$\begin{vmatrix} x\,(\text{year}) & 1891 & 1901 & 1911 & 1921 & 1931 \\ y\,(\text{pop}^{\text{n}}) & 46 & 66 & 81 & 93 & 101 \end{vmatrix}$$

b) Evaluate, $\int\limits_{0}^{1} e^{x}\, dx$ using Simpson's 1/3rd rule ($h = 0.2$). **[5]**

c) Use Euler's method to solve $\dfrac{dy}{dx} = x^{2} + y$, $y(0) = 1$, $h = 0.1$ Tabulate values of y for $x = 0.1$ to $x = 0.4$. **[5]**

OR

Q9) a) Use Runge-Kutta method of 4th order to solve $\dfrac{dy}{dx} = y - x$, $y\,(0) = 1$ at $x = 0.2$ with $h = 0.2$. **[5]**

b) Using modified Euler's method find $y\,(0.1)$, given $\dfrac{dy}{dx} = 1 + xy$, $y(0) = 1, h = 0.1$ (Two iterations only). **[5]**

c) Using Newton's backward difference formula, find y at $x = 3.5$ from following data, **[5]**

$$\begin{vmatrix} x & 0 & 1 & 2 & 3 & 4 & 5 \\ y & 5.2 & 8 & 10.4 & 12.4 & 14 & 15.2 \end{vmatrix}$$

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S.E. (Computer Engineering) (Artificial Intelligence & Data Science Engineering)
# DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester - IV) (210252)

*Time : 2½ Hours]*   *[Max. Marks : 70*
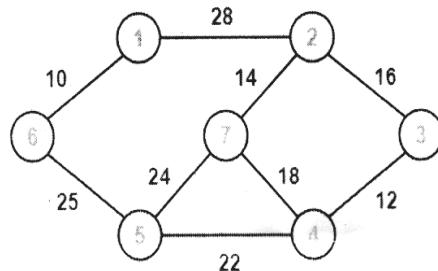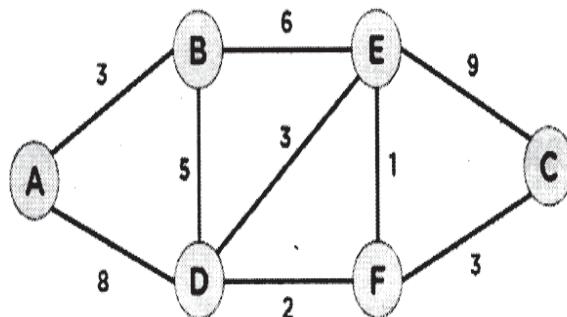
Instructions to the candidates:
1) *Answer to the questions Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No..5 or Q.No.6, Q.No.7 or Q.No.8.*
2) *Assume suitable data, if necessary.*
3) *Draw neat labelled diagrams wherever necessary.*
4) *Figures to the right indicate full marks.*

Q1) a) Write Floyd Warshall Algorithm. **[6]**

b) Construct stepwise minimum spanning tree (MST) for the given graph using Prim's Algorithm. Also calculate sum of all weights. Start from vertex 1. **[6]**
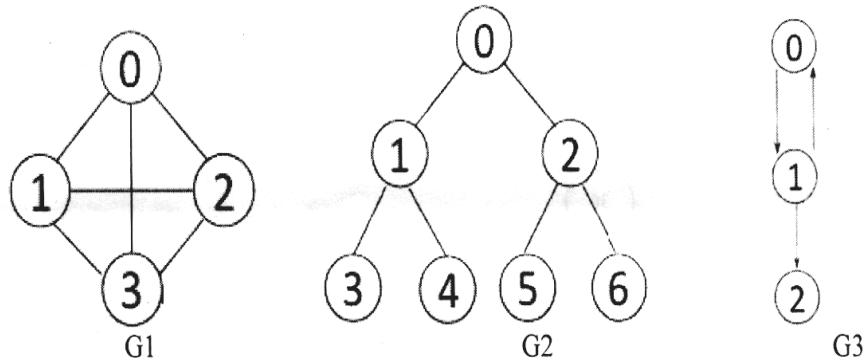
c) Apply Dijkstra's Algorithm for the graph given below, and find the shortest path from node A to node C. **[6]**

OR
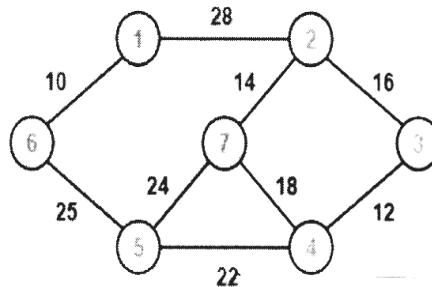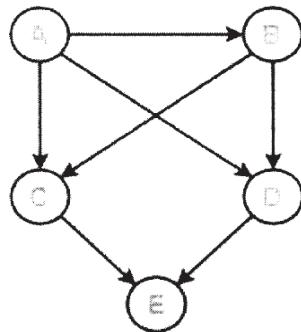
Q2) a) Define indegree & outdegree of a directed graph. Write degree for G1 & G2. Write indegree & outdegree of each vertex for G3 graph. **[6]**

G1   G2   G3

b) Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm. **[6]**

c) Find the number of different topological orderings possible for the given graph. **[6]**
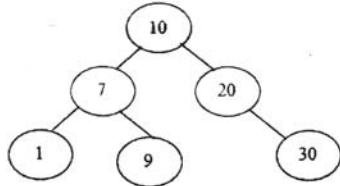
Q3) a) Construct AVL tree for insertion of following data: **[6]**
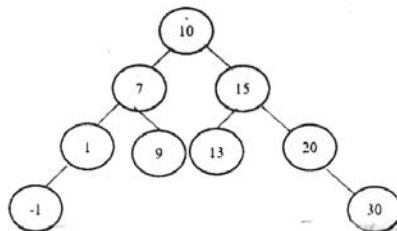
9, 15, 20, 8, 7, 13, 10.

b) Draw splay tree after **[6]**

i) Zig rotation

ii) Zag rotation for follwoing tree-

iii) Zig Zig Rotation
iv) Zag Zag Rotations for following tree-

c) Create 2D tree for following data: **[6]**
   (3, 6), (17, 15), (13, 15), (6, 12), (9, 1) (2,7), (10, 19).
   Also plot all the points in XY plane.

<div align="center">OR</div>

Q4) a) Construct AVL tree for insertion of following data: **[6]**
   63, 9, 19, 27, 18, 108, 99, 81.

b) Define Red Black tree. List its properties. Give example of it. **[6]**

c) Write the functions for split & skew operations in AA tree. **[6]**

Q5) a) Create a B- Tree of order 5 from the following list of data items: **[9]**
   30, 20, 35, 95, 15, 60, 55, 25, 5, 65, 70, 10, 40, 50, 80, 45

b) Explain following indexing techniques: **[8]**
   i) Primary
   ii) Secondary
   iii) Sparse
   iv) Dense

<div align="center">OR</div>

Q6) a) Create a B+Tree of order 3 from the following list of data items: **[9]**

1, 3, 5, 7, 9, 2, 4, 6, 8, 10

b) Define trie tree. Compare trie tree with hash table. Draw trie tree for following data: bear, sell, bell, bid, stock, bull, buy, stop. **[8]**

Q7) a) Explain sequential & direct access file organization. Also list two advantages & disadvantages of same. **[9]**

b) Explain Indexed sequential access file organization. Also list two advantages & disadvantages of same. Compare sequential & indexed sequential file organization. **[8]**

OR

Q8) a) What is linked organization? Explain inverted file and coral rings with respect to linked organization. **[9]**

b) Explain multilist files & cellular partitions. **[8]**

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[6179]-237

S.E. (Computer Engineering) (Artificial Intellignce & Data Science Engineering)
SOFTWARE ENGINEERING
(2019 Pattern) (Semester - IV) (210253)

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) Assume suitable data, if necessary.

Q1) a) Discuss with suitable diagram three major categories of software project resources? **[8]**

   b) What is Estimation with Use Cases? Explain Estimation Using Use Case points with the help of an Example. **[10]**

OR

Q2) a) What are the basic principles of software project scheduling. Explain different tasks of project scheduling. **[8]**

   b) Discuss Empirical Estimation Models. Explain Constructive Cost Model for project estimation with suitable example. **[10]**

Q3) a) With the help of diagram explain how to translate the requirements model into the design model. **[8]**

   b) Explain dimensions of design model with the help of diagram. **[9]**

OR

Q4) a) What is software Architecture? Why Architecture is important? What is the use of Architecture Decision Description Template? **[9]**

   b) Discuss component level and deployment level design elements. **[8]**

Q5) a) Explain Risk and management concern with the help of diagram. **[8]**

b) Discuss any two of the following. **[10]**

    i) Risk Refinement

    ii) Risk Mitigation

    iii) Risk Management

<div align="center">OR</div>

Q6) a) What are the advantages of SCM Repository? Explain functions performed by SCM Repository. **[8]**

b) Write short note on any two of the following **[10]**

    i) Change control mechanism in SCM

    ii) SCM Process

    iii) RMMM Plan

Q7) a) Define testing? Explain graph based functional testing techniques with suitable graph notation diagram. **[9]**

b) Discuss any two of the following. **[8]**

    i) User Acceptance Testing

    ii) Difference between Verification and validation Testing

    iii) Software Testing Life Cycle

<div align="center">OR</div>

Q8) a) What is system testing? Explain any three types system testing. **[8]**

b) Explain with suitable diagram Drivers and stubs in unit test environment. Disucss with suitable diagrams top-up and bottom-up integration in integration testing. **[9]**

<div align="center">🔹 🔹 🔹</div>

[6179]-238

S.E. (Computer)

MICROPROCESSOR

(2019 Pattern) (Semester - IV) (210254)

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.*

Q1) a)   With the help of necessary diagram, explain the complete address translation process in 80386.   **[6]**

b)   Enlist various types of system and non system descriptors in the 80386. Explain their use in brief.   **[6]**

c)   Write a short note on GDTR, IDTR, LDTR.   **[6]**

OR

Q2) a)   Explain the page translation process in 80386.   **[6]**

b)   Explain the use of following instructions in detail.   **[6]**

i)   LGDT

ii)   LIDT

iii) SIDT

c)   Draw and explain the general descriptor format available in various descriptor tables.   **[6]**

Q3) a)   Explain various aspects of protection mechanism of segmentation unit.**[6]**

b)   Write a short note on EPL, DPL, and IOPL.   **[6]**

c)   With the help of neat diagram explain various levels of protection and rules for protection check.   **[5]**

OR

P.T.O.

Q4) a) Explain how control transfer instructions are executed using the call gate in the system? **[6]**

b) Elaborate on the concept of combining segment protection and page level protection in 80386. **[6]**

c) List and explain various privilege instructions. **[5]**

Q5) a) Explain the TSS descriptor and its role in multitasking. **[6]**

b) Explain the structure of V86 task in detail. How is protection provided within the V86 task? **[6]**

c) Differentiate between real mode and virtual mode. **[6]**

OR

Q6) a) Define task switching and explain the steps involved in task switching operation. **[6]**

b) List and explain various features of virtual 8086 mode. **[6]**

c) Draw and explain task state segment of 80386. **[6]**

Q7) a) With the help of neat diagram explain the process of handling interrupts in protected mode. **[6]**

b) Explain different types of exceptions in 80386 with suitable examples. **[6]**

c) With the help of neat diagram explain the architecture of typical microcontroller. **[5]**

OR

Q8) a) Explore various descriptors present in IDT of 80386. **[6]**

b) Explain the following exceptions in brief. **[6]**

i) Divide error

ii) Invalid opcode

iii) Overflow

c) Explain various features of the 8051 microcontroller. **[5]**

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[6179]-239

S.E. (Computer Engineering)
PRINCIPLES OF PROGRAMMING LANGUAGES
(2019 Pattern) (Semester - IV) (210255)

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) *Neat diagrams must be drawn wherever necessary.*
4) *Make suitable assumptions whenever necessary.*

Q1) a) Justify the meaning of each characteristic of java in the statement "java is simple, architecture -neutral ,portable, interpreted and robust and secured programming language." **[6]**

   b) Define String in Java programming. Explain the following operations of class string in Java with example.1. To find the length of a string. 2. To compare two strings 3. Extraction of character from a string **[6]**

   c) Define Constructor. Show the example about overloading of default,

       parameterized, and copy constructors. **[6]**

OR

Q2) a) Write a program to print the area of a circle by creating a class named 'Area' having two methods. First method named as 'setRadius' takes the radius of the circle as a parameter and the second method, named as get 'Area' returns the area of the circle. The radius of circle is entered through the keyboard? **[6]**

   b) Explain the Garbage Collection concept in Java Programming with code example. **[6]**

   c) Explain command line arguments and variable length arguments in Java with an example. **[6]**

Q3) a) Elaborate the significance of the keyword " super " in Java. With code example of each case. **[6]**

b) Explain in brief the interface and package in Java with code examples.**[6]**

c) Create a custom Exception class. You need to consider two integer inputs that the user must supply, You will display the sum of the integers if and only if the sum is less than 100. If it is not less than 100, throw your custom exception **[5]**

OR

Q4) a) Elaborate on the significance of the keyword " final" in java. With code example of each case. **[6]**

b) Explain various Exception Handing mechanism in java **[6]**

c) Write a program to create interface A in a package; in this interface we have two methods meth1 and meth2. Implements this interface in another class named MyClass by importing your package. **[5]**

Q5) a) Explain different ways to implement Threads in Java? With code example. **[6]**

b) Explain the below methods in detail **[6]**

    i)   Isalive

    ii)   Notify

    iii) GetPriority

c) List the Features, advantages and limitations of Vue JS **[6]**

OR

Q6) a) Explain the uses of is Alive() and join() methods in the java thread with examples. **[6]**

b) Explain the thread life cycle model in Java. **[6]**

c) Write a short note on React JS and Angular JS. **[6]**

Q7) a) Explain the features of LISP programming. **[6]**

b) Explain the following Equality predicates using a suitable example. **[6]**

    i)   EQUAL

    ii)   EQ

    iii) EQL

    iv) =

c) Explain the following number predicates using a suitable example. **[5]**

    i)   NUMBERP

    ii)   ZEROP

    iii) PLUSP

    iv) EVENP

    v)   ODDP

OR

Q8) a) Explain the following functions with suitable examples. **[6]**

    i)   CAR()

    ii)   CDR()

    iii) FIRST()

b) Describe Logical Programming. Enlist its features. Also, list the commonly used Logical programming languages. **[6]**

c) Evaluate the following forms of LISP. **[5]**

    i)   (car (cdr '(1 2 3 4 5)))

    ii)   (car (cdr '(a (b c) d e)))

    iii) (car (cdr (cdr '(1 2 3 4 5 6 7 ED))))

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S.E. (Computer Engineering/ Computer Science & Design Engineering/ Artificial Intelligence & Data Science Engineering)
DISCRETE MATHEMATICS
(2019 Pattern) (Semester-III) (210241)
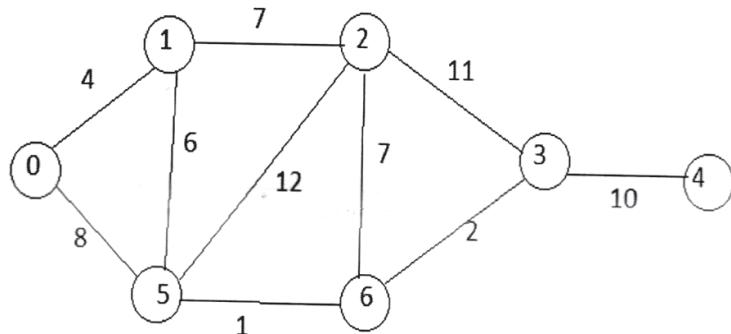
Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Answer Question No. Q1 or Q2, and Q3 or Q4, and Q5 or Q6 and Q7 or Q8.*
2) *Neat diagram must be drawn whenever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) How many bit strings of length 8 bits can be constructed which will either start with '1' or end with '00'? **[6]**

   b) In how many ways can 6 Boys and 2 Girls be seating in a row such that

      i) 2 Girls are seating together

      ii) 2 Girls are not seating together. **[6]**

   c) How many bit strings can be formed of length 10 bits which contains?**[6]**

      i) at least four 1's

      ii) at most four 1's?
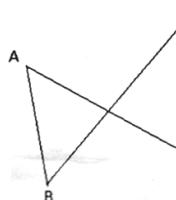
OR

Q2) a) How many bit strings of length 10 can be formed which will contain either 5 consecutive 0s or 5 consecutive 1s? **[6]**

   b) A zip code contains 6 digits. How many different zip codes can be made with the digits 0-9 if.

      i) No digit is used more than once.

      ii) The first digit is not '0' **[6]**

   c) Use the Binomial theorem to expand $(3a-2b)^6$ **[6]**
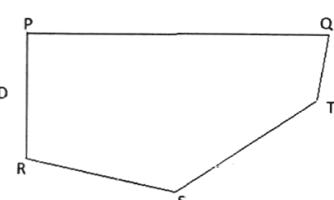
Q3) a) Find shortest path from vertex '0' to vertex '4' using Dijkstra's algorithm.

[7]
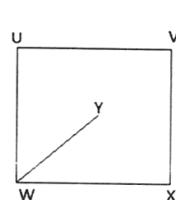
b) Explain with example: [5]
   i) Bipartite Graph
   ii) Connected Graphs

c) What is Graph isomorphism? Which of the following graphs are isomorphic? Justify your answer. [5]
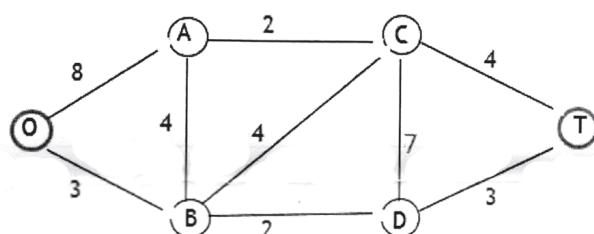
Graph G1   Graph G2   Graph G3

OR
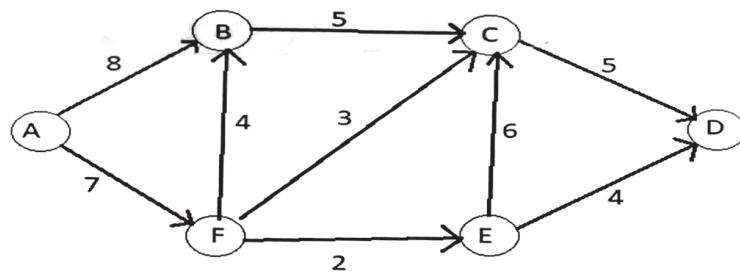
Q4) a) Find shortest path from vertex 'O' to Vertex 'T' using Dijkstra's algorithm.[7]

b) Explain with suitable example: [5]
   i) Euler path & Euler circuit
   ii) Hamilton path & Hamilton circuit.

c) What is planar Graph? A simple planar graph G contains 20 vertices and degree of each vertex is 3. Determine the number of regions in planar graph G? **[5]**
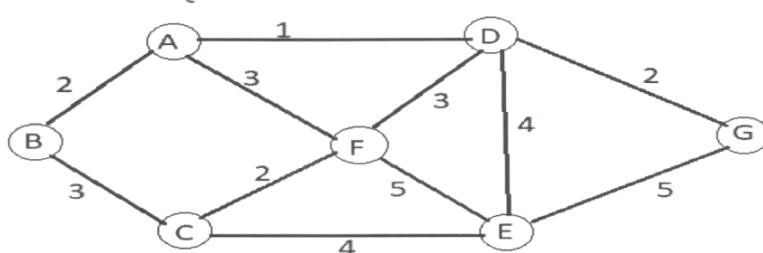
Q5) a) For the following graph find different cut set and identify the max flow in given network? **[6]**

b) Find the optimal prefix code for the given characters with the frequency of occurrences as below. **[6]**

Character	Frequency
A	10
E	15
I	12
O	3
U	4
S	13
T	1

c) Find minimum Spanning tree using prims algorithm. **[6]**
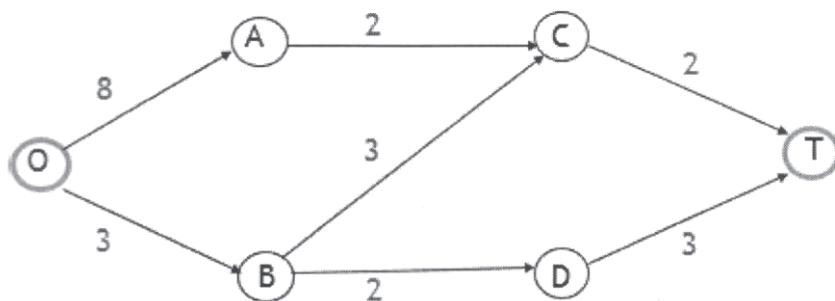
OR
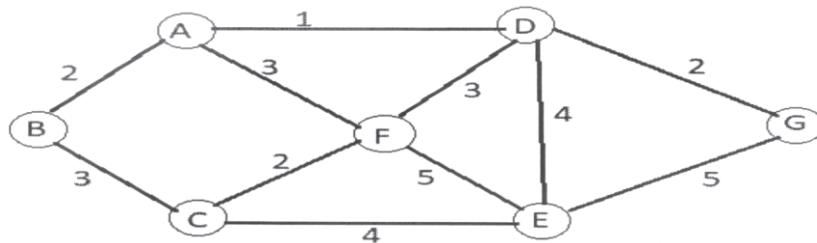
Q6) a) Construct Binary search Tree: **[6]**

21, 28, 14,18,11, 32, 25, 23, 37, 27, 5, 15, 19, 30, 12, 26

b) For the following transport network find the maximum flow using max flow min cut theorem. **[6]**

c) Find minimum spanning tree using Kruskals Algorithm. **[6]**

Q7) a) Let $Z_4=\{0,1,2,3\}$ and 'R' be the relation under operation '+' defined as

$a+b=a+b$: if $(a+b)<4$

$a+b=a+b-4$: if $(a+b)\leq 4$

Where $a,b \in Z_4$

Determine Algebraic System $(Z_4,+)$ is abellian group or not? **[6]**

b) Explain: **[6]**

i)   Integral domain

ii) Field

c) Let $A=\{0,1,2,3\}$ and 'R' be the relation under operation '⊙' defined as a ⊙ b=a,b%4. Determine algebraic system (A, ⊙) is monoid or not? **[5]**

OR

Q8) a) Let Zn={0,1,2,3,...n-1}

Consider 'R' relation under operation '+' defined as "addition Modulo 5" and operation '*' defined as " multiplication modulo 5". Does the Algebraic system. $(Z_5,+,*)$ forms Ring"? **[8]**

b) Explain the following properties of Algebraic structure with example **[4]**

i) Identity

ii) Inverse

c) Consider 'R' be the relation under binary operation '*' on a set Z. Does the algebraic system (Z,*) is Abelian Group? **[5]**

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[6179]-241

S.E. (Computer Engineering A.I & D.S.)
FUNDAMENTALS OF DATA STRUCTURES
(2019 Pattern) (Semester - III) (210242)

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) *Assume suitable data, if necessary.*

3) *Draw neat labelled diagram wherever necessary.*

4) *Figures to the right indicate full marks.*

Q1) a) Sort the following numbers step by step using insertion sort :   **[9]**

55, 85, 45, 11, 34, 5, 89, 99, 67

Comment on time complexity of Insertion sort

b) Explain in brief any three searching techniques. What is the time complexity of these techniques?   **[9]**

OR

Q2) a) Explain Fibonacci Search algorithm with suitable example. What is it's time complexity?   **[9]**

b) Given numbers 29, 57, 47, 39, 36, 20, 55, 28, 31, 39. Sort stepwise using radix sort. When it is appropriate to use radix sort? Write time Complexity.   **[9]**

Q3) a) Write pseudo code for following function using Singly Linked List of students (roll_number and name stored in every node)   **[9]**

i) Search given roll no and delete that record. Draw diagram of operation.

ii) Add given number after specified number in the list. Draw diagram of operation.

b) Write and explain use of Generalized linked list for representation of multivariable polynomial with suitable example. Explain node structure.   **[9]**

P.T.O.

Q4) a) Write pseudocode to perform addition of two polynomials using doubly linked lists into third list. Write time complexity of it. **[9]**

b) Write and explain node structure of Circular Singly Linked List and Doubly Linked list. Write pseudocode for concatenation of two doubly linked lists. **[9]**

Q5) a) Write rules to convert given infix expression to postflx expression using stack. Convert expression (P * Q – (L + M * N) ^ (X * Y / Z) stepwise using above rules.

Where ^ is - exponential operator. **[8]**

b) Explain with example three different types of recursion. **[9]**

OR

Q6) a) Explain procedure to convert infix expression to prefix expression and postfix evaluation with suitable example. **[8]**

b) Write pseudo-C/C++ code to implement stack using Singly linked list with overflow and underfiow conditions. **[9]**

Q7) a) Draw and explain Circular queue using array. Write pseudocode for Add, Remove operations. **[8]**

b) What is Doubly Ended Queue? Draw Dragram with labelling four basic operations at appropriate places. Which two data structures are combined in it and how? **[9]**

OR

Q8) a) Write short note on : **[8]**

i) Comparison of Circular Queue with Linear queue

ii) Priority Queue

b) Draw and explain implementation of Linear Queue using Singly Linked List. Explain Add, Remove, Queue Full and Queue Empty operations.**[9]**

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[6179]-242

S.E. (Computer Engineering) /(Computer Science & Design Engg.)/ (Artifical Intelligence & Data Science Engg.)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester-III) (210243)

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) *Assume suitable data if necessary.*
4) *Use of Calculator is allowed.*

Q1) a) Differentiate between compile time polymorphism and run time polymorphism. **[5]**

b) How do you declare and define a pure virtual function in C++? Explain with help of a program. **[6]**

c) Write a C++ program for unary increment (++) and decrement (--) operator overloading. **[6]**

OR

Q2) a) What is operator overloading and why it is useful? Which Operators cannot be overloaded. **[5]**

b) How virtual functions are implemented in C++? Explain with help of a program. **[6]**

c) Write a program to binary (+) and binary (-) operator in C++. **[6]**

Q3) a) Explain the use of command line arguments. If we want to pass command line arguments what will be prototype of main function and explain its arguments along with example. **[5]**

b) Explain the following file handling functions (solve any three). **[6]**
   i) seekg ( )
   ii) tellg ( )
   iii) seekp ( )
   iv) tellp ( )

c) Write a program Using the C++ file input and output class with open(), get(), put(),close() methods for opening, reading from and writing to a file. Use append mode while opening the file for writing. **[7]**

OR

Q4) a) List and Explain different Mode bits used in open () function, while opening a file. (Any five). **[5]**

b) Define a class Person that has three attributes viz name, gender and age. Write a C++ Program that writes an object to a file and reads an object from a file. **[6]**

c) Explain what is fstream, ifstream and ofstream with help of example? Provide the hierarchy of stream classes in C++. **[7]**

Q5) a) Discuss exception handling mechanism in C++ with syntax. **[5]**

b) Write a program to handle exception using class type exception. **[6]**

c) Demonstrate function template with suitable code in C++. **[6]**

OR

Q6) a) Explain exception handling in constructor, destructor. **[5]**

b) Write a program to demonstrate class template with example. **[6]**

c) Demonstrate overloading function template with suitable code in C++.**[6]**

Q7) a) What is an iterator? Explain how to use an iterator in C++ program with example. **[5]**

b) What is an algorithm in STL? Enlist algorithms and explain any algorithm in detail. **[6]**

c) What is a Map ? Write a program to implement map in C++. **[7]**

OR

Q8) a) What is STL? Enlist and explain in short major components of STL.**[5]**

b) What is iterator and algorithm? Explain each of them with example. **[6]**

c) What is a vector? Enlist and explain any 5 functions of vector by using a C++ program. **[7]**

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[6179]-243

S.E. (Computer Engineering) (AI & DS) (Computer Science & Design Engineering)
COMPUTER GRAPHICS
(2019 Pattern) (Semester - III) (210244)

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 indicates full mark.*
3) *Draw neat diagram wherever necessary.*
4) *Assume suitable data, if necessary.*

Q1) a) Find transformation of a triangle A(1, 0) B(0, 1) C(1, 1) by performing translation by one unit in x and y directions and then rotating 45° about the origin. **[6]**

b) What are the types of Projection and write in brief about any one type of projection. **[6]**

c) Write transformation matrix for (i) 2-D Rotation clockwise direction (ii) 2-D Scaling (iii) 2-D translation (iv) 2-D reflection about X-axis. **[6]**

OR

Q2) a) Explain Perspective projections with example. **[6]**

b) Given a circle C with radius 5 and center coordinates (1, 4). Apply the translation with distance 5 towards X axis and 1 towards Y axis. Obtain the new coordinates of C without changing its radius. **[6]**

c) Given a line segment with starting point as (0, 0) and ending point as (4, 4). Apply 30 degree rotation anticlockwise direction on the line segment and find out the new coordinates of the line. **[6]**

Q3) a) Write a short note on : **[6]**
   i) CMY color model   ii) Properties of light

b) Explain Back-face Removal algorithm. **[6]**

c) Explain ambient light and diffuse reflection with examples. **[6]**

OR

Q4) a) Explain the CIE chromaticity diagram.   **[6]**

b) Explain Painter's algorithm.   **[6]**

c) Explain Gouraud Shading method.   **[6]**

Q5) a) What are various applications of Fractals?   **[5]**

b) Explain Hilbert's curve with an example.   **[6]**

c) Write a short note on Interpolation.   **[6]**

OR

Q6) a) Explain B-spline curve.   **[5]**

b) Explain the Bezier curve. List its properties.   **[6]**

c) What are fractals? Explain Triadic Koch in detail.   **[6]**

Q7) a) Compare Conventional and Computer based Animation.   **[5]**

b) Discuss NVIDIA as a gaming platform in detail.   **[6]**

c) Explain the structure of a segment table with example.   **[6]**

OR

Q8) a) Write short note on Motion Specifications.   **[5]**

b) Explain architecture of i860.   **[6]**

c) Explain creation and renaming of segment.   **[6]**

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[6179]-244

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)   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)   Assume suitable data if necessary.

Q1) a) Distinguish between combinational and sequential switching circuits also write examples of both.   **[6]**

b) Convert Following Flip flops: **[6]**

   i)   SR to T

   ii)   JK to D

c) What is MOD counter ? Design MOD 7 counter using IC 7490.   **[6]**

OR

Q2) a) Draw and explain 4-bit asynchronous up-counter using JK flip flop. Also draw the necessary timing diagram.   **[6]**

b) What do you mean by excitation table of flip flop? Write the excitation table of   **[6]**

   i)   S-R flip flop

   ii)   J-K flip flop

c) With neat diagrams explain the working of the following types of shift registers   **[6]**

   i)   Serial-in, serial-out

   ii)   Parallel-in, serial-out

Q3) a) Draw an ASM chart and state table of a 2 bit up-down counter having a mode control input. **[6]**

M = 1 Up counting M = 0 down counting

b) Implement following Boolean function using PAL **[6]**

Fl = $\sum$ m (0, 2,4,6,8,12)

F2 = $\sum$ m (2,3,8,9,12,13)

F3 = $\sum$ m (1,3,4,6,9,11,12,14,15)

c) Draw a block diagram of the PLA device and explain. **[5]**

OR

Q4) a) What is an ASM Chart? Name the elements of an ASM chart and define each of them. **[6]**

b) Implement BCD to Excess-3 code converter using PAL. **[6]**

c) What is the difference between PAL and PLA. **[5]**

Q5) a) With the help of a neat diagram. Explain the working of two-input TTL NAND gate. **[6]**

b) Draw and explain the circuit diagram of CMOS inverter. **[6]**

c) Define the following terms and mention the standard values for TTL logic Family **[6]**

i) Fan-out

ii) Power Dissipation

iii) Propagation Delay

OR

Q6) a) What is the advantage of open collector output? Justify your answer with suitable circuit. **[6]**

b) Compare TTL and CMOS logic family. **[6]**

c) What is logic family? Give the classification of logic family and also write important characteristics of. CMOS. **[6]**

Q7) a) Draw and explain the basic building of an ideal microprocessor based system with the help of neat diagram. **[6]**

b) What is system bus? Draw microprocessor bus structure and explain in brief. **[6]**

c) Write a short note on ALU IC 74181. **[5]**

OR

Q8) a) With the help of a block diagram explain the fundamental units of a microprocessor. **[6]**

b) Explain the Memory organization of the microprocessor. **[6]**

c) What is microprocessor? List different applications of microprocessor.**[5]**

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[6179]-244A

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) *Solve 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) What are the advantages of M S JK flip flop? Explain the working of MS J-K flip flop in detail. **[6]**

b) State different types of shift registers. Give its applications. **[6]**

c) Draw and explain 3-bit asynchronous down counter using JK flip flop. Also draw the necessary timing diagram. **[6]**

OR

Q2) a) Compare synchronous and Asynchronous counter. **[6]**

b) Explain how JK flip is converted into. **[6]**

   i) D FF

   ii) T FF

c) Write short note on Ring counter. **[6]**

Q3) a) Draw and explain the general structure of PLA. **[6]**

b) Implement following Boolean function using PAL **[6]**

   $F(A, B, C, D) = \Sigma m(0, 1, 3, 15)$

c) Draw the state diagram, state table, and ASM chart for a 2-bit binary counter having one enable line E such that E = 1 counting enabled and E = 0 counting disabled. **[5]**

OR

P.T.O.

Q4) a) What is an ASM Chart? Name the elements of an ASM chart and define each of them. **[6]**

b) Implement BCD to Ex-3 code converter using PAL. **[6]**

c) What is the difference between PAL and PLA. **[5]**

Q5) a) With the help of a neat diagram, explain the working of two - input TTL NAND gate. **[6]**

b) Define the following terms and mention the standard values for TTL logic Family. **[6]**

i) Power dissipation

ii) Noise margin

iii) Propagation Delay

c) Draw and explain the circuit diagram of CMOS inverter. **[6]**

OR

Q6) a) Compare TTL and CMOS logic family. **[6]**

b) What is logic family? Give the classification of logic family and also write important characteristics of CMOS. **[6]**

c) Explain the wired logic output of TTL with neat diagram. **[6]**

Q7) a) What is system bus? Draw microprocessor bus structure and explain in brief. **[6]**

b) Write a short note on following with respect to microprocessor. **[6]**

i) Address Bus

ii) Data Bus

iii) Control Bus

c) Explain the Memory organization of the microprocessor. **[5]**

OR

Q8) a) What is microprocessor? List different applications of microprocessor. **[6]**

b) Write a short note on ALU IC 74181. **[6]**

c) With the help of a block diagram explain the fundamental units of a microprocessor. **[5]**

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[6179]-245

S.E. (Artificial Intelligence & Data Science Engineering)
STATISTICS
(2019 Pattern) (Semester - IV) (217528)

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)   *Neat diagrams must be drawn whenever necessary.*
    4)   *Make suitable assumption whenever necessary.*

Q1) a)   The first four moments of a distribution about the value 5 are 2,20,40 and 50. From the given information obtain the first four central moments, coefficient of skewness and kurtosis.   **[6]**

    b)   Obtain the regression lines y on x and x on y for the data.   **[6]**

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

    c)   Calculate standard deviation for the following frequency distribution. Decide whether Arithmetic mean is good or not.   **[6]**

Wages in rupees earned per day	0-10	10-20	20-30	30-40	40-50	50-60
No. of laborer's	5	9	15	12	10	3

OR

Q2) a)   Following are the values of import of raw material and export of finished product in suitable units.

Export	10	11	14	14	20	22	16	12	15	13
Import	12	14	15	16	21	26	21	15	16	14

      Calculate the coefficient of Correlation between the import values and export values.   **[6]**

    b)   If the two lines of regression are $9x + y - \lambda = 0$ and $4x + y = \mu$ and the means of x and y are 2 and -3 respectively, find the values of λ, μ and the coefficient of correlation between x and y.   **[6]**

P.T.O.

c) Compute the first four moments about arbitrary mean A = 25 for the following frequencies. **[6]**

No of Jobs	0-10	10-20	20-30	30-40	40-50
No of Workers	6	26	47	15	6

Q3) a) 20% of bolts produced by a machine are defective. Determine the probability that out of 4 bolts chosen at a random. **[5]**

i) 1 is defective

ii) Zero are defective

iii) At most 2 bolts are defective

b) The average number of misprints per page of a book 1.5. Assuming the distribution of number of misprints to be Poisson, Find **[6]**

i) The Probability that a particular book is free from misprints.

ii) Number of pages containing more than one misprint if the book contains 900 pages.

c) For a normal distribution When mean = 2, standard deviation $\sigma = 4$, 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) Fit a Poisson Distribution to the following data and calculate theoretical frequencies **[6]**

x	0	1	2	3	4	Total
f	109	65	22	3	1	200

c) The lifetime of an article has a normal distribution with mean 400 hours and standard deviation 50 hours. Find the expected number of articles out of 2000 whose lifetime lies between 335 hours to 465 hours. **[6]**

(Given : $A(z = 1.3) = 0.4032$)

Q5) a) The Table below gives the number of customers visit the certain company on various days of week

Days	Sun	Mon	Tue	Wed	Thurs	Fir	Sat
Number of Customers	6	4	9	7	8	10	12

Test at 5% of level of significance whether customer visits are uniformaly distributed over the days. **[6]**

[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) 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. Test whether the means of the two populations are at the same level. **[6]**

(Given $t_{0.05,22} = 2.07$)

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 Yeallow	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 significant difference between mean score. **[6]**

(Given $Z_\alpha = 1.96$)

c) Find the F statistics from the following data: **[6]**

Sample	Size (n)	Total observation Σx	Sum of squares of observations Σx^2
1	8	9.6	61.52
2	11	16.5	73.26

Q7) a) Let P be the probability that a coin will fall head in a single toss in order to test $H_0 : P = \dfrac{1}{2}$ against $P = \dfrac{3}{4}$. 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]**

b) Show that the likelihood ratio test for testing the equality of variances of two normal distribution is the usual F-test. **[9]**

OR

Q8) a) Write short notes on **[8]**

     i) Most Powerful test

     ii) Level of significance

     iii) Advantages and disadvantages of non-parametric test

b) State and Prove Neyman - Pearson lemma for testing a simple hypothesis against a simple alternative hypothesis. **[9]**

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[6179]-246

S.E. (Artificial Intelligence & Data Science)
INTERNET OF THINGS
(2019 Pattern) (Semester - IV) (217529)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

 1) *Attempt Questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

 2) *Draw neat and Clean diagrams.*

 3) *Assume suitable data, if necessary.*

Q1) a) Explain with the help of a neat diagram the components of IOT with pros and cons? **[9]**

 b) With the help of following sector justify how IOT technology impacting on end to enduser. **[9]**

  i) Big Data Analytics

  ii) Telematics

  iii) Home Automation

OR

Q2) a) Explain in brief SCADA with block diagram and SCADA functionality with middleware structure? **[9]**

 b) How IOT plays an important role in smart city, smart appliances, smart parking, smart lightning? **[9]**

Q3) a) Explain Block diagram of RFID system with frequency ranges? Explain any two strengths and weaknesses of RFID over Barcode? **[9]**

 b) Explain with the help of a neat diagram cellular Machine to Machine application network? **[8]**

OR

Q4) a) Differentiate MQTT and CoAP Protocol? **[9]**

 b) Explain advanced message queuing protocol with architectural diagram?**[8]**

Q5) a) Why is security required in IOT? Explain in detail various security models in the Internet of Things. **[10]**

   b) What is threat analysis in the Internet of Things? Explain details of threat analysis. **[8]**

OR

Q6) a) What is Internet of Things security tomography? Explain in detail layered attacker model? **[10]**

   b) Explain Analog and digital sensors with 2 examples each? **[8]**

Q7) a) Write a detailed business model scenario for the Internet of Things. **[7]**

   b) Explain in detail application of Internet of Things in city automation and home automation. **[10]**

OR

Q8) a) Write applications of Internet of Things for e-health body area network.**[7]**

   b) Explain in detail business model and business innovation in the Internet of Things. **[10]**

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[6179] - 247

S.E. (Artificial Intelligence and Data Science)
MANAGEMENT INFORMATION SYSTEMS
(2019 Course) (Semester - IV) (217530)

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) Discuss Hardware and Software platform trends in IT infrastructure. **[8]**

b) Explain system vulnerability, business value of security and control. **[9]**

OR

Q2) a) What is Business Intelligence? Explain its foundations database and Information management. **[9]**

b) What is IT infrastructure? Explain in brief its components. **[8]**

Q3) a) How to enhance decision making with information systems give suitable examples. **[9]**

b) Discuss the growth of international information systems and organizing international information systems. **[8]**

OR

Q4) a) Explain E-commerce with Digital Markets and Digital Goods. **[8]**

b) Discuss managing global system with technology issues and opportunities for global value chain. **[9]**

Q5) a) Elaborate functional business system in detail with cross functional enterprise systems. **[9]**

b) Describe e-commerce with its applications and issues. **[9]**

OR

P.T.O.

Q6) a) How to manage Supply chain with business network? **[9]**

b) Write short note on i) Fuzzy Logic ii) Virtual Reality, iii) Business and AI. **[9]**

Q7) a) Explain decision support trends in businesses. How data mining and knowledge management is used in Decision Support Systems. **[9]**

b) Explain the role of MIS in data science, explore an open sources tool to perform detective analysis. **[9]**

OR

Q8) a) Write short note on i) Intelligent Agents ii) Genetic Algorithms, iii) Neural Network. **[9]**

b) Explain the value of expert systems with its benefits and limitations. **[9]**

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[6179]-248

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) *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) What is Readers/Writers problem? Explain with suitable example. **[8]**

b) What is deadlock detection and recovery? Explain two options of deadlock recovery. **[6]**

c) What do you mean by pipe? Explain anonymous and named/FIFO pipe. **[4]**

OR

Q2) a) What is Producer-Consumer Problem? How to solve it using Semaphores and Mutex. **[8]**

b) Write a short note on (Any Two) **[10]**
   i) Mutual Exclusion
   ii) Inter-process Communication
   iii) Semaphores

Q3) a) List the page replacement algorithms and explain LRU in detail. **[7]**

b) Explain Buddy system memory allocation with suitable example. **[6]**

c) Write a short note on Segmentation. **[4]**

OR

Q4) a) Explain the concept of Virtual Memory. **[7]**

b) Differentiate between paging and segmentation. **[6]**

c) Explain Fixed Partitioning with suitable example. **[4]**

P.T.O.

Q5) a) What is file system? Explain File system implementation in detail. **[8]**

b) Define following term with respect to disk access **[6]**

    i) Seek time

    ii) Rotational Latency

    iii) Data transfer time

c) Differentiate SCAN and C-SCAN disk scheduling policy. **[4]**

<div align="center">OR</div>

Q6) a) Explain Directory structure with its types. **[8]**

b) Write a short note with respect to disk scheduling policies (Any Two)**[10]**

    i) FIFO

    ii) LIFO

    iii) STTF

Q7) a) Explain in detail the memory management in LINUX system. **[7]**

b) Explain system calls in Linux. **[6]**

c) Differentiate between Linux and Unix **[4]**

<div align="center">OR</div>

Q8) a) Explain Linux file system. **[7]**

b) Explain Linux Shell? **[6]**

c) Explain Linux booting process. **[4]**

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[6179]-249

S.E. (Computer Science and Design)
DATA STRUCTURES AND FILES
(2019 Pattern) (Semester - IV) (218253)
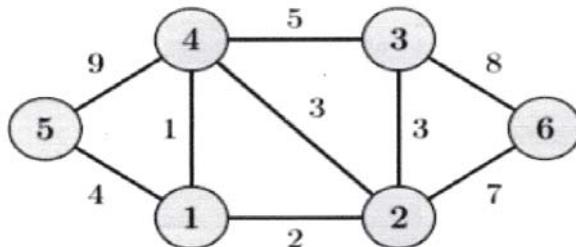
Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
   1) *Solve 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 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
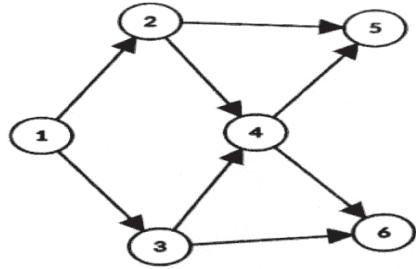
Q2) a)   Consider the graph represented by the following adjacency matrix: **[6]**

	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 **[6]**

15, 20, 24, 10, 13, 7, 30, 36, 25

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. **[6]**

5, 3, 21, 9, 1, 13, 2, 7, 10, 12, 4, 8

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. **[6]**

After Construction max heap delete element 17 and rebuild heap

b) Construct a B+ tree of order 5 for following data one at a time. **[6]**

30, 31, 23, 32, 22, 28, 24, 29, 15, 26, 27, 34, 39, 36

c) Explain with example trie tree. Give advantages 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]**

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[6179]-250

S.E. (Computer Science & Design Engineering)
OPERATING SYSTEM DESIGN
(2019 Pattern) (Semester - IV) (218254)

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.*

Q1) a)   Explain requirements for Mutual Exclusion.   **[8]**

    b)   Explain synchronization in detail with example.   **[9]**

<div align="center">OR</div>

Q2) a)   Elaborate Inter proces communication with one example.   **[8]**

    b)   What is deadlock? How to avoid deadlock?   **[9]**

Q3) a)   What are the requirements for memory management? Explain with example.   **[8]**

    b)   Explain different types of partitioning techniques. Explain in detail.   **[9]**

<div align="center">OR</div>

Q4) a)   What is buddy system? Explain with example.   **[8]**

    b)   Explain segmentation with example in detail.   **[9]**

Q5) a)   Explain all disk scheduling policies in detail.   **[9]**

    b)   What is I/O buffering? Explain in detail.   **[9]**

<div align="center">OR</div>

Q6) a)   Explain different file access methods in detail.   **[9]**

    b)   Explain different file protection mechanism in detail.   **[9]**

Q7) a) Explain different interfaces to Linux. **[9]**

   b) Explain in details different system calls used for process management.**[9]**

<p align="center">OR</p>

Q8) a) Differentiate between Process & Threads. **[9]**

   b) Explain Process scheduling in Linux. **[9]**

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[6179]-251

S.E. (Computer Science and Design)

COMPUTER NETWORKS

(2019 Pattern) (Semester - IV) (Theory) (218255)

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) *Draw Neat and Clean Diagram.*
3) *Assume Suitable Data if Necessary.*

Q1) a) Explain network layer issues in detail. **[5]**

b) Draw and Explain IPV6 header. Explain the significance of extension header. **[6]**

c) Explain link state routing algorithm with example. **[6]**

OR

Q2) a) Explain Address Resolution Protocol (ARP). **[5]**

b) How do IP addresses get mapped onto data link layer addresses, such as Ethernet? **[6]**

c) Find the sub-network address and the host id for the following. **[6]**

IP Address	Mask
120.14.22.16	255.255.128.0
140.11.36.22	255.255.255.0
141.181.14.16	255.255.224.0

Q3) a) What is the difference between TCP and UDP? Explain TCP header format in detail. **[7]**

b) What is 3-Way handshake in TCP? Explain in brief why it is required?**[7]**

c) What is silly window syndrome problem? How it is avoided? Explain.**[4]**

OR

P.T.O.

Q4) a) Define quality of service and list the parameters typical to transport layer.**[7]**

b) What is leaky bucket algorithm? What are the drawbacks of this algorithm? **[7]**

c) What is socket? Which are various socket primitives used in client server communication? **[4]**

Q5) a) Explain working of DHCP. **[5]**

b) What is DNS? Explain with suitable example how query resolving process is done? **[6]**

c) Explain connection oriented and connectionless service. Which protocols at each layer in TCP/IP protocol suite support these services. **[7]**

OR

Q6) a) Explain FTP in details. What is the use of Control connection? **[5]**

b) What is difference between persistent and non-persistent HTTP? Also explain HTTP message format. **[6]**

c) Explain SMTP, POP3 and IMAP with respect to email application. **[7]**

Q7) a) Explain key principles of security? **[5]**

b) Describe in brief DES. **[5]**

c) Define S/MIME with types. **[7]**

OR

Q8) a) Explain different types of attacks? **[5]**

b) Explain IPsec with modes of operation. **[5]**

c) Explain firewall with its types. **[7]**

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[6179]-252

S.E. (Computer Science and Design)
DESIGN THINKING
(2021 Pattern) (Semester - IV) (218256)

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) What is brainstorming? What are the rules to be followed for productive and better ideas while brainstorming. **[5]**

b) Briefly explain various techniques of idea generation. **[6]**

c) How do you evaluate the ideas? **[6]**

OR

Q2) a) What is refinement? When do designers think in images and signs. Explain with example. **[5]**

b) What is appropriation? Describe Some key forms of appropriation. **[6]**

c) Define the following terms with respect to design thinking. **[6]**

i) Personification

ii) Visual metaphors

iii) Modification

Q3) a) How Visualization techniques can be used for understanding any problem? Mention and describe any three techniques. **[7]**

b) What is story boarding? Why is story boarding essential? Give an example of story boarding. **[7]**

c) Write short notes 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) Create a story board for a healthy life style. **[7]**

c) What is a prototype phase of a design thinking process. Give example. **[4]**

Q5) a) How would you test a design thinking strategy? **[4]**

b) What is testing? Why and When to conduct user testing? **[6]**

c) Explain Kano model of testing. **[8]**

OR

Q6) a) How to use customer's feedback in product development? **[4]**

b) What are the principles of usability testing? **[6]**

c) Explain with suitable example desirability testing. **[8]**

Q7) a) How do design thinking and innovation relate? **[4]**

b) Differentiate among idea, invention and innovation. **[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) How do you create an innovation portfolio? **[6]**

c) What is an innovation strategy and how do you create one? **[7]**

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[6179]-253

S.E. (Computer Science and Design Engineering)
DATA STRUCTURE AND 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

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 **[7]**

((A+B)–C*(D/E))+F

Use stack & show step by step conversion.

OR

Q6) a) What is backtracking? Explain the use of stack inbacktracking. **[4]**

b) Explain process of conversion of an infix expression to postfix expression using stack: **[5]**

A*(B – C)/E^F+G

c) Explain evaluation of postfix expression using stack withsuitable 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. **[8]**

OR

Q8) a) Write algorithm to delete intermediate node from Doubly Link List. **[4]**

b) Write pseudo code to implement a circular queueusing arrays. **[6]**

c) Explain Dequeue with the insert and delete operationsperformed on it.**[8]**

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[6179]-254

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)   Draw and explain the working of a 4-bit Ring Counter.   **[6]**

   b)   Design and implement 2 bit synchronous up counter using JK flip flop.**[6]**

   c)   Convert JK Flip flop to T flip flop.   **[6]**

<div align="center">OR</div>

Q2) a)   Draw 3 bit asynchronous up counter using JK flip flops and explain its
         operation using output waveforms.   **[6]**

   b)   Convert JK flip flop into SR flip flop.   **[6]**

   c)   Draw and explain SISO shift register. Give application of each.   **[6]**

Q3) a)   Explain functional units of computer.   **[5]**

   b)   Draw and explain the Von Neumann architecture.   **[6]**

   c)   Draw & Explain the neat diagram of single bus organization of the CPU.**[6]**

<div align="center">OR</div>

Q4) a)   Draw and explain instruction cycle state diagram.   **[5]**

   b)   Compare Hardwired & micro programmed control unit.   **[6]**

   c)   Explain control unit and its function along with block diagram.   **[6]**

Q5) a)   Describe the elements of machine instructions.   **[5]**

   b)   Explain the concept of instruction pipelining with diagram.   **[6]**

   c)   Explain any 3 addressing modes with example.   **[6]**

<div align="center">OR</div>

Q6) a) Write a note on assembly language elements. [6]

b) Explain the RISC and CISC characteristics. [6]

c) Write short note on cluster configuration. [5]

Q7) a) Explain the need of cache memory. [6]

b) Write a note on SRAM. [6]

c) Draw and explain DMA block diagram. [6]

OR

Q8) a) What are the different cache replacement policies. [6]

b) Write a note on memory hierarchy? [6]

c) Explain I/O interfacing techniques. [6]

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[6179]-255

S.E. (Information Technology)
PROCESSOR ARCHITECTURE
(2019 Pattern) (Semester - IV) (214451) (Theory)

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) With suitable format explain each bit of INTCON register. **[8]**

b) Draw and explain the interfacing of LCD with Port B and Port C of PIC18FXX microcontroller. **[7]**

c) What are peripheral interrupts, IVT and ISR? **[3]**

OR

Q2) a) Discuss the steps in executing interrupts in PIC 18 microcontroller. **[7]**

b) Explain the interrupt structure of PIC 18 microcontroller. **[7]**

c) Explain the interface of LED with PIC18Fxxx. **[4]**

Q3) a) Explain the UART operation in PIC18FXX with example. **[6]**

b) Write short note PWM module in PIC 18 F microcontroller. **[5]**

c) Explain operation of capture mode of PIC 18FXX microcontroller with diagram. **[6]**

OR

Q4) a) Compare SPI and I2C bus protocols. **[5]**

b) Explain the function of CCP1 CON SFR along with its format. **[6]**

c) Explain the stepper motor interfacing with PIC 18FXX microcontroller with suitable diagram. **[6]**

Q5) a) State the features of on-board ADC of PIC 18F microcontroller. **[6]**

Explain the signals:

i) SOC

ii) EOC

b) Explain in detail the functions of ADCON0 SFR of PIC18 microcontroller. **[6]**

c) Explain function of any 3 pins of RTC DS 1306. **[6]**

OR

Q6) a) Draw and explain the interfacing of LM34/LM35 with PIC 18FXX for temperature measurement using on - chip ADC. **[6]**

b) State the features of RTC. **[6]**

c) Write steps in programming A to D conversion in PIC18F microcontroller. **[6]**

Q7) a) Explain bits in CPSR of ARM7 in detail along with diagram. What is the use of SPSR. **[6]**

b) Explain ARM core dataflow Model with suitable diagram. **[6]**

c) Compare PIC microcontroller and ARM core processor. **[5]**

OR

Q8) a) Write significance of special registers R13, R14 and R15 in ARM7. **[6]**

b) State difference between the ARM7, ARM9 and ARM 11 processors. **[6]**

c) Why ARM processors are suitable in embedded system applications? **[5]**

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[6179]-256

S.E. (Information Technology Engineering)
DATABASE MANAGEMENT SYSTEM
(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.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn whenever necessary.*
4) *Make suitable assumption whenever necessary.*

Q1) a) Consider a relational database   **[6]**

Supplier (sid, sname, city) Parts (pid, pname, color, weight) Catalog(sid, pid, quantity)

Write SQL queries for the following:

i) Find the names of parts whose color is 'red'.

ii) Find the names of all parts whose weight is less than 25kg.

iii) Sort the suppliers by ascending order of city.

iv) Find the average weight of all parts.

v) Display part details of green color part with its quantity

b) Explain with suitable example SQL aggregate functions.   **[6]**

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

i) Embedded SQL

ii) Dynamic SQL

<p align="center">OR</p>

Q2) a) What is view in SQL? Explain with example.   **[6]**

b) What is trigger? Explain trigger with suitable example.   **[6]**

c) Write the syntax for following commands of SQL: **[6]**

     i)   Create table

     ii)   Insert

     iii)   Update

     iv)   Delete

     v)   Drop table

     vi)   Alter table (add new column)

Q3) a) Student_Details (Stud_id, Stud_name Mob_no, Zip_code, City) Consider this schema, check whether it is in 3NF, if not justify and propose the schema in 3NF. **[6]**

b) Define query processing. What are the steps involved in query procesing? **[5]**

c) Explain insertion, deletion and modifications anomalies with proper example. **[6]**

OR

Q4) a) State the need of normalization? Explain 2NF with suitable example. **[6]**

b) What are the measures of query cost? **[5]**

c) Given the relation schema R = (A, B, C, D, E) with functional dependencies A→BC, CD→E, B→D, E→A, whether A and CD can be the candidate keys for R. Justify your answer. **[6]**

Q5) a) What is deadlock? Explain how deadlock detection and prevention is done. **[6]**

b) Explain in detail. Time stamping methods. **[6]**

c) What are the possible causes of transaction failure? Explain the significance of ACID properties. **[6]**

OR

Q6) a)   Explain log based recovery technique.   **[6]**

b)   Explain shadow paging method in detail.   **[6]**

c)   Define view and conflict serializable schedule with suitable example. **[6]**

Q7) a)   Describe: Centralized and Client-Server Architectures.   **[6]**

b)   Write short note on: **[6]**

i)   SQLite database

ii)   XML database

c)   Categorize different parallel database architectures? Conclude which of them is better.   **[5]**

OR

Q8) a)   Describe : Architecture for Distributed databases.   **[6]**

b)   Write short note on: **[6]**

i)   Cloud database

ii)   Mobile databases

c)   Write short notes on NOSQL database   **[5]**

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[6179]-257

S.E. (Information Technology)
COMPUTER GRAPHICS
(2019 Pattern) (Semester - IV) (214453)

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 drawn wherever necessary.*
3) *Figures to the rightside indicate full marks.*
4) *Assume Suitable data if necessary.*

Q1) a) Use the Cohen Sutherland Line Clipping Algorithm with the help of region codes to clip a line AB with A (30, 70), B (110, 50) and PQ with P (60, 120), Q (90, 30) to clip a line against a window with lower left-hand corner (40, 40) and Upper right-hand corner (100, 80). Show Graphic Representation of Original and Clipped Line. **[9]**

b) Explain the basic transformation techniques in 3D Graphics. **[9]**
   i) Scaling
   ii) Rotation
   iii) Reflection about XZ Plane

OR

Q2) a) What is projection? Explain with diagram, oblique - Cavalier, Cabinet, Orthographic - isometric, diametric, trimetric Parallel projections. **[9]**

b) Let ABCD be the rectangle window with A (150, 150), B (150, 200), C (200, 200) and D (200, 150). Use Cohen Hodgeman polygon clipping algorithm to clip the convex polygon PQRS with P (100, 175), Q (170, 250), R (250, 165), S (180, 100) and find the final coordinates of the clipped polygon. **[9]**

Q3) a) Define Shading. Compare Constant Intensity, Halftoning, Gourand Shading and Phong Shading algorithm. **[9]**

b) Explain in detail with Diagram. **[8]**
   i) RGB Color Model.
   ii) HSV Color Model
   iii) CIE Chromaticity Diagram
   iv) Color Gamut

Q4) a) What is a segment? Why do we need segments? Explain the complete process of **[9]**

    i) Segment Creation

    ii) Segment Renaming and

    iii) Segment Closing

  b) Define Illumination. Explain with diagram Phong illumination model and combined diffuse illumination models in detail. **[8]**

Q5) a) Write short note on Hilbert's and Koch Curve along its Topological and Fractal Dimensions. **[9]**

  b) What are the steps in desing in animation sequence? Describe about each step briefly. **[9]**

Q6) a) What is curve interpolation? As far as splines are concerned what do Bezier and B-splines curves idicates? **[9]**

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

    i) Design of animation sequence

    ii) Frame - by - frame Animation techniques

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]**

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]**

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[6179]-258

S.E. (Information Technology)
SOFTWARE ENGINEERING
(2019 Pattern) (Semester-IV) (214454)

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 diagams must be drawn wherever necessary.*
3) *Figures to the right side indicate marks.*
4) *Assume suitable data, if necessary.*

Q1) a) What is software architecture? Explain data centered and object oriented style **[9]**

    b) Explain the software quality guidelines and attributes of a software design **[9]**

<center>OR</center>

Q2) a) Explain the following fundamental software design concepts: **[9]**
      i) Abstraction
      ii) Architecture
      iii) Patterns

    b) How is interface analysis done? What parameters are considered? **[9]**

Q3) a) The project manager has obtained the following optimistic, pessimistic and most likely times in weeks related to the various activities of a power project. Draw a PERT network diagram and clearly mark the critical path, also what is the probability of power project to get completed in 32 weeks? **[9]**

Activity Sequence	Optimistic time	Most likely time	Pessimistic time
1-2	6	9	18
1-3	5	8	17
2-4	4	7	22
2-5	4	7	10
3-4	4	7	16
3-5	2	5	8
4-5	4	10	22

    b) Explain the typical problems with IT cost estimation **[8]**

<center>OR</center>

Q4) a) What is WBS? Explain how to create WBS along with its benefits **[9]**

b) What do you mean by project scope? What are the key aspects of project scope document? **[8]**

Q5) a) What is a defect? State defect management process **[9]**

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

   i) Black Box testing

   ii) Regression Testing

   iii) Beta Testing

<div align="center">OR</div>

Q6) a) Explain defect life cycle along with diagram also state the importance of defect reporting **[9]**

b) What is software testing? Enumerate seven principles of testing. **[9]**

Q7) a) Explain CASE taxonomy? **[9]**

b) What is risk? Explain risk management and risk responses **[8]**

<div align="center">OR</div>

Q8) a) What is Software Reuse? Explain benefits and Drawbacks of software reuse. **[9]**

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

   i) JIRA

   ii) KANBAN

<div align="center">● ● ●</div>

[6179]-259A

S.E. (Information Technology/A.I. & M.L. Engineering)
DISCRETE MATHEMATICS
(2019 Pattern) (Semester - III) (214441/218541)
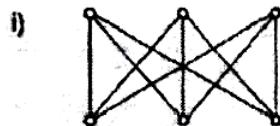
Time : 2½ Hours]

[Max. Marks : 70
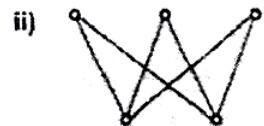
Instructions to the candidates :

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.*
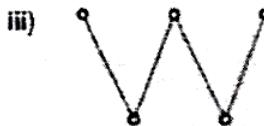
Q1) a) Draw the complement of the following graphs. **[6]**
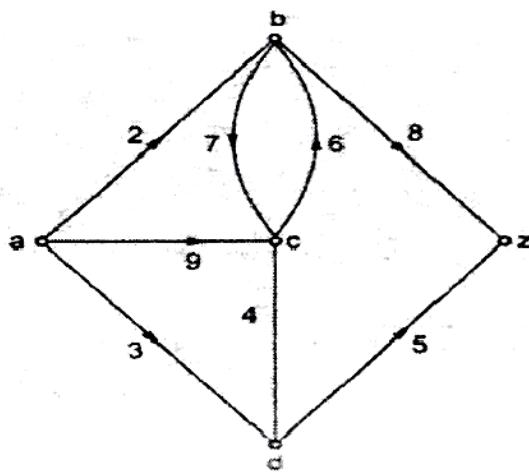
b) Using the labeling procedure, find the maximum flow in the following transport network. **[6]**
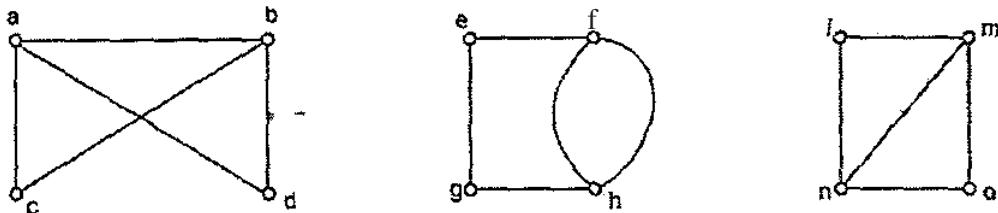
c) What is the Prefix Code? Which of the following codes are prefix codes? Justify your answer. **[6]**

i) a : 0 ,e : 1, t : 01, s : 001

ii) a : 101, e : 11, t : 001, s : 011, n : 010
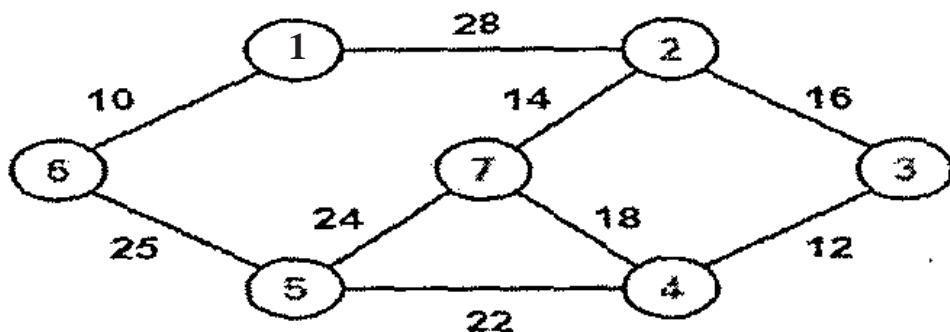
OR

Q2) a) Determine whether the following graphs are isomorphic to each other. Justify your answer. **[6]**

b) Find the minimum spanning tree and weight of it for the given graph using Prim's algorthm. **[6]**

c) Suppose that sumeone 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 functios 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]**

$a_n = 5n_{n-1} - 6a_{n-2}$ where $a_0 = 2$ and $a_1 = 5$.

c) Show that 7 colors are used to paint 50 bicycles, then at least 8 bicycles will be of the same color. **[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. Let A is set of factors of positive integer m and relation is divisibility on A. i.e. $R = \{(x, y)| x, y \in A, x \text{ divides } y\}$. **[6]**

For m = 45. Draw Hasse Diagram.

c) Given $f(x) = x^2 + 3$ and $g(x) = 3x - 2$. Find f(5), g(3), gof(x) and fog(x). **[5]**

Q5) a) Which of the following congruences is true? Justify your answer. **[6]**

i) $556 \equiv 1296 \pmod{10}$

ii) $1655 \equiv 935 \pmod{11}$

iii) $448 \equiv 784 \pmod{56}$

b) Compute GCD of the following numbers using Euclidean Algorithm. **[6]**

i) GCD (765, 150)

ii) GCD (343, 1554)

c) Using Chinese Remainder Theorem, find the value of P using following data. **[6]**

$P \equiv 2 \pmod 5$

$P \equiv 5 \pmod 7$

OR

Q6) a) Find multiplicative inverse of 15 mod 26 using Extended Euclidean Algorithm. **[6]**

b) Find the Euler's totient function of the following numbers. **[6]**

i) 37

ii) 35

iii) 15

c) What is a Mersenne prime number? Which of the following numbers is the Mersenne Prime number? 71, 31, 255, 8191, 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 = a–b

   iii) a*b = a.b (Multiplication)

   iv) a*b = power (a, b)

   v) a*b = 2(a + b)

   vi) a*b = min (1, a, b)

c) Consider the (2, 6) encoding function e. e(00) = 000000, **[5]**

   e(10) = 101010

   e(01) = 011110, e(11) = 111000

   Find the minimum distance of e.

OR

Q8) a) Show that (Z$_6$, +) is an Abelian Group. **[6]**

b) Explain Ring with an example. **[6]**

c) Prove that Hamming Distance d(x, y) = 0 iff x = y where x and y are codewords. **[5]**

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[6179]-260

S.E. (Information Technology Engg.)
LDCO : LOGIC DESIGN & COMPUTER ORGANIZATION
(2019 Pattern) (Semester - III) (214442)

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.*

Q1) a) Differentiate between Combinational circuit & Sequential circuits? **[6]**

b) Design flip flop conversion logic to convert J-K flip flop to T flip-flop?**[6]**

c) Design and draw MOD 96 Counter using IC 7490 & explain its operations?**[6]**

OR

Q2) a) Compare Asynchronous counters with Synchronous counters? **[6]**

b) Design flip flop conversion logic to convert S-R Flip Flop to a J-K Flip-Flop? **[6]**

c) Explain the working of 3-bit synchronous counter using J-K flip flop with suitable circuit diagram and state table? **[6]**

Q3) a) Describe with neat diagram Von Neumann Architecture of computer? **[6]**

b) Write a note on multiple bus hierarchies? **[5]**

c) Explain how system bus organization is used for communication between the major components of a computer with neat diagram? **[6]**

OR

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Q4) a) Describe with neat diagram Harvard Architecture of computer? **[6]**

b) Which are the types of ALU? Explain the operations of ALU by using various control signal? **[5]**

c) Explain the Control unit Implementation using Micro-programmed Implementation? **[6]**

Q5) a) Describe instructions with 0, 1, 2 or 3 addresses using suitable example.**[6]**

b) Differentiate between RISC & CISC Architecture. **[6]**

c) Define and explain with suitable diagram and example Instruction Pipelining Architecture of processor. **[6]**

OR

Q6) a) Describe cluster computer architecture with neat diagram. **[6]**

b) What is SMP? Draw suitable diagram of SMP & explain briefly. **[6]**

c) Explain interrupt handling process using IVT and ISR. **[6]**

Q7) a) Write short note on : **[8]**

i) EPROM

ii) EEPROM

b) What is cache coherency problem? Explain four different approaches to prevent cache coherence problem. **[9]**

OR

Q8) a) Explain cache memory operation using multilevel cache organization.**[8]**

b) Explain with neat diagram Signals used to Connect Memory to Processor.**[9]**

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[6179]-261

S.E. (Information Technology Engg.)
DATA STRUCTURES & ALGORITHMS
(2019 Pattern) (Semester - III) (214443)

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.*

Q1) a) Explain stack data structure as an ADT and Discuss briefly applications of stack. **[6]**

b) Write sudo code for insert and delete operations of linear queue. **[5]**

c) Discuss the types of priority queue with their applications. **[5]**

<div align="center">OR</div>
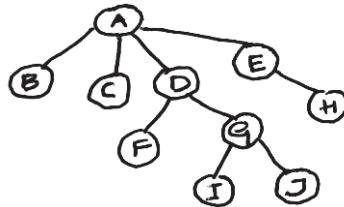
Q2) a) Convert the following infix expressions to postfix using stack. Clearly indicate the contents of stack. **[6]**

   i) $(A+B)*C-D*F+C$

   ii) $(A-5)*(B+C-D*E)/F$

b) Write sudo code for insert & delete operations of circular queue. **[8]**

c) Enlist applications of Queue data structures. **[2]**

Q3) a) Explain importance of threaded binary tree and Discuss inorder threaded binary tree with example. **[6]**

b) Write sudo code for deleting a node in BST considering all scenarios.**[8]**

c) Discuss with the help of example, the significance of height of tree and depth of a tree. **[4]**

<div align="center">OR</div>
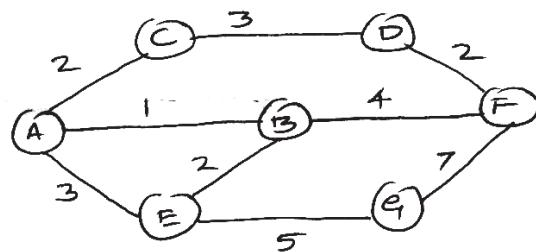
Q4) a) Enlist the difference between a general tree & binary tree. Convert the given general tree to binary tree and write down the steps required for the same. **[8]**

b) Write sudo code for creating a BST of N-nodes. **[6]**

c) Explain with the help of example, threaded binary tree traversals. **[4]**
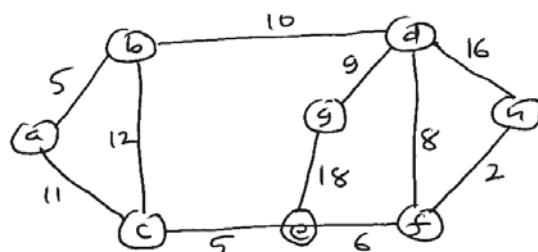
Q5) a) For the given graph show step-wise representation of MST using Kruskal's algorithm. **[6]**

b) Construct an AVL search tree by inserting the following elements in the order of their occurence. Show the balance factor and type of rotation at each stage. **[8]**

c) Enlist and discuss applications of Heap. **[4]**

OR

Q6) a) Find the MST using Prin's algorithm for the following graph. Also write algorithm for the same. **[8]**

b) Which data structures supports to perform sorting using heap data structure. Explain it to sort it in ascending order. 1, 12, 9, 5, 6, 10. **[8]**

c) What is the time-complexity of Prin's algorithm & Kruskal's algorithm.**[2]**

Q7) a) Explain why file opening nodes are important while opening any file. Explain the use of following file-opening nodes. **[8]**

      i)   ios : : app

      ii)   ios : : ate

      iii)   ios : : in

  b) For a given set of values : **[10]**

9, 45, 13, 59, 12, 75, 88, 11, 105, 46

Create a hash table and resolve collison using chaining and without replacement.

<div align="center">OR</div>

Q8) a) Write sudo code to perform following operations on sequential file: **[8]**

      i)   Create and display

      ii)   Insert a record

  b) What is hashing? Explain various hash collision resolution techniques.**[8]**

  c) What is the time complexity of a deleting a record from indexed sequential file. **[2]**

<div align="center">✈ ✈ ✈</div>

[6179]-262

S.E. (Information Technology)
OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - III) (214444)

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 constructor? Explain the Default constructor with an example. **[6]**

b) Create a Bookshop inventory class. Use appropriate constructors for Bookshop Management. **[6]**

c) Can we overload the constructor? Explain with Example. **[6]**

OR

Q2) a) Explain the Parameterized constructor and Copy constructor with an example. **[6]**

b) What is garbage collection? Explain the finalize () method in detail. **[6]**

c) What is a destructor? Differentiate between Constructor and Destructor. **[6]**

Q3) a) What is inheritance? Explain different types of Inheritance. **[6]**

b) What is an interface in Java? What is the difference between interface and abstract class? **[5]**

c) What is polymorphism? What are the different types of polymorphism? Explain with an example. **[6]**

OR

Q4) a) Design and develop inheritance for a given case study, identify objects and relationships and implement inheritance wherever applicable, Employee class has Emp_name, Emp_id, Address, Mail_id and Mobile_noas members. Inherit the classes: Programmer, Team Lead, Assistant Project Manager and Project Manager from the employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, and 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary. **[9]**

b) Explain the concept of Method Overloading and method overriding with examples. **[8]**

Q5) a) What is the Exception exception-handling mechanism in Java? Write a java program to handle the Divide by zero exception. **[8]**

b) Explain user-defined exception with an example. **[5]**

c) Explain Collection classes in detail. **[5]**

OR

Q6) a) What is a generic method? Explain with a suitable example. **[6]**

b) Explain the use of finally in exception handling with an example. **[4]**

c) Write a program Java to handle Array Index Out of Bounds Exception and Null Pointer Exception with the program. **[8]**

Q7) a) Define the term Stream. Explain various stream classes. **[8]**

b) Design a Java program for employee management with following operations - **[9]**

i) Create file

ii) Write data into file

iii) Read data from file. Consider Name, employee id and department as attributes of employee.

OR

Q8) a) Which are different types of Design patterns? **[6]**

b) Explain the Iterator Pattern and its advantages in detail. **[6]**

c) Explain the Adapter pattern and its advantages in detail. **[5]**

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[6179]-262   2

[6179]-263

S.E. (Information Technology)
BASICS OF COMPUTER NETWORKS
(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 indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain the various controlled access methods. **[6]**

     b) Draw & Explain each Field of MAC frame format of IEEE 802.3 **[6]**

     c) Compare TDMA & CDMA with neat Diagram. **[6]**

OR

Q2) a) Explain the following physical layer implementations in standard Ethernet: **[6]**

        i) 10 Base 5

        ii) 10 Base T

        iii) 10 Base F

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

        i) IEEE 802.4 (Token Bus)

        ii) IEEE 802.5 (Token Ring)

     c) Discuss CSMA/CA & CSMA/CD. Also comment on the efficiency of each. **[6]**

Q3) a) Explain network layer services with example. **[6]**

     b) Calculate the following for a network address 192.168, 1.0/27 **[6]**

        i) Number of valid subnets

        ii) Number of actual hosts per subnet

        iii) Network and broadcast address for each subnet

     c) Compare between IPv4 and IPv6. **[5]**

OR

Q4) a) For class C IP address 8 bits is used for subnet. Each subnet has atleast 60 nodes, so calculate subnet mask. **[6]**

b) Explain the Concept of Subnetting and Supernetting. **[6]**

c) Explain NAT & CIDR with neat Diagram. **[5]**

Q5) a) Explain Bellman-Ford Algorithm with help of example. Also write advantages & Disadvantages of Bellman-Ford Algorithm. **[6]**

b) Compare and contrast the advertisement used by RIP and OSPF routing protocols. **[6]**

c) Explain Message format of RIPVI & RIPV2. **[6]**

OR

Q6) a) Discuss the advantages and disadvantages of OSPF and BGP routing algorithms. **[6]**

b) Explain Optimally Principle with help of example. **[6]**

c) Compare Non Adaptive & Adaptive Routing. **[6]**

Q7) a) Explain how to achieve reliability at transport layer. **[6]**

b) Explain the leaky bucket and token bucket algorithm in detail. **[6]**

c) Explain Three Way Handshake algorithm for TCP connection establishment. **[5]**

OR

Q8) a) What is a socket? Explain the various socket primitives and types of socket with Example. **[6]**

b) Discuss flow control and congestion control mechanisms in TCP. **[6]**

c) Compare: TCP & UDP. **[5]**

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[6179]-264

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)   *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 required.*

   3)   *Neat diagrams must be drawn wherever necessary.*

   4)   *Figures to the right indicate full marks.*

Q1) a) Discuss with the help of example Deadlock prevention strategies. **[8]**

    b) What is semaphore and Mutex? Explain with the help of pseudocode, how semaphore is used to solve Producer Consumer Problem. **[9]**

<div align="center">OR</div>

Q2) a) What is the reader-writer's problem? Explain the solution for reader's -writers problem with writers having priority. **[8]**

    b) What is Bankers Safe sequence algorithm? Apply it for finding safe sequence of execution of 5 processes in a system having Snapshot at time T0: **[9]**

	Allocation			Max			Availabe		
	A	B	C	A	B	C	A	B	C
P0	1	1	0	6	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	3	2	2			
P4	0	0	2	4	3	3			

Also determine whether following request for Process P4 "Request$_4$: - 3 1 0" can be granted or not.

Q3) a) Explain the role of Translation Lookaside Buffer (TLB) in virtual memory Implementation and explain it with a neat diagram. **[9]**

b) Consider the following segment table: **[9]**

Segment	Base	Length
0	1900	350
1	5750	1050
2	310	925
3	2400	450
4	4800	655

What are the physical addresses for the following logical addresses?

i) 0, 330

ii) 2, 525

iii) 4, 700

iv) 3, 400

v) 1, 1110

vi) 2, 950

OR

Q4) a) Given memory partitions of 150k, 650k, 280k, 390k and 540k(in order) how would each of the First fit, Best fit, and Worst fit algorithms place processes of 212k, 457k, 112k, 510k and 326k(in order)? **[9]**

b) Explain with the help of a neat diagram, Hierarchical and Inverted page table structure. **[9]**

Q5) a) Explain with help of neat diagram any 3 different file access methods.**[9]**

b) Explain with help of neat diagrams different I/O buffering techniques.**[9]**

OR

Q6) a) A disk drive has 200 tracks, numbered 0-199. The drive is currently serving the requests at track no 100. The queue of pending requests in FIFO order is 37, 128, 118, 196, 127, 31, 20, 64, 120. Starting from the current head position what is the total distance that disk arm moves to satisfy all the pending request for the following disk scheduling algorithms. Assume that the head is moving in the decreasing order of track number for SCAN and C-LOOk. **[9]**

i) SCAN

ii) C-LOOK

iii) SSTF

b) Describe different methods of record blocking with the help of a neat diagram. **[9]**

Q7) a) Write an algorithm for Pass-I of two pass Assembler. **[6]**

b) What are assembler directives? Explain with an example. **[6]**

c) Explain any two phases of the compiler with a suitable diagram. **[5]**

<div align="center">OR</div>

Q8) a) Explain with example imperative statement, and declarative statement of assembly language programming? **[6]**

b) Draw a general model of compiler and explain all phases in brief. **[6]**

c) Discuss with example what is forward reference problem. **[5]**

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[6179]-265

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 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 indicate full marks.*
4) *Assume Suitable data if necessary.*

Q1) a) Explain the architecture of knowledge based agent with suitable diagram. **[6]**

b) Explain the various levels of knowledge based agent. **[6]**

c) What are the different operations performed by KBA? State and explain approaches of designing knowledge based agent. **[6]**

OR

Q2) a) What is meant by knowledge representation? Explain any four types of knowledge. **[6]**

b) Explain any two approaches of knowledge representation with suitable example. **[6]**

c) State different types of Reasoning in AI. Explain any two of them with suitable example. **[6]**

Q3) a) What is machine learning? Why machine learning is important? **[9]**

b) Explain ML life cycle in details. **[8]**

OR

Q4) a) Write difference in between Training versus Testing data. **[8]**

b) Enlist all the machine learning application and explain any 2 in details. **[9]**

P.T.O.

Q5) a) Compare Supervised and Unsupervised learning with example. **[6]**

b) Explain Feature selection and feature extraction. **[6]**

c) What is dimensionality reduction? Why it is needed? **[6]**

OR

Q6) a) What is Unsupervised Learning? Explain types of Unsupervised Learning algorithm with Example. **[6]**

b) Explain different types of feature selection technique. **[6]**

c) Define dimensionality reduction. Explain its advantages and disadvantages? **[6]**

Q7) a) What is confusion matrix? Define the terms True Positive (TP), False Positive (FP), True Negative (TN), False Negative (FN). **[7]**

Consider the following two lass confusion matrix. Calculate Precision, Recall, Accuracy and F1-score.

		Actual Values	
		+ve	-ve
Predicted	+ve	9	2
Values	-ve	1	8

b) Define and explain Sum of Squared Error (SSE), Mean Squared Error (MSE) and Mean Absolute Error (MAE) w.r.t. regression. **[6]**

c) Write a short note on VC dimensions. **[4]**

OR

Q8) a) What is multiclass classification? Explain One-Vs-Rest and One-vs-One multiclass classifier construction method with suitable example. **[7]**

b) Explain under fit, over fit and just fit models for Regression. **[6]**

c) Define the following terms. **[4]**

i) Accuracy

ii) Precision

iii) Recall

iv) F1 - score

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[6179]-266

S.E. (Artificial Intelligence & Machine Learning)
DATABASE MANAGEMENT SYSTEM
(2019 Pattern) (Semester - IV) (218554)

Time : 2½ Hours]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right side indicate full marks.*
3) *Assume Suitable data if necessary.*

Q1) a) Consider the following schema for a company database   **[8]**
Employee (Name, SSN, Address, Sex, Salary, Dno)
Department (Dname, Dnumber, MGRSSN, MGRSTART Date)
Dept-Locations (Dnumber, Dlocations)
Project (Pname, Pnumber, Plocations, Dnum)
Works-On (ESSN, PNo, Hours)
Dependent (ESSN, Dependent-name, Sex, Bdate, Relationship)
Give the queries in SQL:
   i) Retrieve the names and address of employees who work for "Research" Department.
   ii) List all the project names on which employee "Smith" is working.
   iii) Retrieve all employees in Dept. 5 whose salary is between 30,000 and 40,000.
   iv) Retrieve the name of each employee who works on all the projects controlled by department number 5.

b) Compare stored procedure and functions from PL-SQL.   **[5]**

c) What is the significance of views in SQL? Give SQL statement to update data.   **[5]**

OR

Q2) a) Use the schema and answer the queries in SQL.   **[8]**
SAILORS(Sid, Sname, rating, age)
BOATS(bid, bname, color)
RESERVES (sid, bid, day)
   i) Find names of sailors who reserved green boat
   ii) Find the colors of boats reserved by "Ramesh"
   iii) Find names of sailors who have reserved a red or a green boat.
   iv) Find the names of the sailors who have reserved a red boat

b) What is trigger? How it works? Explain with the help of example.   **[5]**

c) Explain with an example aggregate functions and grouping used with SQL.   **[5]**

Q3) a) Define BCNF. How does it differ from 3NF? What is it considered a stronger from of 3NF? Explain with appropriate example. **[8]**

b) What do you mean by equivalent minimal set of functional dependencies? Explain with example. **[5]**

c) What do you mean by **[4]**
   i) Insertion Anomaly
   ii) Deletion Anomaly

OR

Q4) a) Which are various measures of query cost? Explain with example. **[8]**

b) What is the dependency preservation property for decomposition? Why is it important? **[5]**

c) Explain each of the following with example. **[4]**
   i) 1NF
   ii) 2NF

Q5) a) What is schedule? What are the various ways for Serializability checks? **[6]**

b) What is deadlock? Explain how deadlock detection and prevention is done. **[6]**

c) When schedule can be called as recoverable schedule? Explain with example. **[6]**

OR

Q6) a) What is concept of Transaction? Which properties transaction must ensure? Explain each property. **[6]**

b) Compare two protocols used for concurrency control. **[6]**

c) Write short note on : Shadow paging. **[6]**

Q7) a) Explain architecture of parallel databases. **[6]**

b) How atomicity is ensured in distributed databases? Explain protocol used for it. **[6]**

c) Write short note on NoSQL databases. **[5]**

OR

Q8) a) What are various data distribution strategies in distributed databases? **[6]**

b) Explain 2 tier and 3 tier architecture of databases with suitable diagram. **[6]**

c) Write short note on XML databases. **[5]**

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[6179]-267

S.E. (AIML)
COMPUTER GRAPHICS
(2019 Pattern) (Semester-IV) (218555)

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)   What is projection? Explain with diagram, perspective projection with vanishing points as 1 point, 2 point and 3 point.   **[9]**

   b)   Let ABCD be the rectangle window with A (-20,-20) B (40,-20), C (40,30) and D (-20,30) Find the region code for endpoints and use cohen sutherland algorithm to clip the lines P1-P2 with P1 (-30,20) and P2 (60,-10). and Q1-Q2 with Q1 (-10,-30) and Q2 (20,60). Show graphic representation of Original and Clipped line.   **[9]**

OR

Q2) a)   Explain the concept of window, viewport, and viewing transformation. Find the normalization transformation window to viewport, with window, lower left corner at (3,3) and upper right cornet at (6,8) onto a viewport, for entire normalized device screen.   **[9]**

   b)   Let ABCD be the rectangle window with A (150, 150), B (150,200), C (200, 200) and D (200,150). Use Cohen Hodgeman polygon clipping algorithm to clip the convex polygon PQR with P (110, 180), Q (240,160), R (170, 110) and find the final coordinates of the clipped polygon.   **[9]**

Q3) a)   What is a segment? Why do we need segments? Explain the complete process of   **[9]**
   i)   Segment creation.
   ii)   Segment Deletion and
   iii)   Segment closing.

b) Explain in detail with diagram. **[8]**
   i) Ambient light,
   ii) Diffuse light, and
   iii) Specular reflection.

OR

Q4) a) Explain in detail with diagram **[9]**
   i) HSV color model.
   ii) YCbCr color model
   iii) CIE Chromaticity Diagram.

b) Define shading. Explain with help of diagrams phong shading algorithm in detail. **[8]**

Q5) a) What is curve interpolation? As far as splines are concerned what do Bezier and B-splines curve indicate? **[9]**

b) Explain in detail with diagram how midpoint, subdivision method can be used for Bezier-Curve Generation. **[9]**

OR

Q6) a) Write short note on : **[9]**
   i) Methods of controlling animation.
   ii) Various types of animation languages.

b) Why cubic Bezier curves are chosen? What are the properties of Bezier curve. Explain any Bezier Curve generation method. **[9]**

Q7) a) Explain the behavioral modeling in virtual reality. **[6]**
   b) What are sound displays in virtual reality? **[6]**
   c) What is navigation and manipulation interfaces in virtual reality system?**[5]**

OR

Q8) a) Explain the Graphics rendering pipeline. **[6]**
   b) Explain the applications of virtual reality systems. **[6]**
   c) Explain Kinematic modeling in Virtual reality. **[5]**

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[6179]-269

S.E. (AI&ML)

DATA STRUCTURES & ALGORITHMS

(2019 Pattern) (Semester - III) (218542)

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.*

Q1) a) Enlist applications of stack data structure & Define it as an ADT. **[6]**

b) Write sudo code for insert & delete operations of linear queue, if implemented using sequential organization. **[8]**

c) What is the time complexity of push and pop operations for worst cases.? **[4]**

OR
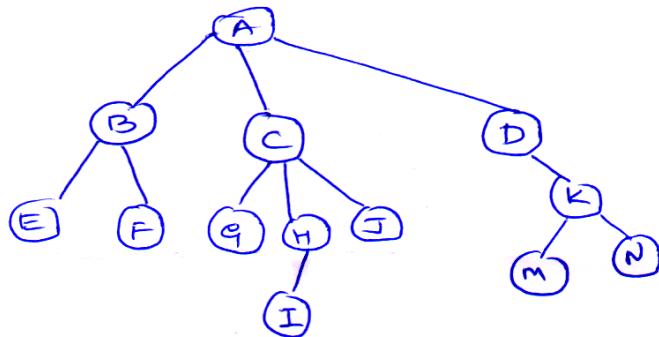
Q2) a) Convert the following infix expressions to prefix and clearly indicate the content of the stack. **[8]**

i) (A+B) ∗ C – D ∗ F$C

ii) A$2 ∗ (B + C/D∗E)$F

($ for power operation)

b) Write sudo code for underflow and overflow conditions for a circular queue implement with sequential organization, using rear and front only. **[8]**

c) Enlist applications of priority queue. **[2]**

Q3) a) Construct a binary tree using the following tree traversals. **[8]**

Pre order   ∗ + a – bc / – de – + fgh

Inorder   a + b – c ∗ d – e/f + g – h

b) Discuss the importance of inorder threaded binary tree with the help of example. **[8]**

c) Discuss the worst-case time complexity of deleting a node from binary seach tree. **[2]**

P.T.O.
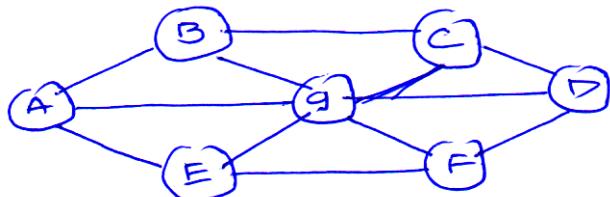
Q4) a) Contrast between general tree & binary tree convert the given general tree to binary tree. **[9]**

b) Discuss all the scenarios of deleting a node from BST with examples for each. **[9]**

Q5) a) Enlist applications of graphs and find BFS & DFS stepwise. **[8]**
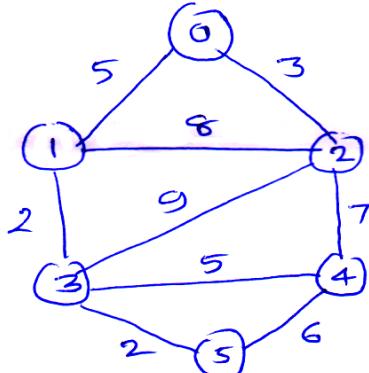
b) Construct an AVL for the following data, show balance factor of each node & type of rotation. **[9]**

58 69 73 18 12 35 24 45

OR

Q6) a) Write sudo code Kruskal's algorithm & find MST using the same for the following graph. **[9]**

b) Discuss the following data structures using examples. **[8]**

i) AVL trees

ii) Heap

Q7) a) Create hash table & solve collision using linear probing with replacement. Table size = 10 hash fn = key % 10

9 45 13 58 13 76 89 15 107 49 **[8]**

b) Write sudo code to perform following operations on index sequential file. **[9]**

i) create records

ii) delete record

iii) display records

<div align="center">OR</div>

Q8) a) Enlist various hashing functions used to create hash table. Discuss any three with examples. **[8]**

b) Contrast between logical & physical deletion of records and illustrate it with the help of example. **[9]**

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SEAT No. :

[**Total No. of Pages : 2**

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S.E. Artificial Intelligence & Machine Learning
COMPUTER NETWORKS
(2019 Pattern) (Semester-III) (218543)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Answer question 1 or 2, 3 or 4, 5 or 6 and 7 or 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 the working mechanism of.   **[9]**

     i)   Stop and Wait ARQ.

     ii)   Selective Repeat ARQ.

   b) What is CRC? Generate the CRC code of message 1101011101. Given generator Polynomial g(x) = $x^3 + x^2 + 1$.   **[9]**

OR

Q2) a) Discuss CSMA/CA random access technique. How collision avoidance is achieved in the same?   **[9]**

   b) What is hamming code? Also find Hamming Code word for following Data word 1001011 using even parity.   **[9]**

Q3) a) Discuss EIGRP protocol in detail.   **[9]**

   b) Explain Subnetting and Subnetting with example.   **[8]**

OR

Q4) a) Explain classful and classless addressing with suitable example.   **[9]**

   b) Discuss in detail fragmentation in terms of IPv4.   **[8]**

Q5) a) Discuss TCP services and TCP timers in detail. **[9]**

b) Explain implementation of Leaky bucket in detail with diagram. **[9]**

OR

Q6) a) Describe the process of connection establishment in TCP. **[9]**

b) Explain the mechanism of congestion control in detail. **[9]**

Q7) a) What is DNS server? Explain lookup methods used by the DNS to resolve the remote names. **[9]**

b) What is MIME? Explain the MIME header with suitable example. **[8]**

OR

Q8) a) Explain SMTP protocol and SNMP protocol. **[9]**

b) Explain FTP with suitable diagram. Which port does it use and for what purpose? **[8]**

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[6179]-271

S.E. (Artificial Intelligence & Machine Learning)
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 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 garbage collection mechanism and why it is important for memory management? **[6]**

b) Explain the different types of constructors with an example. **[6]**

c) What is constructor overloading? Explain the use of constructor overloading with an example. **[6]**

OR

Q2) a) What is construct? Explain the use of constructer in object oriented programming. **[6]**

b) Explain the different characteristics of constructors. **[6]**

c) What is Destructors? Explain finalize function. **[6]**

Q3) a) Differentiate between compile-time and run-time polymorphism. **[5]**

b) What is inheritance? Explain the need of inheritance in object oriented programming. **[6]**

c) Explain the different types of inheritance with pictorial representation.**[6]**

OR

Q4) a) Explain the inheritance and how does it promote code reusability? **[5]**

b) Explain abstract classes and interfaces and how does it achieves data abstraction? Develop a program that utilizes polymorphism through method overriding. **[6]**

c) Provide a detailed analysis of how polymorphism echances the flexibility and maintainability of the code. **[6]**

P.T.O.

Q5) a) Explain the difference between checked and unchecked exception. **[6]**

b) Explain the role of try and catch block in exception handling with suitable example. **[6]**

c) What are generics? Explain the important of generics in programming. **[6]**

OR

Q6) a) What is Exception? Explain the different types of exceptions. **[6]**

b) What is collection classes? Explain Arraylist class and LinkedList class with example. **[6]**

c) Explain the collection interface and its types with example. **[6]**

Q7) a) Explain the purpose of the File class. How does it facilitate file management and operations? **[6]**

b) Use byte stream classes to read and write the contents in the File. **[6]**

c) What is the Singleton design pattern and when would you typically use it in a software application? **[5]**

OR

Q8) a) Explain the difference between input stream class and output stream class **[6]**

b) What is Random access files? Explain the use of random access files to read and write the content in the File. **[6]**

c) What is the Adapter design pattern and when would you typically use it in a software application? **[5]**

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[6179]-272
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 Ql 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 marks.*

 4) *Assume suitable data, if necessary.*

Q1) a) Explain the term Coupling in the context of software design. Also explain the different types of coupling. **[9]**

  b) Explain any three design concepts. **[9]**

<div align="center">OR</div>

Q2) a) Write short note on : (Any three) **[9]**

   i) Data flow architecture style

   ii) Object oriented architecture

   iii) Layered system architecture

   iv) Data-centred architecture

  b) Write and Explain the Interface design steps with diagrammatical representation. **[9]**

Q3) a) Explain with suitable diagram the project management life cycle. **[9]**

  b) Write short note on : **[8]**

   i) W^5HH Principle

   ii) 4 Ps of Project management

<div align="center">OR</div>

Q4) a) List the different project estimation techniques. Explain with example how size oriented metrics are used for project estimation. **[9]**

b) Write short note on : **[8]**
   i) Work Breakdown Structure (WBS).
   ii) Program Evaluation Review Technique (PERT).

Q5) a) Explain the need of quality management? Discuss eight Quality Dimensions. **[9]**

b) What is defect? Describe steps in defect management process. **[9]**

OR

Q6) a) Write short note on : **[9]**
   i) Unit Testing
   ii) Integration testing
   iii) Regression testing

b) What is objective of Testing? Differentiate between testing & debugging. **[9]**

Q7) a) Explain Test driven development (TDD) in detail. **[9]**

b) What is the need of SCM repository? List and explain the SCM repository features. **[8]**

OR

Q8) a) What are the tasks carried out in SCM Process? **[9]**

b) Write short note on : **[8]**
   i) CASE Tools
   ii) Technology evolution

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S.Y. B.Tech. (Biotechnology Engineering)
BIOCHEMISTRY - II
(2019 Pattern) (Semester - IV) (215470)

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.*

Q1) Answer the following :   **[18]**

a) Differentiate between the preparatory and the payoff phase of glycolysis.

b) Name the enzyme which caalzes following reactions in glycolysis

MOLECULE

NAME   ENZYME

glucose

↓ ⊣

glucose-6-phosphate

↓

fructose-6-phosphate

↓

fruclose 1, 6-bisphosphate

↓   ↓

DHAP ⇌ G3P

↓
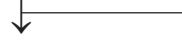
1, 3-bisphosphoglycerate

↓

3-phoshoglycerate

↓

2-phosphoglycerate

↓

phosphoenolpyruvate

↓

Pyruvate

P.T.O.

OR

Q2) Answer the following : **[18]**

a) Gluconeogenesis is energetically expensive, but essential-Explain it.

b) Draw a figure depicting general scheme of the pentose phosphate pathway.

Q3) Write in detail about : **[17]**

a) What is Glycogenin? Explain its role in the glycogen synthesis.

b) Explain about the discovery of TCA cycle in briefly. What is the intracellular location of the enzymes involved in the TCA cycle?

OR

Q4) Answer the following : **[17]**

a) Draw a neat labeled diagram of Cori cycle.

b) Glycogen breakdown is catalyzed by glycogen phosphorylase.

Q5) Answer the following : **[18]**

a) What do you mean by Chromatography? What are different types of Chromatographic techniques? Explain any one.

b) What is ammonia toxicity? Why does it occur? What are its consequences?

OR

Q6) Answer the following : **[18]**

a) Depict a diagram to give an overview of amino acid catabolism in mammals.

b) What is the role of alanine in transport of ammonia from skeletal muscles to the liver

Q7) Answer the following : **[17]**

a) What are the three extra processes required for the complete oxidation of odd no fatty acids?

b) Write in detail about ketoacidosis.

OR

Q8) Answer the following :   **[17]**

    a)   Write the four basic steps about β-oxidation of saturated fatty acids.

    b)   Draw a neat diagram depicting mobilization of stored triacylglycerols due to hormones.

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S.E. (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.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*

Q1) a) How the G-protein coupled receptors (GPCR) function? Give its significance. **[7]**

b) What are the different types of signal transduction pathways in the human body? Give examples. **[10]**

OR

Q2) a) Explain the cell cycle and describe in detail the steps involved in a typical cell cycle. **[10]**

b) Write a detailed note on Apoptosis, its functions and significance. **[7]**

Q3) a) What are Embryonic stem cells? How are they important in regenerative medicine? **[9]**

b) Write short note on nervous tissue. **[9]**

OR

Q4) a) Explain - Blood as the connective tissue. **[9]**

b) What is cancer? What is teratoma? What are the causes of cancer and how does it develop by clonal selection? **[9]**

Q5) a) Explain the disaggregation of tissue with trypsinization and its significance. Draw a flow chart with detailed steps. **[7]**

b) How to establish a mammalian cell line, describe in detail and draw a flow chart starting from explant cluture. **[10]**

OR

P.T.O.

Q6) a) What is a viable cell count? How is it observed and calculated? State the significance in culture initiation. **[8]**

b) What are the different types of media used for animal cell culture explain with examples. **[9]**

Q7) a) Describe and explain the various methods used for gene transfer to plant cells. **[10]**

b) What is micropropagation? Give significance with respect to regeneration of endangered plants. **[8]**

OR

Q8) Write short notes on:

a) Protoplast culture in plant tissue culture. **[9]**

b) Callus culture, with help of a neat diagram describe the steps involved.**[9]**

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S.E. (Biotechnology)

THERMODYNAMICS

(2019 Pattern) (Semester - IV) (215472)

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 right indicate full marks.*

3) *Assume suitable data f necessary.*

Q1) a) What are heat engines? Describe its working and types of heat engines.**[6]**

b) Write note on heat engine PV diagram and write the equation for heat engine efficiency. **[6]**

c) Describe in detail about Carnot cycle/engine. **[6]**

OR

Q2) a) Discuss about heat pump along with its applications and neat sketch.**[6]**

b) Write the limitations in first law of thermodynamics and concept of entropy. **[6]**

c) A reversible heat engine receives 4000 KJ of heat from a constant temperature source at 650 K. if the surroundings temperature is 295 K, determine: **[6]**

i) The heat availability of heat engine

ii) Unavailable heat.

Given data: Q1=4000 KJ

T2=650K

T0= 295 K

Q3) a) What is chemical potential? Derive the expression that shows the fundamental relationship for changes in the free energy of a solution.**[9]**

b) Write in detail about ideal gas mixtures and discuss about the gases which obeys three laws. **[8]**

OR

Q4) a) What is ideal solution? Derive the equation for Raoult's law and discuss the properties and characteristics of ideal solution. **[9]**

b) Discuss in detail about phase Equilibria with neat sketch. **[8]**

P.T.O.

Q5) a) What is chemical equilibrium? Explain the various types of chemical equilibrium with examples. **[8]**

b) Explain about Duhem's theorem for reacting systems. **[10]**

OR

Q6) a) What is Gibbs free energy? Discuss its relationship with equilibrium constant and reaction quotient. **[10]**

b) Explain in detail about effect of temperature on equilibrium constant and write the applications of equilibrium constant. **[8]**

Q7) a) Enlist the feasibility of individual steps for overall chemical reactions and explain them in detail. **[8]**

b) Write note on energy yielding and energy requiring reactions in biosystems. **[9]**

OR

Q8) a) Write in detail about energy transformations in biological Systems with examples. **[8]**

b) Discuss the laws of thermodynamics in biosystems with examples and applications. **[9]**

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S.E. (Biotechnology)
GENETICS AND MOLECULAR BIOLOGY
(2019 Pattern) (Semester - IV) (215473)

Time : 3 Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 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 a calculator is allowed.*
5) *Assume suitable data jf necessary*

Q1) What is semiconservative replication? Explain phases in the replication of DNA. **[18]**

OR

Q2) Draw a neat diagram of the DNA Polymerase enzyme and explain its role in DNA replication Compare and contrast between DNA polymerases in prokaryotes and eukaryotes. **[18]**

Q3) a) How does RNA play a role in DNA replication? Describe with suitable diagrams. **[10]**

b) Draw structures of i) mRNA ii) rRNA iii) tRNA and explain their roles in the central dogma. **[7]**

OR

Q4) a) Differentiate between DNA and RNA as genetic material Why DNA is more stable than RNA Give reason. **[7]**

b) How RNA can function like enzymes, describe the concept with the help of a suitable example. **[10]**

Q5) Describe the process of post-transcriptional modifications of RNA with the help of the following points. **[18]**

a) Capping
b) Splicing
c) Polyadenylation

OR

Q6) What is the major difference between Transcription in prokaryotes and in eukaryotes? Explain the concept of the operon in prokaryotes and discuss the expression of genes with the help of a suitable example. **[18]**

Q7) Describe the process of initiation of translation in detail. Differentiate between translation initiation in prokaryotes and eukaryotes. **[17]**

OR

Q8) a) How elongation of protein sequence is carried out in a eukaryotic cell? Discuss the process of elongation during translation in detail. **[7]**

b) Describe the process of post-translational modifications in proteins.**[10]**

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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) *Q.1 is compulsory.*
2) *Answer Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) Attempt the following :

    a)   The Fourier transform $F(\lambda)$ of $f(x) = e^{-|x|}$ is   **[2]**

        i) $\dfrac{1}{1+\lambda^2}$ ii) $\dfrac{2}{1+\lambda^2}$

        iii) $\dfrac{-1}{1+\lambda^2}$ iv) $\dfrac{-2}{1+\lambda^2}$

    b)   The first four moment of a distribution about the value 5 are 2, 20, 40 and 50 then the value of central moment μ_4 is   **[2]**

        i)   50   ii)   157

        iii) 22.39   iv)   162

    c)   If $\phi = x^2 - y^2 - z^2$ then $\nabla\phi$ at point (1, 2, 3) is   **[2]**

        i) $2\hat{i} - 4\hat{j} - 6\hat{k}$ ii) $2\hat{i} - 4\hat{j} + 12\hat{k}$

        iii) $2\hat{i} + 4\hat{j} + 12\hat{k}$ iv) $\hat{i} + \hat{j}$

    d)   The most general solution of the partial differential equation $\dfrac{\partial^2 4}{\partial x^2} + \dfrac{\partial^2 4}{\partial y^2} = 0$ representing metal plate having length x and breadth $y \to \infty$ is   **[2]**

        i) $(c_1 \cos mx + c_2 \sin mx)(c_3 e^{my} + c_4 e^{-my})$

        ii) $(c_1 e^{mx} + c_2 e^{-mx})$

        iii) $(c_1 \cosh mx + c_2 \sinh mx)(c_3 \cos my + c_4 \sin my)$

        iv) $(c_1 e^{mx} + c_2 e^{-mx})$

e) Fourier sine transform of $\dfrac{1}{x}$ is [1]

    i) π

    ii) $\dfrac{\pi}{2}$

    iii) $\dfrac{\pi}{4}$

    iv) 2π

f) If p-probability of success, q-probability of failure & n-number of trials in Binomial distribution then standard deviation is [1]

    i) $(np)^2$

    ii) $\sqrt{np}$

    iii) $\sqrt{npq}$

    iv) $\sqrt{pq}$

Q2) a) Find the Fourier integral representation of the function, [5]

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

and hence evaluate $\displaystyle\int_0^\infty \dfrac{\sin\lambda\cos\lambda x}{\lambda}\, d\lambda$

b) Using Fourier integral representation show that [5]

$$\int_0^\infty \dfrac{\lambda\sin\lambda x}{\lambda^2 + m^2}\, d\lambda = \dfrac{\pi}{2} e^{-mx}, \quad m > 0,\ x > 0$$

c) Solve the following integral equation. [5]

$$\int_0^\infty f(x)\sin\lambda x\, dx = \begin{cases} 1, & 0 \le \lambda < 1 \\ 2, & 1 \le \lambda < 2 \\ 0, & \lambda \ge 2 \end{cases}$$

OR

Q3) a) Find the Fourier cosine integral representation for the function [5]

$$f(x) = \begin{cases} x^2, & 0 < x < a \\ 0, & x > a \end{cases}$$

b) Find the Fourier transform of [5]

$$f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$$

c) Solve the following integral equation [5]

$$\int_0^\infty f(x) \cos \lambda x \, dx = \begin{cases} 1 - \lambda, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases}$$

Q4) a) The first four moments of a distribution about value 4 are -1.5, 17, -30 and 108. Find moments about mean and coefficient of skewness. [5]

b) Find the coefficient of correlation for following data. [5]

x	10	14	18	22	26	30
y	18	12	24	6	30	36

c) Four coins are tossed simultaneously. What is probability of getting. [5]

  i) At least two heads.

  ii) At least one head.

<div align="center">OR</div>

Q5) a) The two variables x and y have regression lines $3x + 2y - 26 = 0$ and $6x + y - 31 = 0$. Find coefficient of correlation between x and y. [5]

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

c) Assuming that the diagram of 1000 brass plugs taken consecutively from a machine form a normal distribution with mean 0.7515 cm and standard deviation 0.0020 cm. How many of the plugs are likely to be approved if the acceptable diagram is 0.752 ± 0.004 cm. [5]
[Given A(1.75) = 0.4599, A(2.25) = 0.4878]

Q6) a) Find the Directional derivative of $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ in the direction tangent to the curve $x = \sin t$, $y = \cos t$, $z = t$, at $t = \dfrac{\pi}{4}$. [5]

b) Show that $\overline{F} = (y\sin z - \sin x)i + (x\sin z + 2yz)j + (xy\cos z + y^2)k$ is irrational and find scalar ϕ such that $\overline{F} = \nabla\phi$. [5]

c) Using Green's theorem evaluate $\oint_c (xy - x^2)dx + x^2 y \, dy$ along the closed curve c formed by $y = 0$, $x = 1$ & $y = x$. [5]

OR

Q7) a)   If $\phi = x^3 + y^3 + z^3 - 3xyz$ then find curl(gradϕ).   **[5]**

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

   i)   Show that $\nabla^4(r^2 \log r) = \dfrac{6}{r^2}$

   ii)   Prove that $\nabla \cdot \left(\dfrac{\bar{a} \times \bar{r}}{rn} \right) = 0$

c)   Use Stoke's theorem, evaluate $\oint\limits_c \sin z\,dx - \cos x\,dy + \sin y\,dz$ where c is

   the boundary of the rectangle $0 \le x \le \pi, \, 0 \le y \le 1$.   **[5]**

Q8) a)   Solve $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ subject to the conditions   **[8]**

   i) u is finite for all t
   ii) $u\,(0, t) = 0 \; \forall \; t$
   iii) $u\,(l, t) = 0 \; \forall \; t$
   iv) $u\,(x, 0) = u_0$ (constant) for $0 \le x \le l$, where l - is the length of bar.

b)   A string is stretched and fastened to two points L apart Motion is started

   by displaying the string in the form $u = a\sin\left(\dfrac{\pi x}{l}\right)$ from which it is

   released at time $t = 0$. Find the displacement $u(x, t)$ from one end.   **[7]**

OR

Q9) a)   An infinitely long uniform metal plate is enclosed between lines $y = 0$ and
   $y = L$ for $x > 0$. The temperature is zero along the edges $y = 0, \, y = L$ at
   infinity. If the edge $x = 0$ is kept at a const. temperature u_0, find the
   temperature distribution $u(x, y)$.   **[8]**

b)   Solve one dimensional heat flow equation $\dfrac{\partial u}{\partial t} = k \dfrac{\partial^2 u}{\partial x^2}$ subject to the

   condition   **[7]**

   i) $u\,(0, t) = 0$
   ii) $u\,(l, t) = 0$ for all t

   iii) $u(x, 0) = \dfrac{u_0 x}{l}; \; 0 \le x < l, \, u_0$ is constant

   iv) $u\,(n, t)$ is bounded

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S.Y. B.Tech. (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, Q7or Q8.*
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) Answer the following :   **[18]**

a) Draw a general structure of amino acid and sate the common structural features shared by amino acids.

b) Enlist the amino acids which comes under nonpolar, aliphatic R groups.

<div align="center">OR</div>

Q2) Answer the following :   **[18]**

a) Amino acids can act as acids and bases-justify.

b) State the Lambert-Beer Law and give the significance of same.

Q3) Answer the following :   **[17]**

a) Enlist and describe the three characteristic components of nucleotides

b) Complete the following table for nomenclature of nucleotide and nucleic acid

Base	Nucleoside	Nucleotide	Nucleic acid
Purines			
Adenine	Adenosine	_____	_____
	Deoxyadenosine	_____	_____
Guanine	Guanosine	_____	_____
	Deoxyguanosine	_____	_____

<div align="center">OR</div>

Q4) Answer the following : **[17]**

a) What are the Features of Watson-Crick Pairing.

b) Differentiate between DNA and RNA.

Q5) Answer the following : **[18]**

a) Differentiate between phospholipids and glycolipids.

b) Describe in detail about lipid bilayer membrane.

OR

Q6) Answer the following : **[18]**

a) Complete the following table

Carbon skeleton	Structure	Systematic name	Common name
12:0	$CH_3(CH_2)_{10}COOH$	n-Dodecanoic acid	---------
---------	$CH_3(CH_2)_{12}COOH$	---------	Myristic acid
---------	$CH_3(CH_2)_{16}COOH$	n-Octadecanoic acid	---------

b) Triacylglycerols provide stored energy and insulation - Explain

Q7) Answer the following : **[17]**

a) Enlist fat soluble vitamins? Describe the source, functions, and deficiency of any one.

b) Explain the function and deficiency of Na.

OR

Q8) Answer the following : **[17]**

a) What are clinical manifestations of Calcium deficiency.

b) What role do minerals play? Explain the deficiency occur due to any one mineral.

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S.E. Biotechnology
FLUID FLOW AND UNIT OPERATIONS
(2019 Pattern) (Semester-III) (215462)

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 right indicate full marks.*
3) *Assume suitable data, if necessary.*

Q1) a)   Determine the rate at which an air bubble of 0.5 mm diameter will rise in liquid having density 1400 kg/m³ and dynamic viscosity 0.5 kg/ms. Assume that the rise of the bubble is within stoke's range. Neglate density of air and justify the assumption of stoke's range.   **[6]**

b)   Write note on Drag & Lift Force and Free & Hindered settling.   **[6]**

c)   Explain Stoke's law and derive expression for drag force on sphere. **[6]**

OR

Q2) a)   What is gravity sedimentation process? Write about sorting classifiers that uses sink and float method and differential settling method.   **[6]**

b)   What are lift and drag forces related to dynamics of suspended particles? Write the mathematical expression for lift and drag force.   **[6]**

c)   What is centrifugal settling process? Explain in detail about cyclones and hydrocyclones.   **[6]**

Q3) a)   Flow of fluid through solids considered in filtration, explain about filtration and Derive the Darcy's equation for flow of fluid through uniform & constant depth porous bed.   **[9]**

b)   Describe the concept of Computational Fluid Dynamics (CFD) with examples.   **[8]**

OR

P.T.O.

Q4) a) Derive Ergun equation that expresses the friction factor in packed bed column in detail. **[9]**

b) What is fluidization? Explain the applications, advantages and disadvantages of fluidization. **[8]**

Q5) a) Explain about Calculation of power requirement for agitation and obtain its equation. **[8]**

b) What is mixing? Explain the different flow patterns in mixing. **[10]**

OR

Q6) a) Explain the types of centrifugal pumps for fluid flowing with neat sketch. **[10]**

b) Describe the concept of Net Positive Suction Head (NPSH) in detail.**[8]**

Q7) a) Calculate the operating speed of a ball mill from the following data Diameter of the ball mill = 800 mm. Diameter of ball = 60 mm if. **[8]**
 i) Operating speed is 55% less than critical speed.
 ii) Critical speed in 40% more than operating speed.

b) Explain the differences of the following: **[9]**
 i) Open circuit grinding and Closed circuit grinding.
 ii) Ideal screen and Actual screen.

OR

Q8) a) Explain the working, construction, specifications invovled and uses of Jaw crusher and Gyratory crusher with neat sketch. **[8]**

b) Derive an expression for calculating screen effectiveness. **[9]**

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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, 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 are types of condensation? And which is desirable?   **[9]**

     b)   Explain in detail concept of maximum heat flux and critical temperature drop.   **[9]**

OR

Q2) a)   What is Newton's law of cooling? Where it can be used? Why Fourier's law can't be applied in case of convection?   **[9]**

     b)   What are different applications of dimensional analysis?   **[9]**

Q3) a)   Write a short note on 'Thermal Boundary layer and its significance. **[9]**

     b)   Write short notes on :   **[8]**

         i)   Kirchoff's Law

         ii)   Application of heat transfer in Biotechnology

OR

Q4) a)   Give the physical significance of the following.   **[8]**

         i)   Reynolds Number

         ii)   Prandtl Number

         iii) Nusselt Number

         iv)   Stanton Number

     b)   What is Reynold's anlogy and j-factor analogy? Give importance of these transfer analogies and their application.   **[9]**

P.T.O.

Q5) a) Draw a neat sketch and write a detailed note on plate and frame heat exchangers giving 1-2 applications. **[6]**

b) What is NTU effectiveness method? What are different factors considered in NTU effectiveness method? How is it different from LMTD approach?

[12]

OR

Q6) a) Draw and explain Tube in tube type of heat exchangers. Which flow is considered to be effective? **[9]**

b) What is fouling? Why is it necessary to consider a correction factor like fouling while designing heat exchangers? Give expression for unclean surfaces using fouling factor. **[9]**

Q7) a) What is boiling point Elevation or Boiling point rise (BPR)? Why is it necessary to consider BPE during evaporation operation? Is this BPR significant in drying operation and why? **[9]**

b) Write short notes on : **[8]**

i) Calendria Evaporator

ii) Rising Film evaporator

OR

Q8) a) Draw and explain feed forward and feed backward evaporator? Are these types applicable in single effect or multiple effect evaporator? **[9]**

b) What is the difference between evaporation and drying? Explain the significant changes giving 1-2 examples. **[8]**

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S.E. B.TECH (BioTechnology)
MICROBIOLOGY
(2019 Course) (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 and explain the phases. **[9]**

b) Write principle and applications of Standard Plate Count method. **[9]**

OR

Q2) a) Give different biomass determination methods with its applications. **[9]**

b) Write short note on batch,continuous and synchronous cultures. **[9]**

Q3) a) Enlist different methods of control of microorganisms. **[9]**

b) Define - **[8]**

   i) Sterilization

   ii) Disinfection

   iii) Antibiotics and

   iv) MIC

OR

Q4) a) Explain the principle of dry and moist heat sterilization methods with applications. **[9]**

b) Tabulate chemical agents of disinfection with its mode of action and examples. **[8]**

Q5) a) Describe with examples role of microorganisms in food. **[8]**

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

   i) Symbiosis

   ii) Commensalisms

   iii) Antagonism.

OR

P.T.O.

Q6) a) Explain different types of microbial interactions in environment with examples. **[10]**

b) Describe the concept of Potability of water. **[8]**

Q7) a) Give two examples of human disease caused by bacteria with its symptoms and causative pathogens. **[8]**

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

i) Candidiasis and

ii) Rabies

OR

Q8) a) Describe Influenza with its etiological agent, symptoms,tratments and preventive measures. **[8]**

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

i) Typhoid and

ii) Cholera

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S.E. (Chemical Engineering)

INDUSTRIAL CHEMISTRY - II

(2019 Pattern) (Semester - IV) (209347)

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.***

Q1) a)　Explain Titration curve for 0.5 N HCL and 0.5 N NaOH. Which indicator can be used for this titration? **[6]**

　　b)　What is meant by Precipitation Titration? Explain Mohr's method for determination of CI-ions. **[6]**

　　c)　Calculate Molarity and Normality of solution containing 0.5 gm NaOH dissolved in 500 ml solution. **[6]**

OR

Q2) a)　Explain Fajans method for Precipitation Titration in details. **[6]**

　　b)　How is the pH of titration mixture calculated at various stages during strong acid-weak base titration. **[6]**

　　c)　Calculate the weight of KMnO4 required to make 500 ml of 0.1 N KMnO4 solution, for titration in acidic medium. **[6]**

Q3) a)　What is an adsorption isotherm? Explain the Freundlich isotherm. **[6]**

　　b)　Explain "adsorption theory" of catalysis. **[6]**

　　c)　Give Wacker process of metal co-ordination compound catalysed reaction. **[5]**

OR

Q4) a)　What is an adsorption isotherm? Explain the Langmuir isotherm. **[6]**

　　b)　What is activation energy? What is the role of catalyst with respect to activation energy of a reaction? **[6]**

　　c)　Give mechanism of Photolysis of water. **[5]**

Q5) a) Discuss various conformation of butane with their stability. **[6]**

b) Show with the help of potential energy diagram staggered conformations more favoured over eclipsed conformation of propane. **[6]**

c) Explain the terms : **[6]**

i) Enantiomer

ii) Diastereomer

iii) Racemisation

OR

Q6) a) Explain geometrical isomerism with an example. **[6]**

b) Explain optical isomerism with the help of an example. **[6]**

c) Assign R and S conformation in 2-Bromo butene and Lactic acid. **[6]**

Q7) a) What is bond energy, give different types of bond energies. **[6]**

b) Explain the different conditions of spontaneity using Gibbs free energy. **[6]**

c) A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C. As it does so, it absorbs 208J of heat. Calculate the values of w for the process. **[5]**

OR

Q8) a) Deduce the equation of maximum work done in terms of volume and in terms of pressure. **[6]**

b) Derive the relation between heat of reaction at constant pressure and at constant volume mentioned the three case of it. **[6]**

c) A gas expands isothermally against a constant external pressure of 1 atmosphere from a volume of 10 dm^3 to a volume of 20 dm^3. In this process it absorbs 800 J of thermal energy from its surroundings. Find the ΔU for the process in joule. **[5]**

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S.E. (Chemical Engg.)
HEAT TRANSFER
(2019 Pattern) (Semester - IV) (209348)

Time : 2 ½ 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 are the different laws of Radiation? Explain Stefan Boltzmann's law. **[8]**

    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) Define: **[8]**

    i) Emissivity

    ii) Irradiation

    iii) Radiosity

    iv) Kirchoff's Law

    v) Wein's Displacement Law

    vi) Emissive power

    vii) Monochromatic emissivity

    viii) Transmitivity

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. **[10]**

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 37 1K. Calculate the mean heat transfer coefficient rate of heat transfer and mass of steam condensed per hour. **[10]**

Data: Properties of condensate at mean film temperature are

Density $= 960$ kg/m^3 Dynamic Viscosity $= 2.82 \times 10^{-4}$ Ns/m^2,

Thermal conductivity $= 0.68$ W/m.K, Latent heat of condensation $= 2255$ kJ/.kg.

Saturation temperature of steam $= 373$K.

Q5) a) Draw neat sketch of double pipe heat exchanger. **[10]**

b) Water enters a counter flow double pipe heat exchanger at 288 K flowing at a rate of 1300 kg/hr. It is heated by oil flowing at rate of 550 kg/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 2000 J/kg.K and 4187 J/kg.K

Overall Heat transfer coefficient is 1075 W/m^{2}K. **[8]**

OR

Q6) 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/m²ᴷ and heat transfer surface area of 0.25 m², calculate the outlet temperature of liquid and water and the effectiveness of heat exchanger.

Data: Specific heat of water = 4187 J/Kg.K, Specific heat of liquid = 3350 J/Kg.K. **[8]**

Q7) a) A single effect evaporator is fed to concentrate 5000 kg/hr of solution at 303 K 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. **[10]**

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

b) Explain the different factors affecting the evaporation operation. **[7]**

OR

Q8) a) What is Evaporation? Explain classification of Evaporators? **[10]**

b) 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]**

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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.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) *Use of scientific calculators is allowed.*
5) *Assume suitable data, wherever necessary.*

Q1) a) If shaft is subject to combined twisting & bending moment, derive the equation to determine the diameter of shaft. **[6]**

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 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. **[12]**

OR

Q2) a) How are the keys classified? Draw neat sketches of different types of keys and state their applications. **[6]**

b) The shaft and flange of a marine engine are to be designed for the flange coupling, in which the flange is forged on the end of the shaft. the following particulars are to be considered in the design: **[12]**

Power of the engine is 3 MW.

Speed of the engine is 100 RPM,

Permissible shear stress in bolt and shaft is 60 MPa

Number of bolt used is 08,

Pitch circle diameter of bolt is 1.6 times diameter of shaft.

Find:

i) Diameter of shaft

ii) Diameter of bolts,

iii) Thickness of flange, and

iv) Dimeter of flange

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 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) Derive the equation to determine the length of an open belt derive along with proper sketch. **[7]**

OR

Q4) a) Explain different types of riveted joints. Define tearing, shearing & crushing strength of the riveted joints. Aslo define efficiency of joint. **[7]**

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 1 kN, and the coefficient of friction between belt and pully is 0.25? Also draw the sketch. **[10]**

Q5) a) Explain the method for calculating thickness of torispherical head subjected to Internal pressure, and External pressure. **[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. **[12]**

Allowable stress for the material is 1000 Kg/cm^2.

Corrosion allowance is 1 mm.

OR

Q6) a) Calculate the thickness of a toripherical heads (100-6) and (80-6) elliptical head (2:1) and hemispherical head for a pressure vessel having design pressure 7 kg/cm^2. Diameter of vessel is 1500 mm, and the permissible stress is 1250 kg/cm^2. Welded joint efficiency is 85%. **[12]**

b) Explain various types of construction used for high pressure vessels.**[6]**

Q7) a) Write a short note on purging of vessels. **[5]**

b) Calculate the thickness of flanged torispherical head for a vessel having internal diameter 6000mm. Design pressure of vessel is 3.4 kg/cm^2, inside crown radius is 6000mm. Inside knuckle radius is 380mm. Permisibe stress of material is 1190 kg/cm^2. Welded joint efficiency is 100%. **[12]**

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 2400 mm.

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]**

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S.E. (Chemical)
CHEMICAL TECHNOLOGY - I
(2019 Pattern) (Semester - IV) (209350)

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 electronic pocket calculator is allowed.*
5) *Use of cell phone/mobile phone & smart watch are prohibited in the examination hall.*

Q1) a) State importance of Nitrogen fertilizers. **[4]**

     b) Describe in brief the manufacturing process of urea from ammonium carbonate with a neat process flow diagram. **[8]**

     c) Explain in brief major engineering problems of synthetic ammonia process. **[6]**

OR

Q2) a) State uses of Ammonium nitrate and brief about its methods of production. **[8]**

     b) Explain in brief Montecatini intermediate pressure process for manufacturing of Nitric Acid with a neat process flow sheet. **[10]**

Q3) a) Explain in brief about soaps with reactions in saponification. **[5]**

     b) Describe manufacturing process of detergent via sodium reduction of coconut oil. **[6]**

     c) Describe end uses of bio-degradable detergents. **[6]**

OR

Q4) a) Explain in brief Alkyl - Aryl sulfonates with chemical reactions. **[6]**

     b) Which raw materials are used for manufacture of soaps by continuous hydrolysis & saponification process? **[4]**

     c) Draw process flow diagram of a continuous process for manufacturing of fatty acids, soap and glycerin. **[7]**

Q5) a) Describe in brief main commodity polymers. **[6]**

b) Describe in brief classification of plastics or polymers. **[6]**

c) Draw a process flow diagram for production of polyvinyl resin. **[6]**

OR

Q6) a) Explain brief low pressure Ziegler process with a neat process flow diagram. **[9]**

b) Define polycondensation process. **[2]**

c) Draw a neat process flow diagram of production of phenol - formaldehyde resin. **[7]**

Q7) a) Which fractions are obtained in purification of crude oil by atmospheric distillation? **[5]**

b) Describe in brief catalytic cracking process (fluidized bed). **[7]**

c) Draw a flow diagram of high pressure platinum catalyst reforming process. **[5]**

OR

Q8) a) Explain in brief reactions involved in alkylation processes. **[6]**

b) State physical properties important for rubber products. **[3]**

c) Draw a neat flow diagram of Butadiene - styrene (SBR) rubber process. **[8]**

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S.E. (Chemical)
MECHANICAL OPERATIONS
(2019 Pattern) (Semester - IV) (209351)

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 Magnetic Separator and Fabric filter with neat diagram. **[10]**

b) Explain two different types of fluidization with neat sketch. **[8]**

OR

Q2) a) Explain with a neat sketch: **[12]**

i) Cyclone Separator

ii) spouted bed with neat diagram

b) Define Fluidization. State the application of fluidization technique. **[6]**

Q3) a) Explain with neat sketches "Prevention of swirling and vortex formation".**[9]**

b) Define mixing and agitation. Explain the purpose of agitation in Chemical process industries. **[8]**

OR

Q4) a) Write a short note on. **[8]**

i) Muller mixer

ii) Sigma Mixer

b) What is degree of mixing and rate of mixing in case of dry solids and derive the expressions. **[9]**

Q5) a) Derive the following for filtration at constant pressure difference. **[9]**

$$\frac{t - t_1}{V - V_1} = \frac{r\mu\upsilon}{2A^2(-\Delta P)}(V - V_1) + \frac{r\mu\upsilon V_1}{2A^2(-\Delta P)}$$

b) Explain with a neat sketch Rotary Drum Filter. Enlist its advantages. **[9]**

OR

P.T.O.

Q6) a) What is Filtration? Which are two main types? Explain factors to be consider while selecting Filtrating Equipments. **[9]**

b) Explain with a neat sketch Plate and Frame filter press with all the important parts of the press. **[9]**

Q7) a) Explain with neat sketch construction and working of belt conveyors Conveyors. **[9]**

b) What are various equipment's used for storage of solids? Discuss them with neat diagram. **[8]**

OR

Q8) a) Write a short note on Screw conveyors with its advantage and disadvantage. **[8]**

b) Describe in detail elements of chain and flight conveyor systems and write the detail working process. **[9]**

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S.E. (Chemical Engineering)
INDUSTRIAL CHEMISTRY - I
(2019 Pattern) (Semester - III) (209341)

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.*

Q1) a) Explain principle, technique and applications of coloum chromatography. **[6]**

b) State Lambert and Beer laws and derive the combined law equation. **[6]**

c) What is gas chromatography? Give the operation of a gas chromatograph. **[6]**

OR

Q2) a) Explain principle technique and applications of HPLC. **[6]**

b) Give the instrumentation in single beam UV-Visible spectrophotometer. **[6]**

c) Give principle and instrumentation of flame photometry. **[6]**
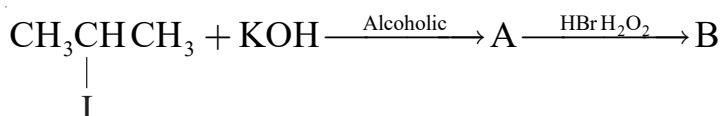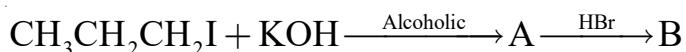
Q3) a) State and explain Henrys law and give its applications. **[6]**

b) Explain Vant Hoff Boyles law and Vant Hoff Charles law and combine form. **[6]**

c) A solution of glucose was prepared by dissolving certain amount in 100 g of water. The depression in freezing point was 0.0410 K. If molal depression constant for water is 1.86 K kg/mol. Calculate the mass of glucose dissolved. (C = 12, H = 1, O = 16). **[5]**

OR

Q4) a) Explain the terms (i) Vapour pressure (ii) Molal elevation constant (iii) Vant Hoff factor (i) **[6]**

b) Derive the thermodynamic equation for Depression in frizzing point of solution. **[6]**

c) The vapour pressure of pure benzene at a certain temperature is 640 mm Hg. A non volatile solute of mass 2.175×10^{-3} kg is added to 39×10^{-3} kg of benzene. The vapour pressure of the solution is 600 mm Hg. What is the molar mass of the solute?

(Given atomic masses C = 12, H = 1) **[5]**

Q5) a) Nitrobenzene undergoes electrophilic substitution at meta only. While amino benzene undergoes electrophilic substitution at ortho and para. **[6]**

b) Identify the compounds A and B in the following reactions. **[6]**

$$CH_3CH_2CH_2I + KOH \xrightarrow{\text{Alcoholic}} A \xrightarrow{\text{HBr}} B$$

$$\underset{\underset{I}{|}}{CH_3CHCH_3} + KOH \xrightarrow{\text{Alcoholic}} A \xrightarrow{\text{HBr H}_2\text{O}_2} B$$

c) Write a note on Beckman's rearrangement. **[6]**

OR

Q6) a) Explain the factors affecting rate of E^1 and E^2 reactions. **[6]**

b) Give the sulphonating agents and mechanism involve in sulfonation of benzene. **[6]**

c) Write a short note on Claisen rearrangement. **[6]**

Q7) a) Describe the classification of dyes on the basis of chemical structure. **[6]**

b) Discuss the methods of synthesis of furan and pyrrole. **[6]**

c) Give the steps involved in the preparation of Methyl Orange. **[5]**

Q8) a)   How is pyridine is synthesized? Explain Chichibabin reaction of pyridine.

[6]

b)   Give the steps involved in the preparation of Crystal violet.   [6]

c)   Explain the electrophilic substitution in Pyrrole.   [5]

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S.E. Chemical
FLUID MECHANICS
(2019 Pattern) (Semester - III) (209342)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
1) *Neat diagram must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, if necessary.*
4) *Use of calculator is allowed.*

Q1) a) What is a Pitot tube? How will you determine the velocity at any point with the help of Pitot tube? **[6]**

b) State Bernoulli's theorem. Mention the assumption made. How it is modified while applying in practice? List out its engineering application. **[6]**

c) An oil of Specific gravity 0.8 is flowing through a venture meter having inlet diameter 20 cm and throat diameter 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venture meter, Take $C_d=0.98$. **[6]**

OR

Q2) a) Derive Euler's equation of motion along a stream line for an ideal fluid starting clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream line. **[6]**

b) Discuss the relative merits and demerits of venture meter with respect to orifice meter. **[6]**

c) An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter gives readings of 19.62 N/cm² and 9.81 N/cm² respectively. Co efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe. **[6]**

Q3) a) Find the Expression for loss of head of a viscous fluid flowing through a circular pipe. **[6]**

b) Show that the loss of head due to sudden expansion in pipe line is a function of velocity head. **[6]**

c) A laminar flow is taking place in a pipe of diameter of 200 mm. The maximum velocity is 1.45 m/s. Find the mean velocity and radius at which this occurs. Also calculate the velocity at 4 cm from the wall of the pipe.**[6]**

OR

Q4) a) Derive "Darcy Weisbach" equation to find head loss due to friction? **[6]**

b) Derive the relation between the maximum and average velocities along with their position in the cross section ot circular horizontal pipe. **[6]**

c) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100mm and of length 10m calculate the difference of pressure at two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. **[6]**

Q5) a) Explain the concept of boundary layer? **[5]**

b) Explain the term dimensionally homogeneous equation. **[6]**

c) Efficiency 'η' of a fan depends on density 'ρ', dynamic viscosity 'μ' of the fluid, angular velocity 'ω', diameter 'D' of rotor and the discharge 'Q'. Express 'η' in term of dimensionless parameter. **[6]**

OR

Q6) a) With suitable example. describe in detail the Rayleigh's Method of dimensional analysis? **[5]**

b) Explain Buckingham's π-theorem in detail. **[6]**

c) Find the expression for the drag force on smooth sphere of diameter 'D', moving with uniform velocity 'v' in a fluid of density 'ρ' and dynamic viscosity 'μ'. **[6]**

Q7) a) Explain value and its type with application? **[5]**

b) Explain phenomenon of cavitation's in centrifugal pumps. How it can be prevented? **[6]**

c) What is fluidization? Write its importance in chemical process industries. **[6]**

OR

Q8) a) Explain fluidization with its type and application? **[5]**

b) Explain operating characteristic of centrifugal pump? **[6]**

c) Differentiate between particulate fluidization and aggregative fluidization. **[6]**

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S.E. (Chemical)

ENGINEERING MATERIALS

(2019 Pattern) (Semester - III) (209343)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

    1)   *Neat diagrams must be drawn wherever necessary.*

    2)   *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*

    3)   *Assume suitable data, if necessary.*

Q1) a)   Write down the difference between Natural and Synthetic rubbers. **[10]**

    b)   Define rubbers and explain its classification.   **[8]**

OR

Q2) a)   Define and write down importance of polymers in various industries. **[10]**

    b)   Write note on High and Low temperature materials with example. **[8]**

Q3) a)   Define corrosion. Write down its types.   **[10]**

    b)   Write down the various methods used for prevention of corrosion. **[6]**

OR

Q4) a)   Explain the various factors affecting corrosion.   **[8]**

    b)   Explain rate method for control of corrosion.   **[8]**

Q5) a)   Define Nanotubes in detail and write down its applications in detail. **[9]**

    b)   Explain Top-down and Bottom-up approaches method for synthesis of nanomaterials.   **[9]**

OR

P.T.O.

Q6) a) Explain Pressure Vapor deposition method for synthesis of nanomaterials. **[9]**

b) Write down various applications of Nanomaterials in Chemical industries. **[9]**

Q7) Explain principle and working of Scanning Transmission Microscope (SEM). **[18]**

OR

Q8) Explain principle and working of atomic force microscopy (AFM). **[18]**

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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 diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculator and steam table is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) A coke is known to contain 90% carbon and 10% non-combustible ash (by weight): (i) find the moles of oxygen theoretically required to burn 100 kg of coke completely? (ii) If 50 percent excess air is supplied, calculate the analysis of Gases at the end of combustion. **[8]**

b) Ethylene Oxide is produce from oxidation of ethylene. 100 kmol of ethylene feed to reactor. The product stream contains 80 kmol ethylene oxide and 10 kmol of CO_2. Calculate percentage conversion of ethylene and percentage yield of ethylene oxide. **[8]**

OR

Q2) a) Gaseous benzene reacts with hydrogen in the presence of Ni catalyst as per the reaction :

$C_6H_6 (g) + 3H_2 (g) \rightarrow C_6H_{12} (g)$

30% excess hydrogen is used above that required by the above reaction. Conversion is 50% and yield is 90%. Calculate the requirement of the benzene and hydrogen gas for 100 moles of cyclohexane produced. **[8]**

b) A gas analyzing $CO_2 = 5.5$ %, $CO = 25$ %, $H_2 = 14$ %, $CH_4 = 0.5$ % and $N_2 = 55$ % (by volume) is burnt in furnace with air which is 10 % excess over that required to burn CO, H_2, CH_4 completely. Give the analysis of the product gas mixture, assuming all reactions proceed to completion. **[8]**

Q3) a) A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K to 383 K. Calculate the heat that must be transferred using C_P data: $C_P^0 = a + bT + CT^2 + dT^3$, kJ/koml.K **[10]**

Gas	a	b × 10³	c × 10⁶	d × 10⁹
CO₂	21.3655	64.2841	–41.0506	9.7999

b) Calculate the heat of formation of ethane gas at 298.15 K from its elements using Hess's law : **[8]**

Data :

Heat of formation of CO_2 (g) = –393.51 kJ/mol

Heat of formation of H_2O (1) = –285.83 kJ/mol

Heat of combustion of ethane gas at 298.15 K = –1560.69 kJ/mol

OR

Q4) a) A stream flowing at a rate of 15 kmol/hr. containing 25 % N2 and 75 % H_2 by mole is heated from 298 K to 473 K. Calculate the heat that must be transfer using Cp data given as follows. **[10]**

Gas	a	b × 10³	c × 10⁶	d × 10⁹
N₂	29.5909	–5.41	13.1829	-4.968
H₂	28.6105	1.0194	-0.1476	0.769

b) Calculate the heat of reaction at 298.15 K of the following reaction : **[8]**

C_2H_6 (g) → C_2H_4 (g) + H_2(g)

Data

Component	ΔH_c° kJ/mol
C₂H₆ (g)	–1560.69
C₂H₄ (g)	–1411.2
H₂ (g)	–285.83

Q5) a) Define wet bulb temperature, dry bulb temperature, humid volume and humid heat. **[8]**

b) 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 1/s. The volume of the gas handled at 101.325 kPa at 303 K is 1425 m³/hr. The gases leaving the tower contain 1% SO_2 by volume. Find the % SO_2 in the outlet water (by weight). **[10]**

OR

Q6) An absorption tower, packed with Telleratte packings, is used to absorb carbon dioxide in an aqueous monoethanol amine solution (MEA). The volumetric flow rate of incoming dry gas mixture is 1000 m^3/h at 318 K and 101.3 kPa a. The CO_2 content of the gas is 10.4 mole%, while the outgoing gas mixture contains 4.5 mole% CO_2. A 3.2 M monoethanol amine solution is introduced at the top of the tower at the rate of 0.625 L/s. Dissolved CO_2 concentration of the entering solution is 0.166 kmol/kmol of MEA. Find the concentration of dissolved CO_2 in the solution leaving the tower.

Data: Specific volume of the gas at 318 K and 101.3 kPa a, V= 26.107 m^3/ kmol. **[18]**

Q7) a) Explain the following : **[6]**
   i)   Classification of fuels
   ii) Calorific values of fuels

b) Fuel gas has the following composition: $CO = 27\%$, $CO_2 = 4\%$, $O_2 = 0.5\%$ and N2 = 68.5% by volume. Find the net theoretical oxygen required. Find the analysis of flue gas if the fuel gas is burned with 80% excess air than the net requirement. **[6]**

c) Define adiabatic flame temperature, HCV and NCV. Is the actual adiabatic flame temperature different than that calculated theoretically? **[6]**

OR

Q8) Calculate the gross and net heating values of the natural gas at 298.15K which has the following molar composition:

$CH_4 = 74.4\%$, $C_2H_6 = 8.4\%$, $C_3H_8 = 7.4\%$, iso-$C_4H_{10} = 1.7\%$, n-$C_4H_{10} = 2.0\%$, iso-$C_5H_{12} = 0.5\%$, n-$C_5H_{12} = 0.4\%$, $CO_2 = 0.9\%$ and $N_2 = 4.3\%$.

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
iso-C_4H_{10}	2868.20	2648.12
n-C_4H_{10}	2877.40	2657.32
iso-C_5H_{12}	3528.83	3264.73
n-C_5H_{12}	3535.77	3271.67

Specific volume of the natural gas at 298.15K and 101.3 kPa = 24.465 m^3/kmol. **[18]**

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S.E. (Production and Industrial Engineering/Production 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. 7or 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) Draw and explain the construction of MOSFET. **[5]**

　　b) State the methods to turn off SCR and explain one of them in detail. **[6]**

　　c) Explain the I-V characteristics of TRIAC. **[6]**

OR

Q2) a) State the applications of SCR. **[5]**

　　b) State the methods to turn on SCR and explain one of them in detail. **[6]**

　　c) Draw and explain the construction of IGBT. **[6]**

Q3) a) Write the non-linear applications of operational amplifier. **[5]**

　　b) What are the applications of IC voltage regulator. **[6]**

　　c) Draw and explain the functional diagram of IC 555. **[6]**

OR

Q4) a) List the features of 1C555 timer. **[5]**

　　b) Define voltage controlled oscillator and write the applications of 566 VCO.
[6]

　　c) What are the advantages and disadvantages of R-2R ladder DAC. **[6]**

Q5) a) Define PLC and explain the application of PLC. **[8]**

   b) Explain the following PLC logic functions i) AND ii) OR **[6]**

   c) What is ladder programming? **[4]**

<div align="center">OR</div>

Q6) a) Explain the input and output module of programmable logic controller.**[8]**

   b) What are the different features of programmable logic controller? **[6]**

   c) Explain the role of PLC in automation. **[4]**

Q7) a) What is an embedded system and state the applications of it. **[8]**

   b) State any six features of Arduino IDE. **[6]**

   c) Compare microprocessor with micro-controller by significant points. **[4]**

<div align="center">OR</div>

Q8) a) Explain the following functions used to handle GPIO in AT mega 328P Arduino board with suitable example. **[8]**

   i)   pinMode()

   ii) digital Write()

   iii) digitalRead()

   iv) analogReference()

   b) Explain the sketch in Arduino **[6]**

   c) Enlist significant features of ATmega328P micro-controller. **[4]**

<div align="center">〇〇〇〇</div>

S.E. (Production Sandwich) (Production Engg. and Industrial Engg.)
DESIGN OF MACHINE ELEMENTS
(2019 Pattern) (Semester - IV) (211092)

Time : 2 ½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Student will solve/write the Answers to any four questions in single answer book only (Note: Solve Q1 OR Q2, Q3 OR Q4, Q5 OR Q 6, 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 electronic pocket calculator is allowed.*

Q1) a)   Derive the torque equation for the square threaded screw to raise the load. **[6]**

b)   An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm/min. The screw has a single square thread of 6mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate power of the motor. **[8]**

c)   Explain importance of Helix angle on efficiency **[4]**

OR

Q2) a)   Explain types of stresses are induced in the power screw. **[6]**

b)   A double start screw is used to raise load of 5 kN, the horizontal diameter is 60 mm and pitch is 9 mm. The threads are of ACME type ($2\theta = 29°$) and coefficient of friction is 0.15. Neglect collar friction, Calculate: 1. Torque required to raise the load, 2. Torque required to lower the load, 3. Efficiency of screw, and 4. Torsional shear stress in the screw. **[8]**

c)   Explain with neat figures the types of power screw threads. **[4]**

Q3) a) Explain the terms used in compression springs; Free length, and Spring Index. **[4]**

b) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm2, find the axial load which the spring can carry and the deflection per active turn. **[8]**

c) 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. **[8]**

b) A close coiled helical compression spring of 12 active coils has a spring stiffness of k. It is cut into two springs having 5 and 7 turns. Determine the spring stiffnesses of resulting springs. **[6]**

c) Draw a neat label sketch a leaf spring assembly. **[3]**

Q5) a) Explain the terms used in gears:1. Pitch Circle Diameter, and 2. Addendum. **[4]**

b) A pair of straight teeth spur gears is to transmit 20 kW when the pinion rotates at 300 r.p.m. The velocity ratio is 1: 3. The allowable static stresses for the pinion and gear materials are 120 MPa and 100 MPa respectively. The pinion has 15 teeth and its face width is 14 times the module. Determine: 1. module; 2. face width; and 3. pitch circle diameters of both the pinion and the gear from the standpoint of strength only, taking into consideration the effect of the dynamic loading. The tooth form factor y can be taken as **[8]**

$$y = 0.154 - \frac{0.912}{No.\,of\,teeth}$$

And velocity factor C_v as

$$C_v = \frac{3}{3+v},$$

where v is expressed in m/s.

c) Explain different causes of gear tooth failure. **[6]**

OR

Q6) a) Derive Lewis beam strength equation of gear teeth. **[7]**

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 r.p.m.; 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.

c) Draw a neat sketch showing Gear Nomenclature and Terminology. **[3]**

Q7) a) What do you understand by bearing life with example. **[5]**

b) A taper roller bearing has a dynamic load capacity of 25 kN. The desired life for 90 % of the bearings is 8000 h and the speed is 350 rpm. Calculate the equivalent radial load that the bearing can carry. **[6]**

c) Explain guidelines for selecting lubrication for rolling contact bearings. **[6]**

OR

Q8) a) Explain the advantages and disadvantages of roller contacting bearing over sliding contact bearing. **[4]**

b) Derive Stribeck's Equation. **[7]**

c) A single - row deep groove ball bearing is subjected to radial force of 9 kN and a thrust force of 4 kN. The shaft rotates at 1250 rpm. The expected life L_{10h} of the bearing is 30,000 h. The minimum acceptable diameter of the shaft is 85 mm. Calculate dynamic load capacity. **[6]**

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S.E. Production Engineering and Industrial Engineering
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) *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) Explain thermoplastics and thermoset plastics   **[8]**
  b) Write two properties and two applications of :   **[8]**
    i) ABS
    ii) Polycarbonates
    iii) Epoxies
    iv) Phenolic

OR

Q2) a) Differentiate between addition polymerization and condensation polymerization.   **[8]**
  b) State the important properties and applications of WC, Al_2O_3 and Si_3N_4**[8]**

Q3) a) What are Functionally Graded Materials? Explain the classification of FGM's with examples.   **[9]**
  b) Explain fibers, whiskers, matrix and reinforcement.   **[9]**

OR

Q4) a) State the advantages of FGMs compared to conventional alloys and composite materials.   **[9]**
  b) Why additive manufacturing is attractive for developing functionally graded materials?   **[9]**

Q5) a) Explain with diagrams   **[9]**
    i) Pressure bag molding
    ii) Pultrusion process
  b) Compare PVD with CVD process of matrix on fibers   **[9]**

OR

Q6) a) Compare CEN standards with ISO standards. [9]
b) Write short notes on: [9]
   i)   Infiltration process
   ii)   Squeeze casting
   iii) Stir casting.

Q7) a) Explain ASTM Standards Committee and Materials codes: [9]
   i)   B-10
   ii)   C-5
   iii) C-28
b) State the importance of standards and codes. [9]

OR

Q8) a) With the help of example explain ASTM and JISC standards. [9]
b) What are the importance of material standards? Who sets ASTM standards? [9]

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Total No. of Questions : 8]

SEAT No. :

P9168

[Total No. of Pages : 2

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S.E. (Production Engg. and Industrial Engg) / (Prdoduction Engg. Sandwich)
INDUSTRIAL ENGINEERING AND MANAGEMENT
(2019 Pattern) (Semester - IV) (211094) (Theory)

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) ElaborateIntellectual Property Rights in detail.   **[6]**

b) What is break even analysis? Explain it.   **[6]**

c) Elaborate various strategy for business growth.   **[5]**

OR

Q2) a) Which one is the important factors to consider in break-even analysis?**[6]**

b) Which are the various sources of finance? Classify those sources.   **[6]**

c) Describe role of communication skill in the process of an entrepreneurship development.   **[5]**

Q3) a) Elaborate on various job evaluation techniques.   **[6]**

b) Explain concept of wages in detail.   **[6]**

c) Classify various productivity improvement techniques.   **[6]**

OR

Q4) a) Discuss historical developments of Industrial Engineering.   **[6]**

b) State procedure for work measurement in manufacturing industry. **[6]**

c) Compare types of productivity techniques.   **[6]**

Q5) a) Describe principle of motion economy.   **[6]**

b) How to use Multiple Activity Chart? Ekplain it with suitable example.**[6]**

c) Write ashort note on SIMO chart.   **[5]**

OR

Q6) a) WhyChronocylegraph..is required. How to use it.   **[6]**

b) Brief on. "5W and 1 H"   **[6]**

c) State assembly procedure for nut-bolt using any of method study. **[5]**

P.T.O.

Q7) a) Elaborate MOST. [6]

b) How to analyze performance rating. [6]

c) State procedure for PMTS. [6]

OR

Q8) a) Explain concept of work sampling. [6]

b) Classify various types of allowances. [6]

c) Writ a short note on MTM2. [6]

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S.E. (Production and Industrial Engineering)/(Robotics & Automation Engg.)/(Sandwich)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207007)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :
1) *Q.1 is compulsory. Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
2) *Figures to the right indicate full marks.*
3) *Assume suitable data, wherever necessary.*
4) *Use of electronic pocket calculator is allowed.*

Q1) a) The first four moments about the working mean 5 are –1, 10, 11, 16 then value of second moment μ_2 about mean is given by **[2]**

    i) 10   ii) 9

    iii) 8   iv) 7

b) Mean and standard deviation of a Binomial distribution are 25 and 5 respectively. Number of trials 'n' is **[2]**

    i) 42   ii) 40

    iii) 9   iv) 44

c) $\nabla^2 \left(\dfrac{1}{r^2} \right)$ **[2]**

    i) $\dfrac{1}{r^3}$ ii) $\dfrac{2}{r^4}$

    iii) $\dfrac{-2}{r^4}\bar{r}$ iv) $\dfrac{6}{r^4}$

d) For a constant vector $\bar{a}, \nabla(\bar{a}.\bar{r}) =$ **[1]**

    i) $\bar{a}$ ii) $3\bar{a}$

    iii) $\bar{r}$ iv) 0

P.T.O.

e) Most general solution of the partial differential equation $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$

representing metal plate having length x & breadth $y \to \infty$ is **[2]**

i) $(C_1 \cos mx + C_2 \sin mx)(C_3 e^{my} + C_4 e^{-my})$

ii) $(C_1 e^{mx} + C_2 e^{-mx})$

iii) $(C_1 e^{mx} + C_2 e^{-mx})$

iv) $(C_1 \cos hmx + C_2 \sin hmx)(C_3 \cos my + C_4 \sin my)$

f) If probability of success $p = 0.7$ then probability of failure $q =$ **[1]**

i) 0.7　　　　　　　　　　　　　　ii) 1.7

iii) –0.7　　　　　　　　　　　　iv) 0.3

Q2) a) Fit a Straight line of the from $y = ax + b$ to the following data by least square method **[5]**

x	0	5	10	15	20	25
y	12	15	17	22	24	30

b) Calculate the first four moments about the mean of the following distribution **[5]**

x	0	1	2	3	4	5	6	7	8
f	1	8	28	56	70	56	28	8	1

c) Obtain the correlation coefficient between population density (per square miles) & depth rate (per thousand persons) from data ralated to 5 cities.**[5]**

x	200	500	400	700	300
f	12	18	16	21	10

OR

Q3) a) Fit a Straight line of the from $y = ax + b$ following data, by using method of least squares **[5]**

x	0	1	2	3	4	5	6	7
y	–5	–3	–1	1	3	5	7	9

b) The first four moments of a distribution about the value 2 are –2, 12, –20 & 100 calculate **[5]**

i) First four central moments.

ii) Coefficients of Skewness & Kurtosis

c) Find the regression line of y on x for the following data **[5]**

x	10	14	18	22	26	30
y	18	12	24	6	30	36

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Q4) a) A set of five similar coins is tossed 210 times & the result is **[5]**

No. of Heads	0	1	2	3	4	5
Frequency	2	5	20	60	100	23

Test the hypothesis that the data follow a binomial distribution.

$\left[\text{Given } \chi^2_{5:0.05} = 5.991\right]$

b) A manufacturer of cotter pins known that 2% of his product is defective. If he sells cotter pins in boxes of 100 pins & guarantees that not more than 5 pins will be defective in a box find the approximate probability that a box will fail to meet the guaranteed quality. **[5]**

c) A random sample of 200 screws is drawn from a population with which represent size of screws. If a sample is distribution normally with a mean 3.15 cm & standard 0.025cm find the expected number of screws whose size fall between 3.12 & 3.2 cm. [Given $A(1.2) = 0.3849$; $A(2) = 0.4772$]
[5]

OR

Q5) a) On an average box containing 10 articles is 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]**

b) Number of road accident on a highway during a month follows a Poisson 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) between 3 and 5

c) In experiment on pea breeding, the following frequencies of seeds were obtained **[5]**

Round & green	Wrinkled green	Round & yellow	Wrinkled & 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 & experiment.

$\left[\text{Given } \chi^2_{3:0.05} = 7.815\right]$

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Q6) a) Find the directional derivative of $\phi = xy + yz^2$ at (1, –1, 1) along the

line $\dfrac{x-1}{1} = \dfrac{y+1}{2} = \dfrac{z-1}{2}$. **[5]**

b) Show that vector field $\overline{F} = (x^2 - yz)\overline{i} + (y^2 - xz)\overline{j} + (z^2 - xy)\overline{k}$ is

irrotational. Find scalar ϕ such that $\overline{F} = \nabla\phi$. **[5]**

c) Evaluate $\int\limits_{C} \overline{F}.d\overline{r}$ along straight line joining (0, 0) and (1, 1) where

$\overline{F} = (2x + y^2)\overline{i} + (3y - 4x)\overline{j}$. **[5]**

OR

Q7) a) Find the directional derivative of $\phi = x + y^2 + z^3$ at the point (1, 1, –1)

along the direction of $2\overline{i} - \overline{j} + 3\overline{k}$. **[5]**

b) Show that (any one) : **[5]**

i) $\nabla\left(\dfrac{\overline{a}.\overline{r}}{r}\right) = \dfrac{\overline{a}}{r} - \dfrac{(\overline{a}.\overline{r})\overline{r}}{r^3}$

ii) $\nabla^2\left(\nabla.\left(\dfrac{\overline{r}}{r^2}\right)\right) = \dfrac{2}{r^4}$

c) Evaluate $\oint\limits_{C} \overline{F}.d\overline{r}$ for a closed curve which is given by $x^2 + y^2 = 1$, $z = 0$

where $\overline{F} = \cos y\,\overline{i} + x(1 - \sin y)\overline{j}$ by using Green's Lemma. **[5]**

Q8) a) A string is stretched and fastened to two points distanced one meter apart is displaced in to the form $y(x, 0) = x$ from which it is released at $t = 0$. Determine the displacement of the string at a distance x from one end. **[8]**

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

i) $u(0, t) = 0°C$

ii) $u(1, t) = 0°C$

iii) $u(x, 0) = 50°C, 0 < x < 1$

iv) $u(x, t)$ is finite, $\forall t$

OR

Q9) a) Using Fourier transform, solve the equation

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0 \text{ subject to the conditions.}$$ **[8]**

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

ii) $u(x, 0) = e^{-x}, x > 0$

iii) $u \to 0$ and $\dfrac{\partial u}{\partial x} \to 0$ as $x \to \infty$

b) Determine the distribution of temperature in the semi infinite medium $x \geq 0, 0 < y < 1$ when the end $x = 0$ is maintained at zero temperature and the initial distribution of temperature is $f(x)$. **[7]**

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S.E. (Production Industrial Engg./Production Engg. 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) Explain major and minor losses of fluid with equations. **[9]**

b) A crude oil of kinematic viscosity 0.4 stroke is flowing through a pipe of diameter 300 mm at the rate of 300 liters per second. Find the head loss due to friction for a length of 50 m of the pipe. **[9]**

OR

Q2) a) How is Buckingham's pie theorem useful for fluid mechanics? **[9]**

b) Explain with sketch types of turbines. **[9]**

Q3) a) How boiler are classify and explain working of any one boiler. **[9]**

b) A boiler working at a pressure of 14 bars evaporates 8kg of water/kg of coal burnt from the feed water entering at 39°C. The steam at the stop value is 0.95 dry. Determine the equivalent of evaporation from & at 100°C. **[8]**

OR

Q4) a) Discuss need of stoichiometric and gravimetric analysis of fuel. **[9]**

b) A boiler plant supplies 5400 kg of steam/hr. at 750 kN/m² and 0.98 dry from feed water at 41.5°C, when using 670 kg of coal/hr. having a calorific value of 31000 kJ/kg. Determine **[8]**

i) The efficiency of the boiler.

ii) The equivalent of evaporator from & at 100°C.

P.T.O.

Q5) a) Explain necessity of air conditioning for micro and nano manufacturing. **[9]**

b) What are various types of refrigeration systems? **[9]**

OR

Q6) a) What is units of refrigeration and coefficient of performance of refrigerator? **[9]**

b) Explain wet bulb temperature,dry bulb temperature, pure air. **[9]**

Q7) a) What are various types of compressions of compressor? Explain with sketches. **[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

OR

Q8) a) What is clearance volume of compressor? Discuss significance of it.**[9]**

b) Discuss classification of Internal Combustion engine in detail. **[8]**

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SE (P.E & I.E/RA/Production S.W)

Strength of Material
(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, Q.7or Q.8*

2) *Use of scientific calculator is allowed.*

3) *Figures to the right side indicate full marks.*

Q1) a) Define Bending Stresses in Beam ,Neutral Axis and Section Modouls What are Assumption made in the theory of Simple bending. **[5]**
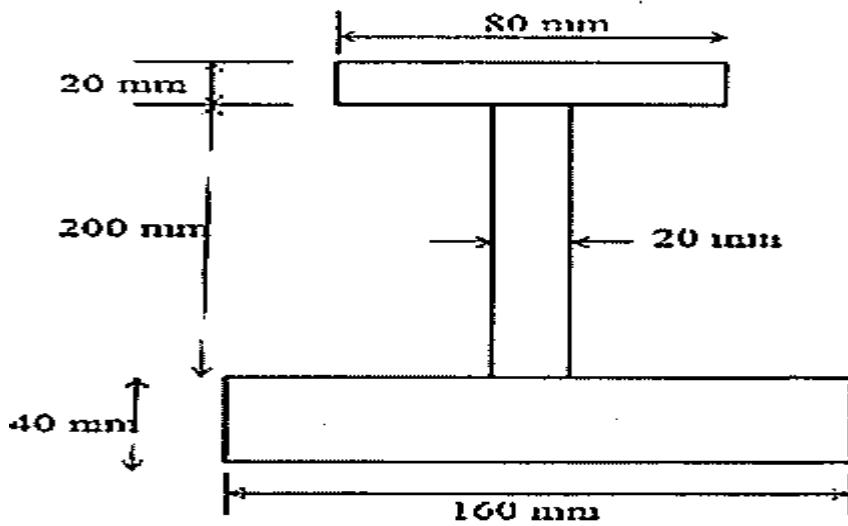
b) Prove that $\dfrac{M}{1} = \dfrac{\sigma}{y} = \dfrac{E}{R}$ Where, *M* is bending moment, *I* is moment of inertia, σ is stress at any fiber at a distance of *y* from the neutral axis, *E* is Modulus of elasticity, and *R* is radius of curvature. **[6]**

c) A Sequre beam of 20 mm x 20 mm in section and 2 m long us supported at the ends. The beam fails when a point load of 400N is applied at the centre of the beam. What uniformly distributed load per meter length will break a cantilever of the same material 40 mm wie.60 mm deep and 3 m Long. **[7]**

OR

Q2) a) A simply supported wooden beam of span 1.3 m having cross section 150 mm wide by 250 mm deep carries a point load W at the center. The permissible stresses are 7 N/ mm² in bending and 1 N / mm² IN SHEARING Calculate Safe Load W **[6]**
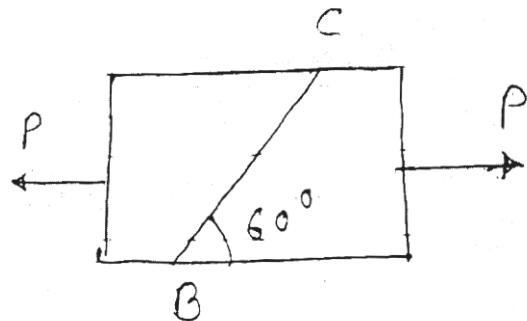
b) A cast iron beam is of the I- section as shown in Fig . The beam is simply supported on a Span of 5 meters. If the tensile stress is not to exceed 20 N/*mm²*. Find the safe uniformly distributed load which the beam can carry. Also find the maximum compressive stress. **[12]**

The figure shows a T-section with top flange 80 mm wide and 20 mm thick, a web 200 mm high and 20 mm wide, and a bottom flange 160 mm wide and 40 mm thick.

Q3) a) Define strain energy, Resilance and proof resilience. Also derive an expression for Strain Energy due to self-weight. **[9]**

b) Calculate the Resilience and Modulus of Resilance of a bar 200 mm long, 50mm thick subjected to a tensile load of 60 KN applied gradually E= 2 × 10⁵ N/mm² **[9]**

<div align="center">OR</div>

Q4) a) Explain in detail the Graphical Method for determining stress on oblique section. **[6]**

b) The stresses at a point in a bar are 200 N/mm^2(tensile) and 100 mm² (compressive).Determine the resultant in magnitude and direction on a plain inclined at 60°C to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at The point. **[8]**

c) A rectangular bar of Crossectional area of 11000mm² is subjected to tensile load Path permissible normal and shear stress on obliue plane BC are 7 N mm² and 3.5 N mm² determine the Value of P **[4]**

The figure shows a rectangular bar with forces P applied at both ends (pointing outward), with an oblique plane BC inclined at 60° across the bar.

Q5) a) Derive an expression for Toque Transmitted by hollow circular shaft Torsion. **[5]**

b) A solid steel Shaft has to transmit 75 KW at 200 rpm. Taking allowable shear stress as 70 N/mm², find the suitable diameter for the shaft if the maximum torque transmitted at each resolution exceed the mean by 30%. **[8]**

c) Find the maximum shear stress induced in solid circular shaft of diameter 15cm when the shaft transmits 150 KW power at 180 rpm **[4]**

OR

Q6) a) A solid Circular shaft Transmits 75 Kw power at 200 r.p.m. Calculate the shaft Diameter, if the twist in shaft not exceed 1° in 2 meters length of shaft, and shear stress is limited to 50 N/mm² take C= 1 × 10⁵ N/mm²**[5]**

b) A shaft ABC of 500 mm length an 40 mm external diameter is bored for a part of its length AB, to a 20 mm diameter and for the remaining length BC to a 30 mm diameter bore. If the shear stresses not to exceed 80 N/mm² find the maximum power of the shaft can transmit at speed of 200 r.p.m. If the angle of twist in length of 20 mm diameter bore is equal to that in the 30 mm diameter bore find the length of the shaft that has been bored to 20 mm and 30 mm diameter. **[8]**

c) Define polar modulus and state the expression for solid Shaft and hollow shaft. **[4]**

Q7) a) What are the assumptions made in Euler's column theory? Explain the end conditions for long Column. **[5]**

b) Calculate the safe compressive load on a hollow cast-iron column (one end is rigidity fixed and other is Hinged) of 15 cm external diameter, 10 cm internal diameter and 10m length. Use Euler's formula with a factors of safety 5 and E =95k.N/mm² **[6]**

c) Expression for crippling load when one end of the column is fixed and other end is free **[6]**

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Q8) a) Determine the crippling load for T* section of dimension 10cm × 10cm × 20cm and of lengths 5m when it is used as strut both of its end are hingned.Take Young's Modulus E = 2.0 105 N/mm² **[6]**

b) Explain the Rankine Formula in details along with expression **[5]**

c) A hollow C.I Column whose outside diameter is 200mm has thickness of 20 mm.It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankins formula using factor of safety 4 .calculate the slenderness ratio and the ratio. **[6]**

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[6179]-299

S.E. (Production and Industrial Engineering/Production Sandwich)
Manufacturing Processes - I
(2019 Pattern) (Semester-III) (211083)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :

     1)   *Solve 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 indicate full marks.*

     4)   *Assume suitable data, if necessary.*

Q1) a)   Explain following lathe operations by neat sketches: **[8]**

         (i) Facing   (ii) Plane turning   (iii) Chamfering   (iv) Drilling

    b)   With the help of neat sketch, explain vertical column and knee type milling machine.   **[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 gang drilling machine. **[10]**

b) Explain the standard marking system used for grinding wheels. **[7]**

OR

Q4) a) Differentiate between multiple spindle and gang drilling machine **[8]**

b) With the help of sketch, explain the construction and working of cylindrical grinding machine. **[9]**

Q5) a) Explain Buffing, Lapping and Burnishing processes in short. **[9]**

b) Explain Polishing, Tumbling and Electroplating processes in short. **[9]**

OR

Q6) a) Explain in short Galvanizing & Metal spraying process. **[9]**

b) Explain Honing process with neat sketch in detail. **[9]**

Q7) a) What is additive manufacturing? What are its advantages and limitations? **[9]**

b) Explain sheet lamination process in detail. **[8]**

OR

Q8) a) Describe various applications of additive manufacturing. **[8]**

b) Explain powder bed fusion additive manufacturing process in detail. **[9]**

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[6179]-300

S.E. (Production Engineering Sandwich)/
(Production Engg. & Industrial Engg.)
MATERIAL SCIENCE & 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)   *Figures to the right indicates full marks.*

   3)   *Draw neat figures wherever necessary.*

   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) Describe with sketch powder metallurgy manufacturing process in detail.

                                                                             [18]

OR

Q2) a) Write note on.   **[9]**

      i)   Diamond impregnated Cutting Tools

      ii)   Cemented carbide tipped tools

   b) Describe any two automobile components which can be manufactured by only powdermetallurgy technique.   **[9]**

Q3) What are the objectives of heat treatment? Explain annealing treatments given to steels in order to change its properties.   **[18]**

OR

Q4) a) Explain types of plain carbon steels with their properties and applications.   **[10]**

   b) Explain the following with neat diagram   **[8]**

      i)   Peritectic transformation

      ii)   Eutectic transformation

Q5) a) Draw and Explain the method of plotting TTT diagram and what information isobtained 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 **[8]**

    b) Write Note on Copper and its Alloy **[8]**

OR

Q8) a) Write Note on Aluminum and its Alloy **[8]**

    b) Write Note on Composite Material and Nano Materials **[8]**

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S.E. (Production Engineering) (Sandwich)
MANUFACTURING PROCESS - II
(2019 Pattern) (Semester - IV) (211121)

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 Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

Q1) a) What are fixed cycles? What is difference between fixed cycle and Subroutine? **[6]**

b) List the advantages and dis-advantages of CNC machines. **[6]**

c) Elaborate on FMS. **[5]**

OR

Q2) a) Enlist profitable applications of CNC Machines. Explain any two applications in detail. **[6]**

b) Write short notes on the following.

  i) Canned Cycle **[6]**

  ii) G Codes **[5]**

Q3) a) What is injection moulding? Explain process with a neat sketch. **[6]**

b) Explain extrusion of plastic. Also, elaborate on extruder. **[6]**

c) Brief on Vacuum Forming. **[6]**

OR

Q4) a) What is thermoforming stage in plastic processing? Brief its any application. **[6]**

b) Compare with a neat sketch pressure forming process over vacuum forming process. **[6]**

c) Elaborate Pressure forming. **[6]**

Q5) a) Explain with neat diagram construction and working of IBM processes.**[6]**

b) Draw schematic diagram of EDM. Explain its construction and working.**[6]**

c) Draw neat sketch of AJM System. **[5]**

OR

Q6) a) Explain briefly USM process characteristics. **[6]**

b) State various methods of rapid prototype. Compare any two methods.**[6]**

c) Explain PAM system. **[5]**

Q7) a) Describe the design principles for jigs and fixtures. **[6]**

b) Explain the importance accessories of jig and fixture. **[6]**

c) Explain 3-2-1 Principle. **[6]**

OR

Q8) a) Explain briefly with neat sketch cylindrica1 and adjustable locators. **[6]**

b) What is meant by clamping? Explain the principle involved in the design of clamp? **[6]**

c) Explain procedure of Fixture installing. **[6]**

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[6179]-302

S.E. (Printing Engineering and Graphic Communication)
ELECTRICAL MACHINES AND UTILIZATION
(2019 Pattern) (Semester - IV) (203155)

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)   Torque-Slip Characteristics of 3 phase Induction Motor in details.   **[9]**

     b)   Explain any two types of Starters used for 3 phase Induction Motor. **[9]**

<div align="center">OR</div>

Q2) a)   Explain any two types of Speed Control methods of 3 phase Induction Motor.   **[9]**

     b)   A 12-pole, 3-phase induction motor has rotor resistance per phase = 1Ω, and stand-still reactance per phase = 3Ω. At stand still rotor induced EMF is 100 volts between the slip rings. Calculate the rotor current per phase and rotor power factor when (i) slip-rings are short-circuited (ii) when resistance of 3Ω/phase is inserted in the rotor circuit.   **[9]**

Q3) a)   Explain nine requirements of Good Lighting Scheme.   **[9]**

     b)   The front of a building 50 m × 16 m is illuminated by sixteen 1000-W lamps arranged so that uniform illumination on the surface is obtained. Assuming a luminous efficiency of 17.4 lumens/watt and a coefficient of utilization of 0.4, determine the illumination on the surface.   **[8]**

<div align="center">OR</div>

Q4) a)   Explain the types of Lighting Scheme with diagrams.   **[9]**

     b)   A badminton hall to be provided with a lighting installation. The hall is 30 m × 20 m × 10 m (high). The mounting height is 5 m and the required level of illumination is 150m/m². Using metal filament lamps, estimate the size and number of single lamp luminaries and also draw their spacing layout. Assume : Utilization coefficient = 0.6, Maintenance factor = 0.75, Space/ height ratio = 1, Lumens/watt for 300W lamp = 13 lumens/watt for 500 W lamp = 16.   **[8]**

Q5) a) Explain in details principal of Induction Heating and Vertical Core Type Induction Furnace. **[9]**

b) Explain in details of Dielectric Heating with types. **[9]**

OR

Q6) a) Explain in details Temperature Control Methods of Furnaces. **[9]**

b) Explain in details Core Less type Induction Furnace. **[9]**

Q7) a) Enumerate the selection of motors depending on load characteristics.**[9]**

b) Explain in details types of Relays used in Printing Industry. **[8]**

OR

Q8) a) State the difference between Individual & Group Drive. **[9]**

b) Explain in details various types of Relays and Electric Encoders used Printing Industries. **[8]**

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[6179]-303

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 side indicate full marks.*

    3)   *Assume Suitable data if necessary.*

    4)   *Neat diagrams must be drawn wherever necessary.*

Q1) a)   Explain in brief work and tumble method with suitable example. **[8]**

    b)   Design and draw a graphical representation of 1 × 16 page, Z scheme considering all knife folding. **[9]**

<div align="center">OR</div>

Q2) a)   Design and draw a graphical representation of 2 × 16 page, G scheme considering all knife folding. **[9]**

    b)   Explain in brief full sheet work method with suitable diagram. **[8]**

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]**

<div align="center">OR</div>

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]**

Q5) a)   Write Short note on lamination methods.   **[9]**

b)   Explain the need of utility operations and draw suitable diagram of any two utility operations.   **[8]**

OR

Q6) a)   Distinguish between wet lamination and dry lamination process.   **[6]**

b)   Write Short note on calendar rimming process.   **[5]**

c)   Compare perforating and punching operations.   **[6]**

Q7) a)   Calculate papers for endpapers in double crown size for 5000 books in crown 8vo size with 1%.   **[6]**

b)   A ream of paper in 61 × 88cm size weight 21.5kg. Find the weight of the same paper in quad crown 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 8vo size with 1% wastage allowances.   **[6]**

b)   Find out the weight of one ream of paper of 80GSM in double medium 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]**

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[6179]-304

S.E. (Printing Engineering)
INTRODUCTION TO PACKAGING CONCEPTS
(2019 Pattern) (Semester - IV) (208287)

Time : 2 ½ 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)　What is the importance of demography.　　　　　　　　　　**[9]**

　　　b)　Explain retail market of packaging industry.　　　　　　　　**[9]**

OR

Q2) a)　Explain psycho-graphic segmentation in detail with examples.　**[9]**

　　　b)　How retail marketing has extreme importance.　　　　　　　**[9]**

Q3) a)　Explain 4 different scenarios of product and package relationship.　**[9]**

　　　b)　Explain product's physical characteristics.　　　　　　　　**[8]**

OR

Q4) a)　Explain the concept of center of gravity with diagram and symbol.　**[8]**

　　　b)　Write down wood characteristics.　　　　　　　　　　　　**[9]**

P.T.O.

Q5) a) Write down different physical test required to check quality of package. **[9]**

b) Explain quality standard aspects in packaging. **[9]**

OR

Q6) a) Explain conditioning in packaging. **[9]**

b) Which ISO standards are important in packaging industry. **[9]**

Q7) a) Explain the growth of food and beverage packaging industry in India. **[8]**

b) What are environment considerations for packaging industry. **[9]**

OR

Q8) a) Explain different packaging laws and regulations. **[8]**

b) How India has become the world's fifth largest packaging industry. **[9]**

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[6179] - 305

S.E. (Printing Engineering)

MICROPROCESSOR AND MICROCONTROLLER TECHNIQUES IN PRINTING

(2019 Course) (Semester - IV) (208288)

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) *Black figures to the right indicate full marks.*
3) *Assume Suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) Explain the pin configuration of 8051 microcontroller **[18]**

OR

Q2) Explain the PSW and the special function register of 8051 microcontroller. **[18]**

Q3) Explain the addressing modes used in 8051 microcontroller **[17]**

OR

Q4) a) Differentiate the microcontroller and microprocessor. **[5]**

     b) Explain following instructions in microcontroller 8051 (Any six) **[12]**
         i) MOV A,R0
         ii) MOVC A,@A+DPTR
         iii) MOV A,@R1
         iv) SWAP A
         v) RR A
         vi) MUL AB
         vii) RET
         viii) MOVX A,@DPTR

Q5) Describe in detail about the peripheral interface IC 8255. **[18]**

OR

Q6) a) Describe the block diagram of programmable IC 8253. **[9]**

b) Explain programmable interrupt control IC 8529. **[9]**

Q7) Explain the Interfacing of printer with 8085. **[17]**

OR

Q8) Explain the use of microprocessor and microcontroller in the printing industry.
[17]

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[6179]-306

S.E. (Printing)

PRINT PRODUCTION TECHNIQUES

(2019 Pattern) (Semester - IV) (208289)

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) *Assume suitable data if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) a)   What is Digital Halftone? What are the advantages of Halftone process.**[10]**

   b)   Explain Hybrid Screening.   **[8]**

OR

Q2) Draw the diagram and explain Subtractive Color Model for C,M,Y, C+M, M+Y, Y+C, C+M+Y.   **[18]**

Q3) What is dot gain curve? What is the dot compensation curve?   **[17]**

OR

Q4) What is Plate Linearization process? Explain in details the importance of plate Linearization   **[17]**

Q5) Explain Trapping, Hue Error, Grayness, and Print Contrast with.diagrams and equations.   **[18]**

OR

Q6) Draw and explain a dot variation stripe. Also explain the necessity of Dot compensation Curve.   **[18]**

Q7) Draw and explain the production workflow from Design to Delivery. Also explain what is production strategy.   **[17]**

OR

Q8) a) Explain relation between customer, designer and Printer. **[7]**

b) Explain which printing process is ideal for following jobs and why

    i) 10,000 A4 size leaflets, 4 color job, Lamination

    ii) 5 lacks labels, size 4" x 4", CMYK + 1 pantone

    iii) 50 wall papers, size 10 ft × 3 ft, multicolor

    iv) 500 Wedding cards on handmade paper, single color, gold foiling

    v) 500 copies of a book, 100 pages in a book, single color no artwork, only text **[10]**

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[6179]-307
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 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)   Define brake and gives general requirements of good braking system. **[5]**

b)   Write a short note on block brakes. **[5]**

c)   A single block brake has a brake drum diameter of 1 m and angle of contact is 30°. It takes 280 Nm torque at 300 rpm. [Take u = 0.35] **[7]** Determine required force when drum rotating clockwise.
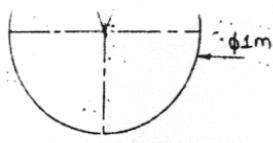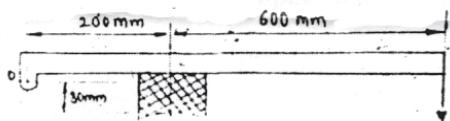

Fig.1 (c)

OR

Q2) a)   Explain Single block brake with the help of neat sketch. **[5]**

b)   Explain self-locking and self-energizing condition for differential band brake. **[5]**

c)   A bicycle and rider of mass 120 kg are travelling at a speed of 15 km/hr on a level road. The rider applies brake to the rear wheel which is 0.9 m diameter. How Far bicycle will travel before it comes to rest? Pressure applied 100N and u= 0.05. Also find number of revolutions. **[7]**

Q3) a) Derive an equation for length of cross belt drive. **[5]**

b) State and Explain types of pulleys. **[5]**

c) The width of belt is 15 cm and maximum tension per cm width is not to be exceeded 140 N. The ratio of tension on the two sides is 2.25. The diameter of the driver is 1.05 m and it makes 220 rpm. Find power transmitted. **[7]**

OR

Q4) a) Define the Following terms. **[5]**

   i) Belt drive

   ii) Rope drive

b) Define chain drive with its different types. **[5]**

c) The initial tension in a flat belt drive is 1800N. The angle of lap on smaller pulley is 170°. The coefficient of friction of the belt and pulley is 0.25. pulley diameter 0.9m and runs at 540 rpm. Find the power transmitted. neglect centrifugal tension. **[7]**

Q5) a) A four bar chain mechanism ABCD with its dimension is shown in figure,. It is driven by crank AB which rotates at 600 rpm in clockwise direction. The link AD is fixed. Find the absolute velocity of link CB & CD. **[10]**
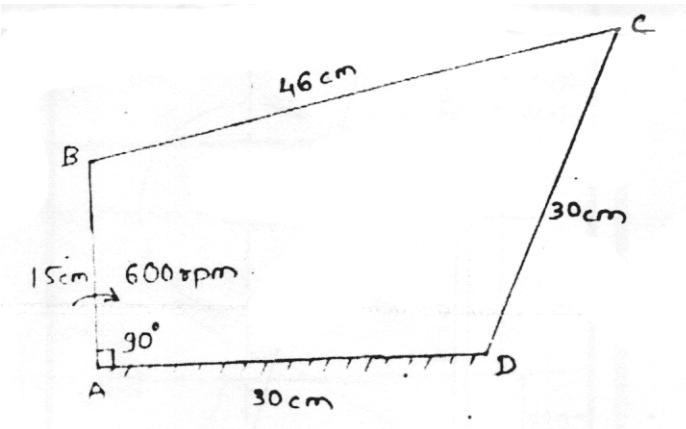

Fig.5(a)

b) The crank of I.C engine is 10cm long and it rotates at a uniform speed of 20 rad/s clockwise. The length of connecting rod is 40 cm. Determine the velocity and angular acceleration of connecting rod. When crank is at 45° from i.d.c. **[8]**
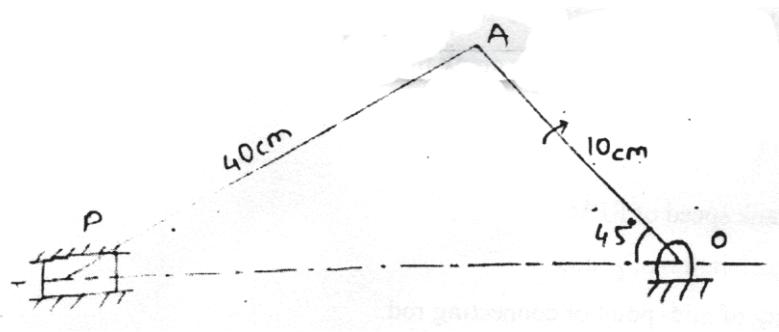
Fig.5(b)

OR

Q6) A shaper mechanisms is shown in figure,. A straight link CD is used to drive the ram. Determine for the position shown the following when the crank Ab rotates clockwise at 40 rpm. **[18]**

i) Velocity of slider D and angular velocity of link CD.

ii) Draw the acceleration polygon and find the linear acceleration of slider D and angular acceleration of link of slotted OC.
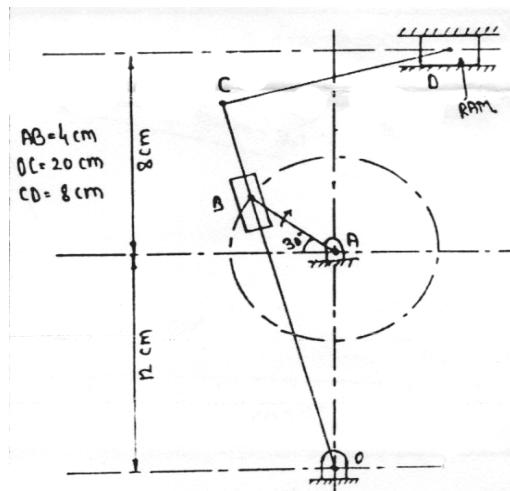
Fig.6

**Q7)** In an engine mechanism, The crank is 20 mm and connecting rod is 80 mm. The angular acceleration of connecting rod is 54 rad/s^2 , when the crank makes an angle of 45° with IDC. While rotating at uniform angular speed. **[18]**
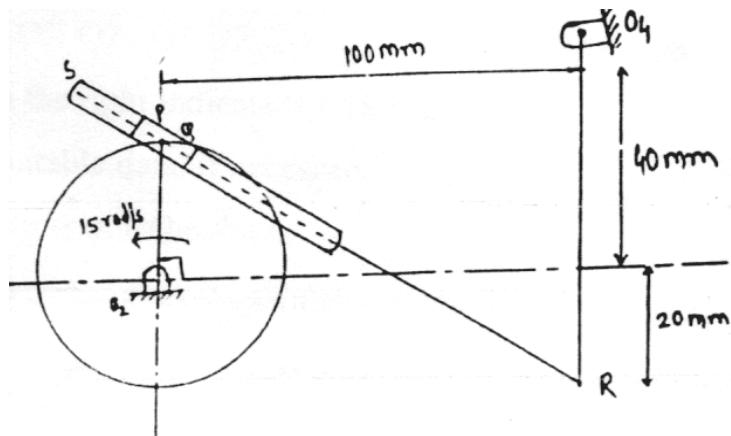
Determine :

i) The crank speed of RPM

ii) The acceleration of piston

iii) Velocity of mid- point of connecting rod.

OR

[6179]-307   3

Q8) Vertical position as shown. Link O$_2$P is having angular velocity 15 rad/s in anticlockwise sense and gives oscillatory motion to output link O$_4$RS. **[18]**

Determine

i)   Angular velocity of link O$_4$RS

ii) Angular acceleration of link O$_4$RS

Fig.8

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[6179]-308A

B.E. (Printing Engineering)
INTRODUCTION TO PRINTING PROCESSES
(2019 Pattern) (Semester - III) (208281)

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.*

Q1) a)   What are the different materials used in screen printing?   **[6]**

     b)   What are the different types of screen-printing methods?   **[6]**

     c)   Write short notes on types of screen-printing frames and its applications.   **[6]**

OR

Q2) a)   For printing an original of size 8×11 cm. What are the factors to be considered in selecting the screen-printing frame?   **[6]**

     b)   For screen printing on polymer substrates, What type of squeegee is generally preferred?   **[6]**

     c)   What are the factors which affect the life of a squeegee in screen printing?   **[6]**

Q3) a)   The specifications given by the manufacturer for a screen-printing frame with mesh is as follows. 150/380-31 W PW. Briefly explain the meaning of each number given the specification.   **[6]**

     b)   What is theoretical ink volume? How is it calculated?   **[6]**

     c)   Write short notes on PET screen printing mesh.   **[5]**

OR

Q4) a)   Describe in brief the polypropylene screen-printing mesh.   **[6]**

     b)   Write about the importance of screen-printing fabric area.   **[6]**

     c)   What are the factors which affects colour in screen printing.   **[5]**

P.T.O.

Q5) a) Describe the stages in the adhesion of a screen mesh to the frame. **[6]**

b) Explain in brief the static frames and the self-tensioning frames. **[6]**

c) What are pallet adhesives? Where it is used. **[6]**

<center>OR</center>

Q6) a) Briefly explain the screen angles for different colours in four colour screen printing. **[6]**

b) Write about the designing considerations for a screen-printing job. **[6]**

c) Describe about water-based adhesives and their applications. **[6]**

Q7) a) What is the difference between direct and indirect screen-printing method. **[6]**

b) What is printed circuit board? How is it manufactured with screen printing process. **[6]**

c) Write about polyethylene bags manufacturing process with screen printing and also its applications. **[5]**

<center>OR</center>

Q8) a) Can we use pantone colours in four colour screen printing process. Justify your answer. **[6]**

b) Write about screen printed gaskets. **[6]**

c) Name any five electronic devices which can fabricated by screen printing process in printed electronics. **[5]**

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[6179]-309

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) Ink is composed of many ingredients which impart specific properties to it. Explain each ingredient and its role.   **[18]**

OR

Q2) Explain following terms: **[18]**

  a)   Length

  b)   Tack

  c)   Viscosity

Q3) Resins are very important ingredient of inks: Justify this statement with properties of resins and its function in the ink   **[17]**

OR

Q4) a)   What is CFB? Explain its properties and applications   **[9]**

  b)   What type of paper-based material is used for food packaging and why **[8]**

P.T.O.

Q5) Explain following terms: **[18]**

    a)   GSM

    b)   MD and CD

    c)   Caliper

    d)   Smoothness

<div align="center">OR</div>

Q6) a)   What is FBB? Explain its properties and applications   **[9]**

    b)   What is SBS? Explain its properties and applications   **[9]**

Q7) a)   Explain the terms surface energy and surface tension with suitable diagrams.   **[9]**

    b)   What are two different types of plastics with respect to its response to application of heat, explain in details   **[8]**

<div align="center">OR</div>

Q8) Explain any 3 defects/issues in printing which may arise due to problems in paper. Suggest action taken to overcome the issue   **[17]**

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[6179]-310

S.E. (Printing Engineering)
PRINTING DIGITAL ELECTRONICS
(2019 Pattern) (Semester - III) (208283)

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*

Q1) Perform Following   **[18]**

     a) Convert the $[32]_{10}$ decimal in binary and calculate its l's complement

     b) 2's complement of 11001

     c) 1011 × 10

     d) 1011 ÷ 10

     e) Solve (12-5) using 2' s complement method

     f) Convert the 36 and 48 in BCD.

     g) 1011 - 1001

     h) 101101 + 010110

     i) Multiply 110110 and 101

OR

Q2) a) Describe the Design of half full adder with the help of K-Map .   **[9]**

     b) Describe the design of one bit magnitude comparator using k-Map **[9]**

Q3) a) Describe D Flip flop along with timing diagram   **[6]**

     b) Differntiate between the Combinational circuits and Sequential circuits **[6]**

     c) Draw and explain RS Flip flop   **[5]**

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]**

Q5) a) Differentiate PLA and PAL **[6]**

b) Describe the flash type 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 SRAM and DRAM 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]**

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[6179]-311

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 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) Describe the factors impacting emergence of entrepreneurship.   **[5]**

b) Following data is available for ABC company :   **[12]**

Selling Price per unit = Rs. 20

Variable cost per Unit= Rs.12

Fixed cost= Rs.25000

Total units sold = 34000

Calculate :

i)   PV ratio   ii)   BEP in units

iii)   BEP in sales   iv)   Total Profit

v)   Margin of Safety

<div align="center">OR</div>

Q2) a) Describe the funding organizations which promotes start ups.   **[5]**

b) Explain the following terms related to Break Even Analysis.   **[12]**

i)   Contribution   ii)   PV ratio

iii)   BEP in units   iv)   BEP in sales

v)   Total Profit   vi)   Margin of Safety

Q3) a)   Define Basic work content.   **[8]**

Describe the factors which affects the basic work content (i.e. excess work content)

b)   Describe Taylor Piece Wage System and Merrick Piece Wage System with suitable illustration. State the advantages and limitations of these systems.   **[9]**

OR

Q4) a)   Describe Halsey plan and Rowan plan of wage and incentive system with their characteristics, advantages and limitations.   **[8]**

b)   Define Job evaluation and Job specification. What are the different methods of Job evaluation?   **[9]**

Q5) a)   Describe the economic and technical factors to be considered while selecting the job for method study.   **[9]**

b)   Describe SIMO chart with suitable illustration and appropriate symbols with their meaning.   **[9]**

OR

Q6) a)   Describe principles of motion economy related to workplace design and tools with neat sketches.   **[9]**

b)   Describe Multiple activity chart with suitable illustration & appropriate symbols.   **[9]**

Q7) a)   Describe Method Time Measurement with suitable illustration.   **[6]**

b)   Describe the following types of Rating :   **[12]**

i)   Westinghouse system

ii)   Synthetic Rating

iii)   Objective rating

OR

Q8) a)   Describe the process to carry out work sampling study. State how the standard time is calculated using work sampling study.   **[10]**

b)   The following data is collected from work sampling study.   **[8]**

Determine :

i)   Normal time

ii)   Standard time

Duration of the study(Hrs)	1200
Total number of units produced during study	6000
Total number of observations	750
Number of observations of productive work	600
Number of observations of machine controlled work	400
Average performance rating	90
Total allowances (%)	13

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[6179]-312

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, Q7 or Q.8.*
2) *Assume suitable data, if necessary.*
3) *Figures to the right side indicates full marks.*
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. **[8]**

b) Find range of K for stability unity feedback system with Characteristics equation, $G(S) = K / [S (S+2) (S+4) (S+6)]$. Also define what is pole, zero & S-Plane. **[9]**

OR

Q2) a) State the properties of root locus. **[8]**

b) Sketch root locus of unity feedback system with open loop transfer function $G(S) = K / [S (S+1) (S+3) (S+5)]$. **[9]**

Q3) a) Draw the polar plot for $G(S) = 1 + as$. **[8]**

b) Define phase margin, gain margin? Derive the expression for Resonant frequency and Resonant Peak. **[9]**

OR

Q4) a) State Nyquist theorem and explain Nyquist stability criteria. **[8]**

b) Draw Bode plot of system with open loop transfer function $G(s) = 100 / (S + 1) (S + 2) (S + 5)$ & comment on its stability. **[9]**

P.T.O.

Q5) a) Explain the selection criteria used for PLC. **[9]**

b) Explain Digital Control System with Block diagram. Enlist its advantages and disadvantages. **[9]**

OR

Q6) a) What is sampling? Explain the process of sampling with waveform. **[9]**

b) Explain input and output field devices used in PLC (any 9). **[9]**

Q7) a) What is a compensator? Explain Cascade compensation techniques.**[9]**

b) Explain the Procedure to design of lead compensator using root locus. **[9]**

OR

Q8) a) What is phase lag compensation? Enlist effects, advantages, disadvantages of phase lag compensation. **[9]**

b) Explain the Procedure to design of lag compensator using root locus. **[9]**

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[6179]-313
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) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Use of scientific calculator is allowed.*
3) *Figures to the right side indicate full marks.*

Q1) a) Derive the expression Efficiency of Square Threaded Screws and Maximum Efficiency of a Square Threaded Screw. **[8]**

b) 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: 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. **[8]**

OR

Q2) a) A power transmission screw of a screw press is required to transmit maximum load of 100 kN and rotates at 60 r.p.m. Trapezoidal threads are as under The screw thread friction coefficient is 0.12. Torque required for collar friction and journal bearing is about 10% of the torque to drive the load considering screw friction. Determine screw dimensions and its efficiency. Also determine motor power required to drive the screw. Maximum permissible compressive stress in screw is 100 MPa **[8]**

Nominal dia, mm	40	50	60	70
Core dia, mm	32.5	41.5	50.5	59.5
Mean dia, mm	36.5	46	55.5	65
Core area, mm^2	830	1353	2003	2781
Pitch, mm	7	8	9	10

b) Explain along with Sketch Different Steps Involved in Design of Screw Jack in Detail. **[8]**

P.T.O.

Q3) a) Derive expression for Deflection of Helical Springs of Circular Wire.**[6]**

b) Explain in detailed Surge in Springs. **[4]**

c) A mechanism used in printing machinery consists of a tension spring assembled with a preload of 30 N. The wire diameter of spring is 2 mm with a spring index of 6. The spring has 18 active coils. The spring wire is hard drawn and oil tempered having following material properties: Design shear stress = 680 MPa Modulus of rigidity = 80 kN/mm² Determine: i) the initial torsional shear stress in the wire; ii) spring rate; and iii) the force to cause the body of the spring to its yield strength.**[8]**

OR

Q4) a) Derive the expression for Series and parallel connections. **[6]**

b) It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 and 81 370 N/mm² respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils. **[7]**

c) It is required to design a helical compression spring subjected to a maximum force of 7.5 kN. The mean coil diameter should be 150 mm from space consideration. The spring rate is 75 N/mm. The spring is made of oil-hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm². The permissible shear stress for the spring wire is 30% of the ultimate tensile strength (G = 81 370 N/mm²). Calculate (i) wire diameter; and (ii) number of active coils. **[5]**

Q5) a) Explain the classification Classification of Gears. **[4]**

b) 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 centre 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. **[10]**

c) Write A short note on Lewis Equation for Beam Strength. **[4]**

Q6) a) Write a short note on Gear tooth Failure along with corrective action.**[6]**

b) A pair of spur gears with 20° full-depth involute teeth consists of a 19 teeth pinion meshing with a 40 teeth gear. The pinion is mounted on a crankshaft of 7.5 kW single cylinder diesel engine running at 1500 rpm. The driven shaft is connected to a two-stage compressor. Assume the service factor as 1.5. The pinion as well as the gear is made of steel 40C8 (Sut = 600 N/mm^2). The module and face width of the gears are 4 and 40 mm respectively **[12]**

    i) Using the velocity factor to account for the dynamic load, determine the factor of safety.

    ii) If the factor of safety is two for pitting failure, recommend surface hardness for the gears.

    iii) If the gears are machined to meet the specific cations of Grade 8, determine the factor of safety for bending using Buckingham's equation for dynamic load.

    iv) Is the gear design satisfactory? If not, what is the method to satisfy the design conditions? How will you modify the design?

Q7) a) Explain Types of rolling contact bearings along with example. **[4]**

b) A single-row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. **[6]**

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]**

Q8) a) The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability. **[6]**

b) Selection of Bearing from the Manufacturing Catalogue explain in detail. **[5]**

c) A single-row deep groove ball bearing has a dynamic load capacity of 40500 N and operates on the following work cycle : **[7]**

   i)   Radial load of 5000 N at 500 rpm for 25% of the time

   ii) Radial load of 10000 N at 700 rpm for 50% of the time; and

   iii) Radial load of 7000 N at 400 rpm for the remaining 25% of the time.

   Calculate the expected life of the bearing in hours.

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[6179]-314

S.E. (Robotics & Automation)
METROLOGY AND QUALITY ASSURANCE
(2019 Pattern) (Semester - IV) (211511)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

    1)   *Figure to the right indicates full marks.*

    2)   *Neat Diagram must be drawn wherever necessary.*

    3)   *Assume Suitable data if necessary.*

    4)   *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

    5)   *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*

Q1) a)   Explain concept of RMS and CLA value for surface roughness measurement. **[8]**

    b)   Explain with neat sketch Floating Carriage Micrometer. **[9]**

<div align="center">OR</div>

Q2) a)   Derive an expression for measuring of effective diameter using Three Wire Method. **[8]**

    b)   Explain with neat sketch Profile Projector. **[9]**

Q3) a)   Contrast between Quality Control & Quality Assurance. **[9]**

    b)   Explain following SQC tools : **[9]**

        i)   X chart

        ii)   R chart

        iii)   P chart

<div align="center">OR</div>

Q4) a)   Write short note on : **[9]**

        i)   Single sampling plan

        ii)   Double sampling plan

        iii)   Multiple Sampling Plan

b) Explain : [9]

    i)   Producer's Risk

    ii) Consumer's Risk

    iii) LTPD/RQL

Q5) a) Explain Deming's approach of Quality. [8]

    b) Explain any three quality control tools with neat sketch. [9]

<div align="center">OR</div>

Q6) a) With neat sketch explain Juran's Trilogy. [8]

    b) Write a short note on Total Quality Management. [9]

Q7) a) Explain the Concept of Quality Management System. [9]

    b) State & Explain prerequisites for implementing ISO 9000 quality standards. [9]

<div align="center">OR</div>

Q8) a) Explain in detail ISO 9000:2000 series standards. [9]

    b) Explain function, methodology, and advantages of quality audit. [9]

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[6179]-315

S.E. (Robotics and Automation)
COMPUTER GRAPHICS FOR ROBOTICS
(2019 Pattern) (Semester-IV) (211512)

Time : 2½ Hour]   *[Max. Marks : 70*
Instructions to the candidates:
1) *Neat diagrams must be brawn wherever necessary.*
2) *Figures to the right side indicate full marks.*
3) *Use of calculator is allowed.*
4) *Assume suitable data if necessary.*

Q1) a) For the following data , use Lagrange method to determine y at x=4 on a curve which is generated by using 4 data points having following co-ordinates:**[9]**

x	2	3	8	10
y	1	7	5	9

b) A point (4,2,1) is rotated by 45° using a quaternion coincident with y axis. Determine the transformed position of the point. **[8]**

OR

Q2) a) With suitable examples explain any two methods of 2D interpolation.**[8]**

b) For the data given below, use inverse distance weighting method to determine z at $x=3$ and $y=12$ **[9]**

x	1	4	5	8
y	12	10	11	14
z	1	5	4	6

Q3) a) A line with end point (3,2,0) and (4,1,0) is simultaneously revolved about x-axis by 360° and translated along x-axis by 50 units to generate sweep surface. Obtain the point on this sweep surface for t=0.4 and s=0.1. Where t is parameter for line and s is parameter for revolution and translation. **[10]**

b) What are B-spline curves? How the geometric continuity is determined for B spline curves? **[7]**

OR

Q4) a) Obtain x-y co-ordinates of a point on cubic spline curve at parameter value t=0.3 considering control points as (4,6), (6,2), (10,7) and (12,6) for second segment. **[10]**

b) Determine the point of Bezier curve at t=0.6 for three control points : P_0 (2,3), P_1(6,5), P_2 (8,1) **[7]**

Q5) a) Determine the point of intersection of the line AB having endpoints: A (2,1,–4) and B (1, –3, 2) with plane $x + 4y - z = 8$ **[10]**

b) What is analytic geometry? Explain its application in robotics. **[8]**

OR

Q6) a) Write note on : Intersection of a circle with a straight line. **[10]**

b) Determine the angle between a line $L = i - j + 3k$ and a plane $x + 2y - 3z = 10$ **[8]**

Q7) a) Show that the multiplication of basis blades e_3 and e_{13} is $-e_1$. **[9]**

b) Demonstrate with example, the outer product of 2 vectors in 3 dimensional space. **[9]**

OR

Q8) a) Write a note on reflection vector and discuss its applications. **[9]**

b) Obtain the table containing all basis blades in 3 dimension. **[9]**

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[6179]-317

S.E. (Robotics & Automation Engineering)
INDUSTRIAL ELECTRONICS AND ELECTRICAL TECHNOLOGY
(2019 Pattern) (Semester - III) (211501)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

  1)   *Solve Q1 or Q2; Q3 or Q4; Q.5 or Q.6; Q.7or 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 a non-programmable calculator is allowed.*

Q1) a)   Draw the schematic showing the interfacing of an ATmega-based Arduino board to a DC motor with L293D.   **[4]**

  b)   Explain the concept of Pulse Width Modulation (PWM).   **[6]**

  c)   Draw and explain the interfacing of the Accelerometer with Arduino ATmega 328P. Write its algorithm.   **[8]**

OR

Q2) a)   Draw a neat schematic showing the interfacing of temperature sensor LM 35 with ATmega 328P-based Arduino board. The output of LM 35 is connected to analog pin A4 of the Arduino board. Write the algorithm for the same.   **[8]**

  •   What is the operating temperature range of LM 35?

  •   How many pins are available for the LM 35 sensor?

  •   What is the output voltage of LM 35 per degree Celsius temperature?

  b)   Draw a neat diagram showing the interfacing of the strain gauge with an ATmega 328P-based Arduino board. Given that the output voltage from the strain gauge after signal conditioning is connected to analog pin A0 of the Arduino board. Write algorithmic steps to display strain on the serial monitor.   **[6]**

  c)   Explain the concept of ADC in ATmega 328P-based Arduino board.**[4]**

P.T.O.

Q3) a) Draw and explain the Speed-armature current characteristics and torque-armature current characteristics of the DC shunt motor. **[6]**

b) Write any four industrial applications of the DC series and DC shunt motor. **[4]**

c) Draw the schematic of the three-point starter used for the DC shunt motor. Indicate the following components of the three-point starter and write their functions during operation: (i) No volt coil; (ii) Overload release. **[7]**

OR

Q4) a) State and explain the working principle of the DC generator along with a diagram. **[6]**

b) Derive the expression for the torque of the DC machine. **[7]**

c) What is the back emf in the DC motor? Write the emf equation of the DC generator. **[4]**

Q5) a) Distinguish between squirrel cage and slip ring induction motors. Write **any four** valid points. **[4]**

b) Derive the expression for the torque developed in a three-phase induction motor under running conditions. **[8]**

c) The useful torque of the three-phase, 50 Hz, an 8-pole induction motor is 190 NM. The frequency of the rotor is 1.5 Hz. Calculate the rotor copper loss if the mechanical losses are 700 watts. **[6]**

OR

Q6) a) Explain the operation of star - delta starter used for three phase induction motor with the help of a neat schematic diagram. **[8]**

b) Explain constructional details of three-phase IM with its appropriate diagram. **[6]**

c) Write any four industrial applications of the induction motor. **[4]**

Q7) a) What is a linear induction motor? Draw its diagram. **[4]**

b) Describe the construction and working of the Universal motor with the help of suitable diagrams and state its two applications. **[7]**

c) Explain the construction and working of the shaded pole induction motor with the help of a suitable diagram. **[6]**

Q8) a) Describe the construction and working of Brushless DC (BLDC) motor with the help of a suitable diagram and state any two applications of it.

[7]

b) Describe the constructional details and operation of the capacitor start capacitor run induction motor with the help of diagrams. **[6]**

c) Differentiate AC and DC motors. Write any four valid points. **[4]**

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[6179]-319

S.E. (Robotics and Automation)
MANUFACTURING TECHNOLOGY
(2019 Pattern) (Semester - III) (211502)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates :
1) *Solve Q.1 or Q.2, Q.3or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Figure to the right indicates full marks.*
3) *Neat diagram must be drawn wherever necessary.*
4) *Electronic pocket calculator is allowed.*

Q1) a) Explain in brief wire drawing. How stock preparation is done in wire drawing? **[8]**

b) What are different wire drawing dies used in Industries? Which material is preferable in wire drawing dies and why? Brief reason of failure of wire drawing process and suggest remedies to minimize failure. **[9]**

OR

Q2) a) Enlist defects in extrusion, identify the reason why defects occurs and suggest remedies on this. **[8]**

b) Explain the concept : Extrusion Ration; Circumscribing circle diameter and Shape factor also explain how metal flow is observed in extrusion? **[9]**

Q3) a) Compare and contrast MIG welding and TIC welding, highlighting their respective advantages and disadvantages. **[9]**

b) Describe the role of a flux in flux-cored arc welding. How does it contribute to the welding process? **[8]**

OR

Q4) a) Describe the differences between oxyacetylene welding and oxyacetylene cutting. Discuss the equipment used and the key principles of each process. **[9]**

b) Enlist the defects in welding process and suggest remedies for the same. **[8]**

P.T.O.

Q5) a) Explain the fundamental principles of Electrochemical Machining (ECM). How does ECM differ from traditional machining methods, and what are its key applications? **[9]**

b) Discuss the working principles and applications of Ultrasonic Machining (USM). What are the advantages and limitations of using ultrasonic energy in machining processes? **[9]**

OR

Q6) a) Examine the principles of Electro-discharge Machining (EDM). What considerations are important for achieving precision in EDM? **[9]**

b) Describe the concept of Plasma Arc Machining (PAM). How does the generation of a high-temperature plasma jet facilitate cutting, and what industries commonly use PAM for material processing? **[9]**

Q7) a) How have robots revolutionized traditional manufacturing methods, and what advantages do they offer in terms of efficiency and precision? **[9]**

b) Discuss the factors that industries consider when implementing robotic automation in manufacturing. **[9]**

OR

Q8) a) Elaborate how the robot is suitable for repetitive operations in mass production? **[9]**

b) Describe in details, how the robots have contributed in any assembly line? Explain with suitable example. **[9]**

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[6179]-320

S.E. (Robotics & Automation)
MATERIALS SCIENCE AND ENGINEERING METALLURGY
(2019 Pattern) (Semester - III) (211503)

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) *Figure to the right indicates full marks.*
3) *Neat diagram must be drawn wherever necessary.*
4) *Assume suitable data if necessary.*
5) *Use of Logarithmic Table, Slide rule is electronic pocket calculator is allowed.*

Q1) a) What is powder metallurgy? Discuss advantages, disadvantages and its applications. **[8]**

    b) Explain term : **[10]**
       i) Electric contact materials
       ii) Cermets

OR

Q2) a) What is conditioning of metal powders? Why it is done? **[8]**

    b) Write a note on : **[10]**
       i) production of sintered structural comports
       ii) Self-lubricating bearing

Q3) a) Draw iron-iron carbide equilibrium diagram and label the temperature, composition and phase. **[9]**

    b) Define the following : **[9]**
       i) Ferrite
       ii) Austenite
       iii) Cementite

OR

Q4) a) Classify C.I.? And give its application. **[9]**

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

   i) Sensitization of stainless steel

   ii) Weld decay of stainless steel.

Q5) a) Explain the method of plotting TTT diagram and what information is obtained from this diagram. **[8]**

   b) Explain terms : **[9]**

   i) Quenching

   ii) Annealing

   iii) Normalizing

OR

Q6) a) Explain why heat treatment of steel is done. **[8]**

   b) Write short note on Quenching media. **[9]**

Q7) a) Write note on High temperature alloy. **[8]**

   b) Write note on copper and its alloy. **[9]**

OR

Q8) a) Explain : **[9]**

   i) Biomaterials

   ii) Nano-materials

   iii) Sports materials

   b) What you know about Super alloys & Ti-Alloys? **[8]**

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[6179]-321

S.E. (Automobile & Mechanical/Automation & Robotics/Mechanical S.W)
KINEMATICS OF MACHINERY
(2019 Pattern) (Semester - IV) (202047)

Time : 2½ Hours]   *[Max. Marks : 70*
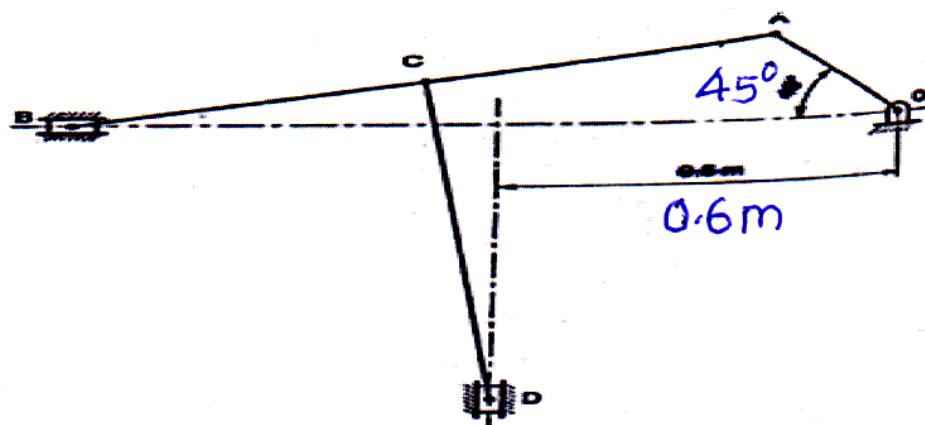
Instructions to the candidates:

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 indicate full marks.*

4) *Use of electronic non programmable calculator is allowed.*

5) *Assume suitable data if necessary.*

Q1) a)   Explain velocity image principle with neat sketch.   **[6]**

b)   The length of various links of mechanism as shown in figure are OA=0.3 m, AB=1 m, CD=0.8 m, AC=CB. The horizontal distance from point O and axis of vertical slider is 0.6 m. Determine for the given configuration   **[12]**

i)   Velocity of slider B   ii)   Velocity of slider D

iii) Angular velocity of CD   iv)   Angular velocity of AB

If OA rotates at 60 rpm clockwise use instantaneous centre method.

OR
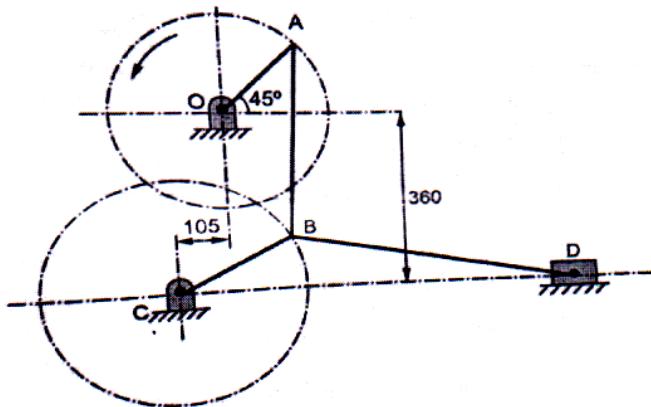
Q2) a) Explain with neat sketch Kennedy's theorem. **[6]**

b) In the mechanism shown, the slider D is constrained to move on a horizontal path. The crank OA is rotating at 180 rpm counter clockwise increasing at a rate of 50 rad/s². The dimensions of links are OA = 180 mm, CB = 240 mm, AB = 360 mm, BD = 540 mm. For the given configuration find **[12]**

    i) Velocity of slider D,

    ii) Angular velocity of links AB, CB and BD,

    iii) Angular acceleration of BD.

Q3) a) Explain with neat sketches three position synthesis of slider crank mechanism using relative pole method. **[5]**

b) Determine the Chebychev spacing for function $y = 2x^3 - x$ for the range of $0 \le x \le 4$ where four precision points are required. For three precision points determine **[12]**

θ_1, θ_2, θ_3, and ϕ_1, ϕ_2, ϕ_3 if $\Delta\theta = 45°$ and $\Delta\theta = 90°$

<div align="center">OR</div>

Q4) a) Explain in short : **[6]**

    i) Type synthesis,

    ii) Number synthesis,

    iii) Dimensional synthesis

b) Determine the Chebychev spacing for function $y = \log_{10}X$ for the range of $1 \le x \le 5$ where three precision points are required to be considered. **[11]**

Q5) a) Compare between Involute and Cycloidal gear tooth profile. **[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, length of the path of contact, arc of contact and contact ratio. **[12]**

OR

Q6) a) State and explain Law of gearing with neat sketch. **[5]**

b) Two involute gears in mesh have a module of 8mm and a pressure angle of 20°. The larger gear has 57 while pinion has 23 teeth. If addenda on pinion and gear wheels are equal to one module, Find contact ratio, angle of action of pinion and wheel, ratio of sliding to rolling velocity at beginning / end of contact and at pitch point. **[12]**

Q7) a) Define automation. Why automation is important for any industry? **[5]**

b) The following data relates to Knife Edge follower.

The follower to move outward through a distance of 20 mm during - 120°

The follower to dwell for the next - 60°

The follower to return to its initial position during - 90°

The follower to dwell for the remaining 90° of cam rotation.

The cam is rotating clockwise at a uniform speed of 500 rpm.

The minimum radius of the cam is 40 mm and line of stroke of the follower is offset 15 mm from the axis of the cam and displacement of the follower is to take place with uniform and equal acceleration and retardation both the inward and return stroke. **[13]**

OR

Q8) a) Write short note on : **[5]**

   i) Assembly line balancing

   ii) Buffer storages

b) A cam operates a roller, inline reciprocating follower while rotating at 300rpm. 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 = 150° (Nature of return is uniform acceleration and retardation where acceleration is equal to retardation in magnitude). Draw the cam profile. **[13]**

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[6179]-322

S.E. (Mechanical/Automobile)
APPLIED THERMODYNAMICS
(2019 Pattern) (Semester - IV) (202048)

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) *Neat diagrams must be drawn wherever necessary.*
4) *Make suitable assumption whenever necessary.*
5) *Scientific calculator is allowed.*

Q1) a) Outline the various phases involved in combustion in a compression-ignition engine. **[9]**

b) Illustrate and provide a concise explanation of the diverse types of combustion chambers in spark-ignition engines. **[8]**

OR

Q2) a) Define detonation in a spark-ignition engine and describe the different factors that influence detonation in such engines? **[8]**

b) Categorize the fuel injection systems employed in compression-ignition engines, and elucidate the operational mechanics of the Common Rail Diesel Injection system, accompanied by a clear diagram. **[9]**

Q3) a) The following data were recorded in a test of one-hour duration on a single cylinder oil engine working on four stroke cycle.
Bore = 300 mm, stroke = 450 mm, mean effective pressure = 5.8 bar, Brake friction load = 1860 N, Diameter of brake wheel = 1.22m, Fuel used = 8.8 Kg, CV. of fuel = 41800KJ/kg, Average speed = 200 RPM. Calculate **[10]**
i) Mechanical efficiency
ii) Brake thermal efficiency

b) Detail the operational process of the Non-Dispersive Infrared (NDIR) method for measuring emissions? **[8]**

OR

Q4) a) In a test of a four-cylinder four stroke petrol engine of 75mm bore and 100mm stroke, the following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082 Kg/min. **[9]**

BP with all cylinder working = 15.24 kW,

BP with cylinder 1 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 = 10,45 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 fuel is 44MJ/Kg.

b) Explain the following : **[9]**

i) Mean effective pressure

ii) Air fuel ratio

iii) Heat balance sheet.

Q5) a) What is the magneto ignition system and what are its advantages and disadvantages? **[9]**

b) Illustrate a well-labeled diagram of a wet sump lubrication system and provide a comparative analysis distinguishing the features of wet sump and dry sump lubrication systems. **[8]**

OR

Q6) a) Elaborate on thermostatic water-cooling systems, providing a detailed illustration. Additionally, distinguish the characteristics of air-cooling and water-cooling systems. **[9]**

b) Define supercharging and outline the distinctions between supercharging and turbocharging? **[8]**

Q7) a) A single stage, single acting reciprocating air compressor delivers air 0.7 kg of air per minute 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 150 mm respectively. The clearance is 3 % of swept volume. Assuming index of compression and expansion to be 1.3. **[9]**

Calculate,

   i) Volumetric efficiency of compressor.

   ii) Actual power required to run the compressor if η_{mech} = 85%.

b) Categorize various types of air compressors and provide a list of applications where air compressors are commonly utilized. **[9]**

<div align="center">OR</div>

Q8) a) A two stage reciprocating air compressor takes in air at 1 bar and 27 °C. Air is delivered at 10 bar. The intermediate pressure is ideal and intercooling is perfect. The law of compression is $PV^{1.35} = C$. The rate of discharge is 0.1 kg/s. Take R = 0.287 KJ/Kg.K and C_p = 1 KJ/Kg.K.**[9]**

Calculate,

   i) Power required to drive the compressor

   ii) Power required to compress the air in single compression

   iii) Isothermal efficiency for multistage.

b) Define the isothermal efficiency of compressors and elucidate the diverse methods and strategies employed to enhance compressor efficiency.**[9]**

<div align="center">▽ ▽ ▽ ▽</div>

[6179]-323

S.E. (Automobile and Mechanical)
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 indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a)   Distinguish between :   **[4]**

   i)   Uniform and Non-uniform Flow

   ii)   Laminar & Turbulent Flow

   b)   Derive a generalized continuity equation for three-dimensional flow field.

[6]

   c)   Given that $u = x^2 - y^2$ and $v = -2xy$, determine the stream function and potential function for the flow.   **[7]**

OR

Q2) a)   Explain the following properties with their mathematical properties: **[4]**

   i)   Velocity Potential

   ii)   Stream function

   b)   Prove that the velocity potential line and stream line are orthogonal to each other.   **[6]**

   c)   The stream function for a two-dimensional flow is given by $\psi = x^2 - y^2$. Calculate the velocity and acceleration at P (2,2).   **[7]**

Q3) a) What is Pitot tube? How Pitot Static Tube is used measure velocity of flow at any point in a pipe or channel? **[4]**

b) State Bernoulli's Theorem for a steady flow of an incompressible fluid flow. Derive Bernoulli's equation from Euler's equation along the stream line. Also, state the assumptions made while deriving it. **[6]**

c) Crude oil of viscosity 0.96 poise flows through a circular pipe of diameter 15 cm and the length of pipe is 15cm. Determine the difference in pressure at the two ends of the pipe if discharge is 4 lit/s. Also determine shear stress at the pipe wall. **[8]**

OR

Q4) a) What are the characteristics of laminar flow? **[4]**

b) Prove that for steady laminar flow through pipe, the velocity distribution across the section is parabolic and the average velocity is half the maximum velocity. **[6]**

c) A vertical venturi meter carries a liquid of relative density 0.8 and has inlet and throat diameter of 150mm and 75mm. The pressure connection at throat is 150mm above that at the inlet. If the actual rate of flow is 40lit/s and the C_d is 0.96, Calculate the pressure difference between inlet and throat in N/m². **[8]**

Q5) a) Explain the following term with their graphical representation: **[4]**

    i) Hydraulic Grade Line.

    ii) Total Energy Line.

b) Derive Dupit's equation. **[6]**

c) For the following velocity profiles, determine whether the flow is attached, detached or on the verge of separation. **[8]**

    i) $\dfrac{u}{U} = 2\left(\dfrac{y}{\delta}\right) - \left(\dfrac{y}{\delta}\right)^2$

    ii) $\dfrac{u}{U} = -2\left(\dfrac{y}{\delta}\right) + \left(\dfrac{y}{\delta}\right)^3 + 2\left(\dfrac{y}{\delta}\right)^4$

    iii) $\dfrac{u}{U} = 2\left(\dfrac{y}{\delta}\right)^2 + \left(\dfrac{y}{\delta}\right)^3 - 2\left(\dfrac{y}{\delta}\right)^4$

OR

Q6) a) Define the following term with brief explanations, **[4]**

   i) Streamline body

   ii) Bluff body

   b) What do you mean by Boundary Layer Separation? Write the methods of preventing the separation of boundary layer? **[6]**

   c) A pipe of diameter 0.4 m and of length 2000 m is connected to a reservoir at one end. The other end of the pipe is connected to a junction from which two pipes of lengths 1000 m and diameter 3000 m are parallel. These parallel pipes are connected to another reservoir, which is having level of water 10 m below the water level of the above reservoir. Determine the total discharge if f=0.015 Neglect minor losses. **[8]**

OR

Q7) a) State and explain Buckingham's π- theorem? What do you mean by repeating variables? How are repeating variables selected in Dimensional Analysis? **[8]**

   b) Prove that velocity through an orifice can be expressed as

   $$V = \sqrt{2gH}\, \phi\left[\frac{\mu}{\rho V H}, \frac{D}{H}, \frac{\sigma}{\rho V^2 H}\right]$$ H head, D orifice diameter, viscosity μ

   and density ρ, σ surface tension **[9]**

OR

Q8) a) Define following Dimensionless number and state their significance: **[8]**

   i) Reynolds Number

   ii) Mach's Number

   iii) Euler's Number

   iv) Weber Number

   b) The pressure difference ΔP in pipe of diameter D & length L due to viscous flow depends on velocity V and viscosity μ and density ρ. Using Buckingham's π theorem, obtain expression for pressure difference. as

   below $\Delta P = \dfrac{\mu v}{D} \times \dfrac{L}{D}\, \phi\left(\dfrac{SVD}{\mu}\right)$. **[9]**

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[6179]-324

S.E. (Automobile & Mechanical/Automation & Robotics)
MANUFACTURING PROCESSES
(2019 Pattern) (Semester - IV) (202050)
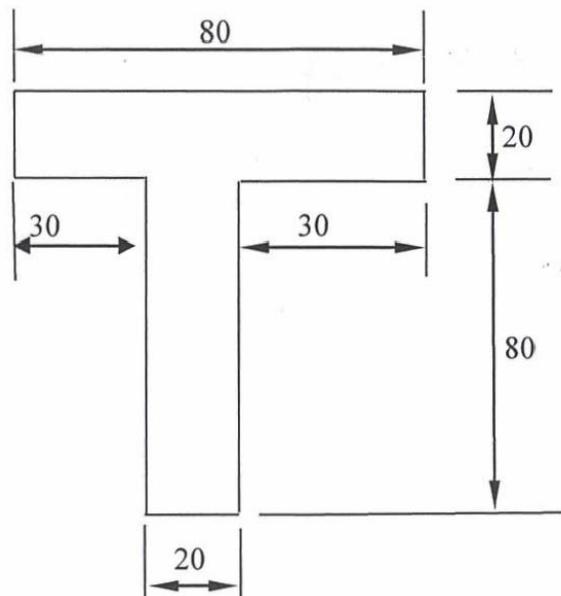
*Time : 2½ Hours]*   *[Max. Marks : 70*

Instructions to the candidates :

  1) *Neat diagrams must be drawn wherever necessary.*

  2) *Figures to the right indicate full marks.*

  3) *Assume Suitable data if necessary and mention it clearly.*

  4) *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.*

Q1) a)   Compare Compound Die and Progressive dies with neat sketch.   **[8]**

   b)   Find center of pressure of the component as shown in fig.   **[10]**

All dimensions are in mm.

OR

Q2) a)   Explain following press-working operations with neat sketch.   **[8]**

   i)   Punching,

   ii)   Blanking,

   iii)   Lancing,

   iv)   Perforating

P.T.O.

b) A Washer with a 12.7 mm internal hole and 25.4 mm outside diameter is to be made from a MS strip of 1.5 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 clearance to be 5% of the stock thickness.

Q3) a) Differentiate between Brazing and soldering. **[5]**

    b) With neat sketches state the characteristics of gas welding flames. **[6]**

    c) Explain Gas Tungsten Arc welding (GTAW) with neat sketch. **[6]**

<div align="center">OR</div>

Q4) a) Classify welding processes according to source of heat generation.**[5]**

    b) Explain Single carbon arc Welding with neat sketch. **[6]**

    c) Explain Metal Inert Gas Welding process with neat sketch. **[6]**

Q5) a) State any two applications of each of the following processes : **[6]**

    i) Transfer Molding,

    ii) Injection Molding,

    iii) Thermoforming process

    b) What are some of the attractive properties of plastics over metals? What are some of the major limitations of plastics over metals? **[6]**

    c) Compare between Thermosetting and Thermoplastic. **[6]**

<div align="center">OR</div>

Q6) a) Explain extrusion process for thermoplastic plastics. **[6]**

    b) Explain blow molding with suitable sketch. **[6]**

    c) Describe screw type injection moulding with neat sketch. **[6]**

Q7) a) What are composites? State its advantages, limitations and applications. **[6]**

b) Classify composite materials and discuss applications of each type. **[5]**

c) Differentiate between spray layup and hand lay up for composite process. **[6]**

OR

Q8) a) Differentiate between ceramic matrix and metal matrix composite. **[6]**

b) Write a short note on- polymer matrix composites (PMC). **[5]**

c) Explain hand lay-up process of composite manufacturing. **[6]**

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[6179]-325

S.E. (Automobile&Mechanical/Mechatronics)
(Mechanical S.W) (Automation & Robotics)
ENGINEERING MATHEMATICS-III
(2019 Pattern) (Semester-IV) (207002)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
  1) *Q.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 indicate full marks.*
  5) *Use of electronic pocket calculator is allowed.*
  6) *Assume suitable data, if necessary.*

Q1) Choose the correct option.

  a) ∇e^r is equal to   **[2]**

  i) $e^r \bar{r}$ ii) $\dfrac{e^r}{r}$

  iii) $\dfrac{e^r}{r} \bar{r}$ iv) $\dfrac{r}{e^r} \bar{r}$

  b)   The most general solution of heat equation $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ subject to usual

  initial and boundary conditions is u=   **[2]**

  i) $(c_1 \cos mx + c_2 \sin mx)e^{-c^2 m^2 t}$

  ii) $(c_1 \cos mx)e^{-c^2 m^2 t}$

  iii) $(c_2 \sin mx)e^{-c^2 m^2 t}$

  iv)   None of these

  c)   For the data presented in the form of frequency distribution, then the
      arithmetic mean $\bar{x}$ is given by (by considering N=Σf)   **[1]**

  i) $\dfrac{\sum fx}{N}$ ii) $N \sum fx$

  iii) $\dfrac{\sum f |x - A|}{N}$ iv) $\dfrac{\sum fx^2}{N}$

P.T.O.

d) The standard deviation and arithmetic mean of the distribution are 12 and 45.5 respectively. Coefficient of variation of the distribution is **[2]**
   i) 26.37
   ii) 32.43
   iii) 12.11
   iv) 22.15

e) An unbised coin is thrown 10 times, the probability of getting 6 heads is **[2]**
   i) 0.2000
   ii) 0.2050
   iii) 0.5
   iv) 0.3

f) The value of $\nabla . \bar{r}, \bar{r} = xi + yj + zk$, is **[1]**
   i) 0
   ii) 1
   iii) 2
   iv) 3

Q2) a) The first four moments about the working mean 30.2 of a 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. **[5]**

b) For the tabulated values of x and y given below fit a linear curve of the type $y = mx + c$ **[5]**

x	1.0	3.0	5.0	7.0	9.0
y	1.5	2.8	4.0	4.7	6.0

c) The regression equations are $8x - 10y + 66 = 0$ and $40x + 18y = 214$. The value of variance of x is 9. Find **[5]**
   i) The mean values of x and y.
   ii) The correlation x and y.
   iii) The standard deviation of y.

OR

Q3) a) Goals scored by two teams A and B in a football season were as follows: **[5]**

No of Goals Scored in a match		0	1	2	3	4
No of Matches	A	27	9	8	5	4
	B	17	9	6	5	3

b) Using following values of x and y. Fit the curve of the type $y = ab^x$ using least square method. **[5]**

x	2.1	2.5	3.1	3.5	4.1
y	5.14	6.788	10.29	13.58	20.578

c) Obtain regression lines for the following data **[5]**

x	2	3	5	7	9	10	12	15
y	2	5	8	10	12	14	15	16

Find estimal of y when x=6

Q4) a) Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both king. If **[5]**

i) The first card drawn is replaced.

ii) First card drawn is not replaced.

b) The number of accidents per week on a highway follows a poisson distribution with mean 0.5. Find the probability that during a week there will be at the most one accident. **[5]**

c) The lifetime of an article has a normal distribution with mean 400 hours and standard deviation 50 hours. Assuming normal distribution. Find the expected number of articles out of 2000 whose lifetime lies between 335 hours to 465 hours [Given : z=1.3, A=0.4032] **[5]**

OR

Q5) a) A can hit target 1 out of 4 times, B can hit the target 2 out of 3 times, C can hit the target 3 out 4 times. Find the probability of at least two hit the target. **[5]**

b) A fair coin is tossed 5 times. What is the probability of getting at least two tails? **[5]**

c) A nationalized 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	1	2	3	4
Number of Customers	150	250	170	230

Test whether the customers are uniformly distribution over the windows.

$$\left[Given\ \chi^2_{3.005} = 7.815\right]$$

Q6) a) Find the angle between the tangents to the curve $\bar{r} = t\bar{i} + t^2\bar{j} + t^3\bar{k}$ at $t=1$ and $t = -1$ **[5]**

b) Find $f(r)$ so that $f(r)\,\bar{r}$ is solenoidal. **[5]**

c) Evaluate $\int_C \bar{F}.d\bar{r}$ where $\bar{F} = (2x + y)\bar{i} + (3y - x)\bar{j}$ where C is the curve along Straight line joining (0,0) and (3,2). **[5]**

OR

Q7) a) Find the directional derivative of $\varphi = 5x^2y - 5y^2z + 2z^2x$ at $(1,1,1)$ in the direction of line $\dfrac{x-1}{2} = \dfrac{y-3}{-2} = \dfrac{z}{1}$ **[5]**

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

i) Show that $\nabla\left(\dfrac{\bar{a}.\bar{r}}{r^3}\right) = \dfrac{\bar{a}}{r^3} - \dfrac{3(\bar{a}.\bar{r})}{r^5}\bar{r}$

ii) Show that $\nabla^2\left(\dfrac{1}{r}\log r\right) = -\dfrac{1}{r^3}$

c) Apply Green's theorem to evaluate.

$\int_c (2x^2 - y^2)\,dx + (x^2 + y^2)\,dy$ Where C is the curve of area enclosed by the axis and the upper half of the circle $x^2 + y^2 = 16$. **[5]**

Q8) a) Solve $\dfrac{\partial u}{\partial t} = c^2\dfrac{\partial^2 u}{\partial x^2}$ subject to the following conditions. **[8]**

i) u is finite for all t

ii) $u(0,t) = 0, \forall t$

iii) $u(l,t) = 0, \forall t$

iv) $u(x,0) = u_0(\text{constant}), \text{for } 0 \leq x \leq l$

Where l is the length of the bar.

b) A tightly streatched string with fixed end points $x=0$ and $x=l$ is initially in

a position given by $y = y_0 \sin^3\left(\dfrac{\pi x}{l}\right)$. If it is released from rest from this

position, find the displacement y at any distance x from one end at any
time t. **[7]**

OR

Q9) a) An infinitely uniform metal plate is enclosed between lines $y=0$ and $y=l$,
for $x>0$. The temperature is zero along the edges $y=0$ and $y=l$ and at
infinity. If the edge $x=0$ is kept at a constant temperature u_0, find the
temperature distribution $u(x,y)$ **[8]**

b) Use fourier sine transform to solve partial differential equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \ 0 < x < \infty, t > 0$$
[7]

subjected to

i) $u(0,t) = 0, \quad \forall t$

ii) $u(x,0) = 4, \ 0 < x < 1$

$\qquad\qquad =0, \quad x > 1$

iii) u (x,t) is bounded.

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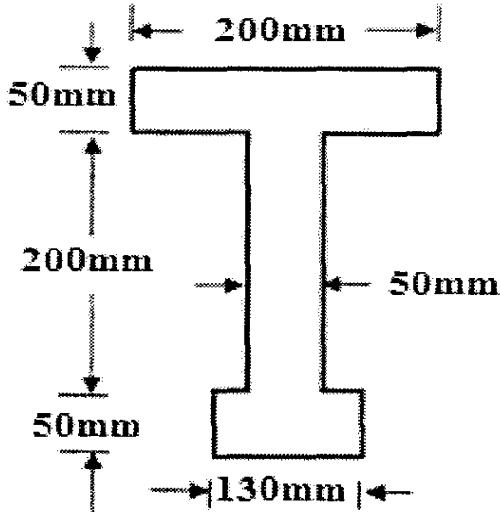
S.E. (Automobile & Mechanical/ Mechanical Sandwich and Automation & Robotics)

SOLID MECHANICS

(2019 Pattern) (Semester-III) (202041)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.*

2) *Figures to the right indicate full marks.*

3) *Use of electronic pocket calculator is allowed.*

4) *Assume suitable data, if necessary.*

Q1) a) The shear force of 50kN acts on I section beam as shown in fig. 1 have unequal flanges. Moment of inertia about neutral axis is 2.849×10^8 mm^4. Calculate magnitude of shear stress at important points and draw shear stress distribution diagram. **[9]**

Q1 (a) Fig.1
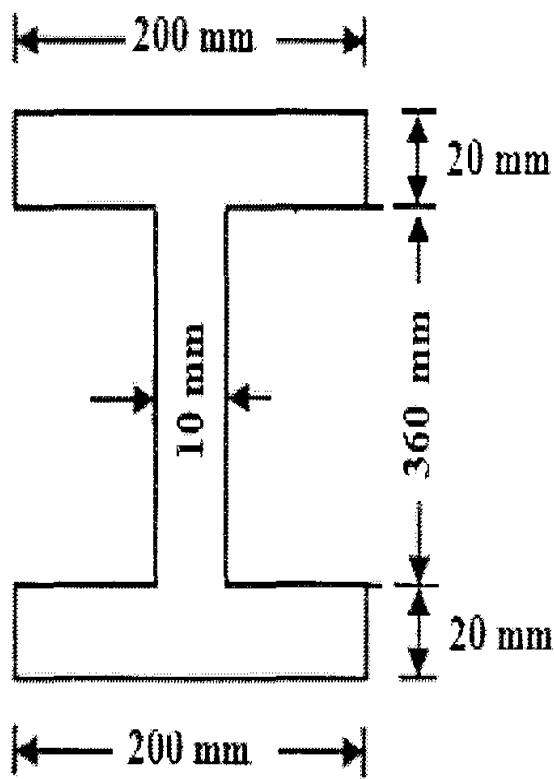
b) A beam of length 6 m is simply supported at its end and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from left Support. Find **[9]**

P.T.O.

i) Deflection under each load,

ii) Maximum deflection and

iii) Point at which maximum deflection occurs. Take $I = 85 \times 10^6$ mm^4 and $E = 2 \times 10^5$ N/mm^2.

OR

Q2) a) A simply supported beam is 10 m long carries udl of 40 kN/m over entire span. The cross section of beam is I as shown in fig.2. Calculate the maximum stress produced due to bending. Also draw bending stress distribution diagram across depth : **[9]**
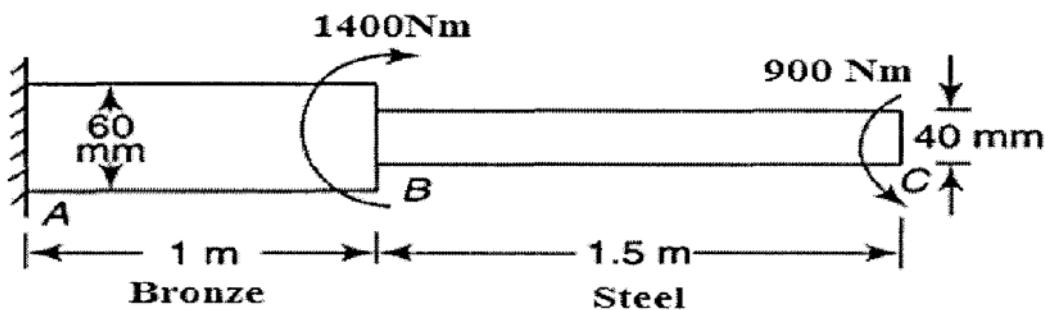

Q.2(a) Fig.2

b) The T shaped cross section of beam has 200 mm wide × 50 mm thick flange and overall depth of section is 250 mm. The web is 50 mm thick. Section is subjected to vertical shear force of 100 kN. Calculate the shear stress at the neutral axis and at the junction of flange and the web. Take I about NA = 1.134×10^8 mm^4. Also draw the shear stress distribution diagram. **[9]**

Q3) a) A shaft of hollow circular section has outer diameter 120mm, inner diameter 100mm. Permissible shear stress is 95MPa. Angle of twist is not to exceed 3.6 degree in a length of 3m. Maximum torque is 30% excess of mean torque. Speed of shaft is 2 Hz. Determine maximum power transmitted by shaft. Take G = 80 GPa. **[9]**

b) A cylindrical tube having internal diameter 70 mm and external diameter 80 mm is subjected to an axial tensile load of 90 kN undergoes an extension of 3 mm over its 8 m length. What is the safe axial load resisting capacity of Column when cylindrical tube is fixed at one end and free at other end. Determine safe load on column taking FOS as 3. **[8]**
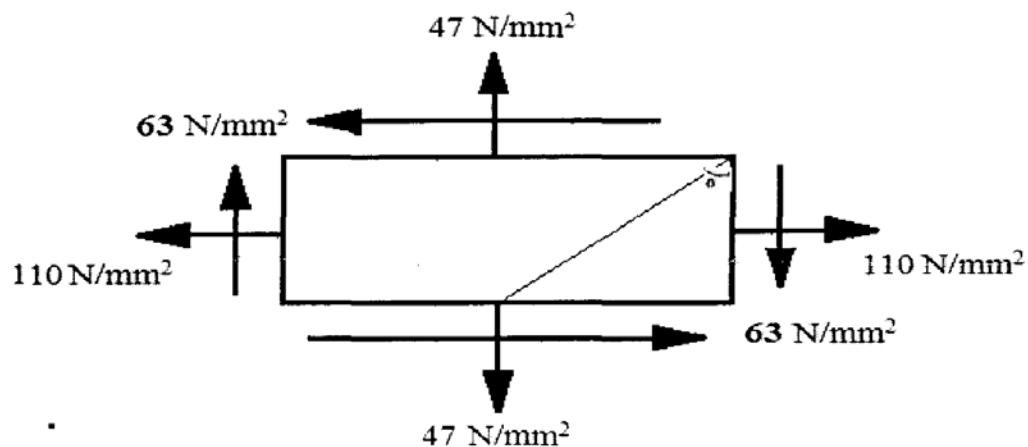
OR

Q4) a) The solid circular composite shaft ABC consists of steel and bronze segments as shown in fig.3. Shaft is rigidly fixed at A and free at C, subjected to a torque as shown. Determine angle of twist at free end with respect to fixed end. Take C = 83GPa for steel and C= 35 GPa for bronze. **[9]**

Q.4(a) Fig.3

b) A bar of length 4 m when used as SSB and subjected to UDL of 50 kN/m over the whole span, deflects 20 mm at Centre. Determine the crippling load when it is used as a column with following conditions. **[8]**
   i) Both end pinned joints
   ii) One end fixed and other end free
   iii) Both end fixed

Q5) a) A strained material is subjected to stresses σx = 110 N/mm² Tensile, σy = 47 N/mm² (Tensile) and τxy = 63 N/mm². Determine the intensity of normal tangential and resultant stress and angle of obliquity on a plane inclined at 30° to the plane carrying 110 N/mm² stress as shown in Fig.4. Also find Principal stresses and its orientation. Use analytical method. **[12]**

[6179]-326   3

47 N/mm²

63 N/mm²

110 N/mm²

110 N/mm²

63 N/mm²

47 N/mm²
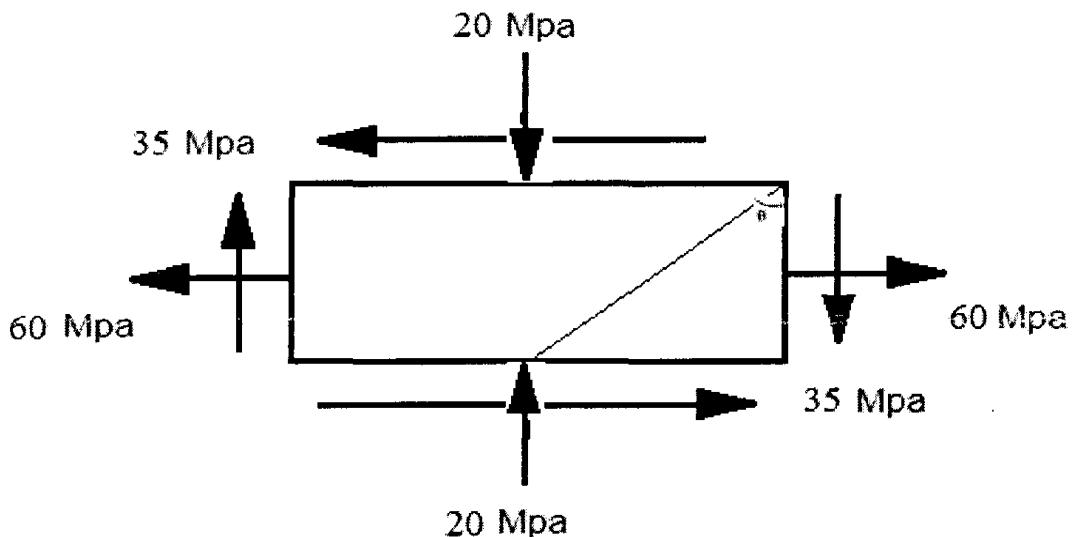
Q.5(a) Fig.4

b) According to maximum shear stress theory determine the diameter of a bolt which is subjected to an axial pull force of 9 kN together with a transverse shear force of 4.5kN. Elastic limit in tension is 225N/mm², factor of safety is 3. **[6]**

OR

Q6) a) The planes are stressed as shown in fig.5, determine the principal stresses and its orientation. Determine normal and tangential stresses on oblique plane inclined at 30° with the plane of 60 MPa. Also determine the maximum shear stress and plane on which it acts using Mohr's Circle method. **[12]**


20 Mpa

35 Mpa

60 Mpa

60 Mpa

35 Mpa

20 Mpa

Q.6(a) Fig.5

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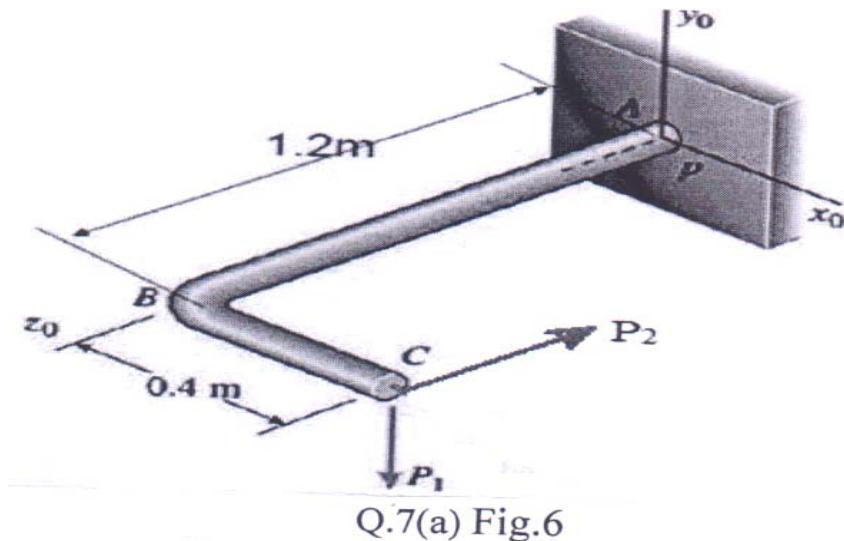
b) A machine element is subjected to the stress σx = 60 MPa, σy = 45MPa, τ_{xy} = 30 MPa. Find the factor of safety if it is made of C45 steel having yield stress as 353 MPa. Using the following theories. Take 1/m = 0.3.**[6]**

    i)   Maximum shear stress theory

   ii)   Distortion energy theory, Maximum principal strain theory.
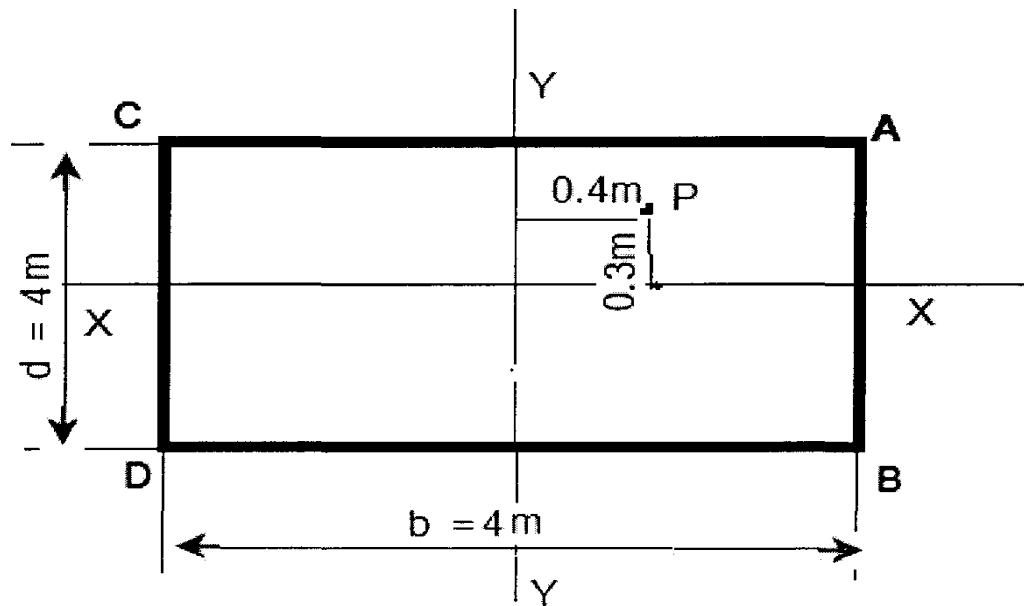
Q7) a)   A horizontal bracket ABC consist two perpendicular arm having circular cross section with diameter 60 mm. At point C, P_1 vertical load 2.02kN and P_2 horizontal 3.07 kN are acting as shown in fig. 6. Neglecting weight of bracket calculate the maximum and minimum stresses developed at support due to P_1 & P_2.   **[9]**

Q.7(a) Fig.6

b)   A solid shaft of diameter 80 mm is subjected to twisting moment of 8 MN-mm and bending moment of 5 MN-mm at a point. Determine   **[8]**

    i)   Principal stresses and

    ii)   Position of plane on which it acts.

OR

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Q8) a) Determine the resultant stress at four corners of column subjected eccentric load of P= 600 kN as shown in Fig. 8. **[9]**

Q.8(a) Fig.8

b) Draw core or kernel of section for a rectangular section having dimensions 600 mm × 450 mm. show the dimension of core/kernel of section in it. **[8]**

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S.E. (Automobile & Mechanical / Mechanical SW / Automation & Robotics)
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 wherever necessary.*

Q1) a)   What is Geometry & Topology? Also differentiate between Sweep & Loft? **[8]**

     b)   What is sweep representation in solid modeling? Explain any four types with neat sketches. **[9]**

OR

Q2) a)   What do you mean by assembly modeling? Also differentiate between bottom up assembly and top down assembly. **[8]**

     b)   Explain the concept of feature based modeling with its advantages and disadvantages. **[9]**

Q3) a)   Given a triangle with corner coordinates (0, 0), (1, 0) and (1, 1). Rotate the triangle 90 degree anticlockwise direction and find out the new coordinates. **[9]**

     b)   What is the transformation? Explain it in details with classification? **[9]**

OR

Q4) a)   What is Geometric Projection? Explain any two types of projections in details. **[10]**

     b)   Write a short note on any two with neat sketch : **[8]**

         i)   Model Coordinate System (MCS)

         ii)   Working Coordinate System (WCS)

         iii)   Screen Coordinate System (SCS)

Q5) a) Explain the any two file formats with its significance and advantages. **[10]**

b) Explain Data Interoperability with its issues encountered for implementing in CAD? **[7]**

OR

Q6) a) Explain the concept of Multi-Body Dynamics with suitable example? **[8]**

b) What is Additive Manufacturing? Explain the 3D printing with principal of working, advantages and disadvantages? **[9]**

Q7) a) Explain in detail Model Based Definitions (MBD). How the MBD approach is different from the traditional approach? **[9]**

b) What is CAD customization? Explain Need for CAD Customization. **[9]**

OR

Q8) a) Explain CAD Automation with types and suitable examples? **[9]**

b) Explain Application Programming Interface in details with its advantages & disadvantages. **[9]**

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S.E. (Mechanical-Sandwich/Automobile & Mechanical) ENGINEERING THERMODYNAMICS
(2019 Pattern) (Semester - III) (202043) (Theory)

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, steam table is allowed.*

    5)   *Assume suitable data, if necessary.*

Q1) a)   Give the following statements of second law of thermodynamics.   **[7]**

      i)   Clausius statement

      ii)   Kelvin-Plank statement

    b)   A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is -340KJ. The system completes 200 cycles per minute.   **[10]**

      Complete the following table showing the method for each item and compute the net rate of work output in kW.

Process	Q KJ/min	W KJ/min	ΔE KJ/min
1-2	0	4340	?
2-3	42000	0	?
3-4	-4200	?	-73200
4-1	?	?	?

OR

Q2) a) A system at 500 K receives 7200 KJ/min from a source at 1000 K. The temperature of atmosphere is 300 K. Assuming that the temperature of system and source remain constant during heat transfer, Determine: **[8]**

 i) The entropy produced during heat transfer

 ii) The decrease in available energy after heat transfer.

 b) State Boyle's law and Charle's law and derive an equation of the state for a perfect gas? **[9]**

Q3) a) Explain the following terms: (i) Saturated steam, (ii) Dry saturated steam, (iii) Wet steam, (iv) Superheated steam, (v) Dryness fraction of steam, (vi) Specific volume of steam, and (vii) Saturated water. **[8]**

 b) 0.025 m³ of steam at 3.5 bar and dryness fraction 0.8 is converted into dry saturated steam at 11 bar. By how much are the enthalpy and internal energy changed? **[10]**

OR

Q4) a) A Rankine cycle operates between pressure of 80 bar and 0.1 bar. The maximum cycle temperature is 600°C. If the steam turbine and condensate pump efficiencies are 0.9 and 0.8 respectively. Calculate specific work and thermal efficiency? **[12]**

P	T°C	Specific Volume m³/kg		Specific Enthapy KJ/Kg			Specific Entropy KJ/KgK		
bar		v_f	V_g	h_f	h_{fg}	h_g	S_f	S_{fg}	S_g
0.1	45.84	0.0010103	14.68	191.9	2392.3	2584.2	0.6488	7.5006	8.1494
80	295.1	0.001385	0.0235	1317	1440.5	2757.5	3.2073	2.5351	5.7424

At 80 bar, 600°C: V_{sup} = 0.486 m³/Kg; h_{sup} = 3642 KJ/Kg; S_{sup} = 7.0206 KJ/Kg K

 b) Explain the constructional details & working of Throttling calorimeter? **[6]**

Q5) a) How the analysis of exhaust and flue gas carried out? Explain in details with neat sketch? **[6]**

 b) The following is the ultimate analysis of a sample of petrol by weight: Carbon, C = 85%, Hydrogen, H_2 = 15% **[11]**

 Calculate the ratio of air to petrol consumption by weight if the volumetric analysis of dry exhaust gas is:

 CO_2 = 11.5%, CO = 1.2%, O_2 0.9%, N_2 = 86%

 Also; determine the % excess air supplied?

OR

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Q6) a) What do you mean by Higher Calorific value of fuel (HCV) and lower calorific value of fuel (LCV)? Name the apparatus used for the determination of HCV of the fuel. **[6]**

b) A fuel $C_{10}H_{22}$ was burnt using an air fuel ratio of 13:1 by weight. Determine the complete gravimetric analysis of the products of combustion, assuming that the whole amount of hydrogen burns to form water vapour and there is neither any free oxygen nor any free carbon. ***The carbon burns to CO_2 and CO***. Air contains 77% of nitrogen and 23% of oxygen by weight. **[11]**

Q7) a) What is the function of Boiler Accessories? Explain with neat sketches any two of the accessories? **[8]**

b) In a boiler test 1250 Kg of coal are consumed in 24 hours. The mass of water evaporated is 13000 Kg and the mean effective pressure is 7 bar. The feed water temperature was 40°C, heating value of coal is 30000 KJ/Kg. The enthalpy of 1 Kg of steam at 7 bar is 2570.7 KJ. Determine:**[10]**

   i) Equivalent Evaporation per Kg of coal;

   ii) Efficiency of the Boiler.

<div align="center">OR</div>

Q8) a) What do you mean by Boiler Draught and how are they classified. Enumerate the advantages of Mechanical Draught? **[6]**

The following observations were made during the trial of a boiler plant consisting of a battery of 6 Lancashire boilers and an economizer:

Calorific value of fuel/coal per Kg ....29915 KJ

Mass of feed water per Kg of dry coal ....9.1 Kg

Equivalent Evaporation from and at 100°C per Kg of dry coal .... .9.6 Kg

Temperature of feed water to economizer ....   12°C

Temperature of feed water to boiler ....   105°C

b) Air Temperature ....   13°C **[12]**

Temperature of the flue gases entering economizer ....   370°C

Mass of flue gases entering the economizer ..   18.2 Kg/Kg of coal
Mean specific heat of flue gases ....   1.046 K.J/Kg°C
Determine:

   i) The efficiency of the boiler alone?

   ii) The efficiency of the economizer alone?

   iii) The efficiency of the whole plant?

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S.E.

(Automobile & Mechanical Engineering/Mechanical SW/ Automation & Robotics)

Engineering Materials and Metallurgy

(2019 Pattern) (Semester-III)(202044)

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, No.5 or Q.No. 6, Q.No. 7or Q.No.8.*

   2)   *The figures to the right indicate full marks.*

   3)   *Use Graph Paper for Graphical Solution.*

   4)   *The use of an electronic pocket calculator is allowed.*

   5)   *Assume suitable data if necessary.*

Q1) a) With neat labels draw Iron Carbon Equilibrium Diagram? **[6]**

    b) Discuss nucleation & crystal growth in solidification of pure metals?**[6]**

    c) Discuss Hume Rothery rules for substitutional solid solutions? **[6]**

OR

Q2) a) Explain homogenous and heterogeneous nucleation with neat sketches.**[6]**

    b) What is Equilibrium diagram? With diagram explain three important reactions in Iron Carbon Equilibrium diagram? **[6]**

    c) Draw neat microstructures of the following: **[6]**

       i)   0.2% carbon steel,

       ii)   0.8% carbon steel

       iii) 1.2% carbon steel

Q3) a) Write short note on carburizing and list its applications? **[6]**

b) Explain the transformation of austenite into pearlite and bainite with neat sketch? **[6]**

c) Define hardenability? Differentiate between austempering and Martempering withdiagram? **[5]**

<div align="center">OR</div>

Q4) a) Define annealing and explain types of annealing? **[6]**

b) Draw isothermal time temperature transformation diagram? What is the importance of TTT diagrams in Heat Treatment processes? **[6]**

c) Differentiate between Carburizing and Nitriding. **[5]**

Q5) a) Explain classification of Alloying Elements of steel with respect to the relation with carbon. Give examples for each category? **[6]**

b) Define steel? Explain classification of steel with applications? **[6]**

c) Draw the microstructure of Grey Cast Iron, White Cast Iron and Nodular Cast Iron. **[6]**

<div align="center">OR</div>

Q6) a) State the composition of the following steel which is specified as per Indian Standard Designation System: **[6]**

i) T75W18Cr4V1   ii) Fe410K   iii) C20

iv) St 310K   v) 80 T11   vi) FeE330

b) Write a short note on Grey Cast Iron and Nodular Cast Iron. **[6]**

c) Discuss effect of alloying elements on steel. **[6]**

Q7) a) Give typical composition, important properties and applications of Inconel? **[6]**

b) What is age hardening? Explain with example application of age hardening? **[6]**

c) List important properties of aluminium? Write composition and application of duralumin? **[5]**

<div align="center">OR</div>

Q8) a) Write short note on: Titanium and its alloys **[6]**

b) Differentiate between Brass and Bronze? **[6]**

c) What properties are required for bearing materials? Give composition of any two nonferrous alloy used as bearing? **[5]**

<div align="center">▶◀ ▶◀ ▶◀</div>

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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 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 calculators is allowed.*

Q1) a) What is the back emf in a DC motor? Explain the significance of back emf in the operation of the motor. **[4]**

b) Derive the expression for the armature torque developed in a DC motor. **[6]**

c) The armature resistance of a 200 V DC shunt motor is 0.4 Ω and the no load armature current is 2 A. When loaded and taking an armature current of 50A, the speed is 1200 rpm. Find the no load speed. **[8]**

OR

Q2) a) Draw the cross sectional view of a DC motor and name important part of it. **[4]**

b) What is electrical braking in a DC motor? Explain regenerative braking for a DC shunt motor in detail. **[6]**

c) A 250 V DC shunt motor has armature circuit resistance of 0.2 Ω and field resistance of 125 Ω. it runs at 1500 rpm and draws a current of 50A on full load. Calculate the speed of motor at half load condition.**[8]**

Q3) a) Enlist any three applications of a three phase induction motor. **[3]**

b) Draw and explain the torque-slip characteristics of a 3 phase induction motor in details. **[6]**

c) A 24 pole. 50Hz star connected induction motor has rotor resistance of 0.016 Ω per phase and rotor reactance of 0.265 Ω per phase at standstill. It is achieving its full load torque at a speed of 247 rpm. Calculate the ratio of i) full load torque to maximum torque ii) starting torque to maximum torque. **[8]**

OR

Q4) a) Explain the working principle of a three phase induction motor. **[3]**

b) What is the need of a starter for a three phase induction motor? Explain the operation of a star-delta with the help of neat diagram. **[6]**

c) A 4 pole,50 Hz. three phase induction motor runs at 1440 rpm while delivering the power output of 40kW. The stator losses at this load are equal to rotor losses and mechanical losses amount to 3500 W. **[8]**
Calculate :
   i) slip
   ii) mechanical power developed by rotor
   iii) rotor cu loss
   iv) rotor input
   v) stator input and
   vi) efficiency

Q5) a) List the significant benefits of use of an electric vehicle. **[4]**

b) Draw the block diagram of the structure of an electric vehicle and explain the function of any three major parts. **[6]**

c) Explain the configuration of a Battery Electric Vehicle (BEV) with the help of a diagram. **[8]**

OR

Q6) a) Write the challenges faced by EV technology in present days. **[4]**

b) Explain the Vehicle to Grid (V2G) technology with the help of a diagram. **[6]**

c) Explain the configuration of a Plug-in Hybrid Electric Vehicle (PHEV) with the help of a diagram. **[8]**

Q7) a) Explain the C - rate of a battery. **[3]**

b) Elaborate the factors used in the selection of an energy storage device in case of EVs. **[6]**

c) Explain the working of a three phase induction motor drive for EVs with the help of block diagram. **[8]**

OR

Q8) a) Calculate the capacity of a battery in Wh if a 2kW of constant power is discharged for the duration of 2.5 hours .**[3]**

b) What are supercapacitors? Explain the role of supercapacitors in the development of electric vehicles. **[6]**

c) Explain the construction and working of a BLDC motor drive using suitable diagram. **[8]**

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S.E. (Mechanical Sandwich)

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. 7or 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 the following term with their graphical representation: **[6]**
  i) Hydraulic Grade Line
  ii) Total Energy Line.

b) Derive an expression for maximum power transmitted through the pipe.**[6]**

c) Write he following term in M L T form **[4]**
  i) Viscosity   ii) Surface Tention

OR

Q2) a) Derive an expression of velocity and Shear stress distribution for laminar flow between fixed Parallel plates. **[8]**

b) Define following Dimensionless number and state their significance: **[8]**
  i) Reynolds Number
  ii) Mach's Number
  iii) Euler's Number
  iv) Weber Number

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) A jet of water moving with V m/s strikes at the centre of a curved vane which is moving with u m/s. If the outgoing jet makes an angle θ with the incoming jet, prove that **[8]**

i) Maximum efficiency, ηmax= 8/27(1 + cosθ)

ii) Blade speed, u = *V*/3

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 effieciency = 95% Calculate the power delivered by the runner, speed ratio , Hydraulic Efficiency, Overall efficiency and. Draw velocity triangle. **[10]**

b) Explain the functions of following. **[8]**

i) Casing of Pelton wheel

ii) Notch of bucket

iii) Governing mechanism

Q5) a) Explain unit quantities in reaction turbine. **[6]**

b) For the Francis turbine following data is available **[8]**

shaft power = 130 kW

Net Head = 9m, Speed = 120 RPM,

Overall efficiency = 75%,

Hydraulic efficiency = 90%,

Velocity of flow at inlet = 1,15 H

Maximum absolute velocity at inlet = 3.45 H 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 77m³/s. The runner dimeter and hub diameter are 4.2m and 1.5 m respectively. Taking the speed ratio of 2.1. 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. **[8]**

b) Write difference between Impulse turbine and Reaction turbine. **[6]**

c) Explain the following terms.(any two) **[4]**

i) Specific speed (ii) Run away speed (iii) Degree of reaction

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 m3/s. If the manometric efficiency of the pump is 75%, determine: (i) the diameter of the impeller, and (ii) the width of the impeller at outlet. **[7]**

b) Explain the following terms (any three) **[6]**

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) Explain working principle of centrifugal pump with figure. **[6]**

b) 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]**

c) What is Priming? Explain methods of priming in pump. **[5]**

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S.E. (Mechanical Sandwich)
MANUFACTURING ENGIEERING
(2019 Pattern) (Semester - IV) (202063)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:
1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *Assume Suitable data if necessary and mention ft clearly.*
4) *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.*

Q1) a) What are the problems encountered with the use of coated electrodes?**[5]**

b) Illustrate with neat sketches common types of welded joints. **[5]**

c) Explain GTAW (Gas Tungsten Arc Welding) process with neat sketch. Give its advantages and limitations. **[7]**

OR

Q2) a) Describe the principle of oxy-fuel gas cutting. **[5]**

b) A Flux covered arc welding electrode is designated by 6 digit numeral as shown below. Explain the meaning of each one **E-3-2-5-411-P**. **[5]**

c) Explain spot welding process with neat sketch. **[7]**

Q3) a) In an orthogonal cutting if the feed is 1.25 mm/rev, and chip thickness after cutting is 2 mm and shear angle is 10 degrees. Determine: i) Chip thickness ratio, ii) Shear angle. **[5]**

b) State Taylors' Tool life equation. Enlist the factors affecting tool life. **[5]**

c) Explain any two methods of taper turning with neat sketches. **[8]**

OR

Q4) a) Demonstrate the various types of chips formed during metal cutting. **[5]**

b) How do you specify a lathe machine? **[5]**

P.T.O.

c) The following equation for tool life is given for a turning operation $vT^{0.13}f^{0.77}d^{0.37} = C$, A 60 min tool life was obtained while cutting at $v = 30$ m/min, $f = 0.30$ mm/rev, and $d = 2.5$ mm. Calculate the change in tool life if the cutting speed, feed and depth of cut are increased by 25% together. **[8]**

Q5) a) Differentiate between Gang and Multi spindle drilling. **[5]**

b) Explain following Milling operations with suitable sketch : **[5]**
   i) Straddle Milling
   ii) Gang Milling

c) Index for **69** divisions by compound indexing using following Brown and Sharpe Plate. **[7]**
   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

OR

Q6) a) Calculate the time required to produce 10 holes on a MS plate of 40 mm thickness with the following data : **[5]**
   (i) Drill diameter = 30 mm, (ii) cutting speed = 25m/min, (iii) Feed = 0.1 mm/rev., (iv) Overrun and approach 0.3 x drill diameter

b) Explain the geometry of a Milling cutter. **[5]**

c) Construct a Radial Drilling Machine and Explain. Show various motions of tool head. **[7]**

Q7) a) Explain the meaning of following letters which are used to specify Grinding wheel. **[5]**
   W-A-46-K-5-V-17

b) Explain the Principle of centreless grinding with neat sketch. **[5]**

c) Draw a neat sketch of broach and name the functions of its different parts. **[8]**

OR

Q8) a) Explain dressing of a grinding wheel. **[5]**

b) What is mean by the terms Grit, Grade and structure of a Grinding Wheel? **[5]**

c) Explain Lapping and Honing processes with neat sketch. **[8]**

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[6179]-333

S.E. (Mechanical Sandwich)
THERMAL ENGINEERING
(2019 Pattern) (Semester - IV) (202061)

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. 6 or Q. No. 8.*
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) *Figure to the right indicate full marks.*
5) *Assume suitable data, if necessary.*

Q1) a) Define the following terms :   **[8]**
   i)   Relative humidity
   ii)   Dry bulb Temperature
   iii) Wet bulb depression
   iv)   Absolute Humidity

   b) Explain on the Psychrometric Chart following Processes   **[9]**
   i)   Cooling and Dehumidification
   ii)   Heating and Humidification

<center>OR</center>

Q2) a) How the air conditioning systems are classified and explain the year-round air-conditioning system with neat sketch.   **[8]**

   b) Atmospheric air at 30 °C dry bulb temperature and 45 % R.H. is to be conditioned to 17 °C dry bulb temperature and 15 °C wet bulb temperature. Find the amount of heat rejected by the air. Also find the sensible heat factor of the process.   **[9]**

Q3) a) Explain Diesel cycle with the help of P-V & T-S diagram, and derive an expression for ideal efficiency of Diesel cycle.   **[9]**

   b) How gas turbines are classified and explain Open cycle gas turbine and closed cycle gas turbine with neat sketch.   **[9]**

Q4) a) Explain Closed Cycle Gas Turbine 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 50mm, a stroke is of 75 mm and the clearance volume is of 21.3 cm³. **[9]**

Q5) a) Explain the supercharging and turbocharging with neat sketch. **[8]**

b) Explain with neat sketch battery ignition system. **[9]**

OR

Q6) a) Explain the air-cooling system and what are its advantages and disadvantages? **[8]**

b) What is necessity of lubrication system and what are different types Lubrication systems and explain any one? **[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
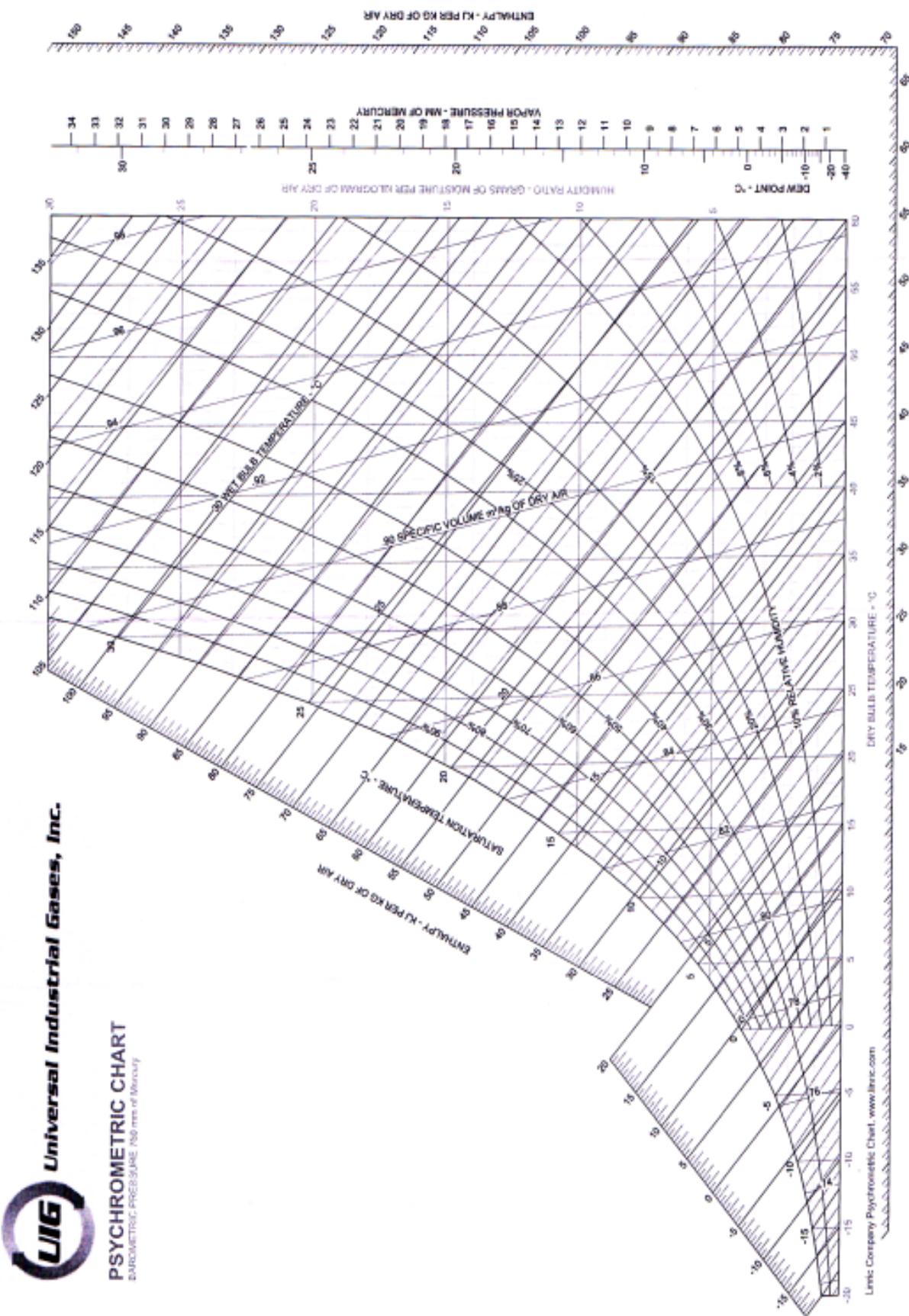
Q8) a) Explain stages of combustion in SI engine with P-θ diagram. **[9]**

b) An IC engine uses 6 kg of fuel having calorific value 44000 KJ/kg in one hour. The IP developed is 18 KW. The Temperature of 11.5 kg of cooling water was found to rise through 25 ° C per minute. The temperature of 4.2 kg of exhaust gas with specific heat 1 KJ/kg K was found to rise through 220 °C. Draw the heat balance sheet for the engine. **[9]**

PSYCHROMETRIC CHART
BAROMETRIC PRESSURE 750 mm of Mercury

Universal Industrial Gases, Inc.

Lmtc Company Psychrometric Chart. www.liinc.com

[6179]-334

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 grippers in a brief.   **[4]**

     b)   Discuss mechanical grippers with neat sketch.   **[6]**

     c)   Explain in brief Active and Passive compliance.   **[8]**

<p align="center">OR</p>

Q2) a)   Explain characteristics of Grippers.   **[4]**

     b)   Explain the design consideration for selection of gripper.   **[6]**

     c)   Illustrate which type of gripper is suitable for following application and justify.   **[8]**

        i)   Industrial Spray Painting

        ii)   Pick & Place

Q3) a)   What is meant by LVDT. State its applications.   **[4]**

     b)   Explain in a brief Piezo Electric sensor with the figure.   **[6]**

     c)   Explain in a brief Force and Torque sensors.   **[7]**

<p align="center">OR</p>

Q4) a)   Explain sensor selection criteria for robotics applications.   **[4]**

     b)   Explain in a brief Proximaty Sensor. With the figure.   **[6]**

     c)   Explain with block diagram machine vision system for robots.   **[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].

<div align="center">OR</div>

Q6) a) Explain properties of Jacobian Matrix of a manipulator. **[4]**

b) Explain the steps involved in DH Notation for 2 DOF Robot. **[6]**

c) Explain the geometric based inverse kinematic analysis of two joints robot. **[8]**

Q7) a) Explain and compare different methods of Robot Programming. **[4]**

b) Write short note on Offline Robot Programming. **[6]**

c) Write a program to write letters by Robot using VAL Language. **[7]**

<div align="center">OR</div>

Q8) a) Sketch and explain with suitable example "A Robot Program as a path in Space". **[4]**

b) Write short note on Online Programming. **[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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[6179]-335

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) A siphon of diameter 0.2m connects two reservoirs having a difference in elevation of 15m. The length of the siphon is 400m and summit is 3m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 12[0m. Determine the discharge through the siphon and also pressure at the summit. Neglect minor losses. Take coefficient of friction f = 0.005. **[10]**

  b) Explain the characteristics of Laminar and Turbulent flow. What is Raynolds number? What significance of Reynold's number in case of Laminar and Turbulent flow. **[8]**

OR

Q2) a) 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 m3/se. Assuming. friction factor = 0.04, determine rate at which water enters in the lown reservior. **[10]**

  b) Explain major losses and derive equation for finding out losses due to friction. **[8]**

Q3) a) What is actuator? Explain any one type of actuator with appropriate diagram. **[8]**

  b) Write a note on **[9]**

    i)   Electric actuator

    ii)   Solenoid actuator and

    iii) Digital actuator

P.T.O.

OR

Q4) a) State the classification of control valve and differentiate between ball valve and pinch valve. **[8]**

b) Explain the noise problems associated with control valve and their remedies. **[9]**

Q5) a) Single stage reciprocating air compressor takes in 8 m³/min of air at 1 bar and 30°C and delivers it at 6 bar. The clearance is 5% of the stroke. The expansion and compression are polytropic, n = 1.3, Calculate : **[10]**

　　 i) The temperature of delivered air

　　 ii) Volumetric efficiency

　　 iii) Power of the compressor

b) Draw and explain actual indicator diagram of reciprocating compressor. **[7]**

OR

Q6) a) An air compressor cylinder has 150mm bore and 150mm stroke and the clearance is 15%. It operates between 1 bar, 27°C and 5 bar. Take polytrophic exponent n = 1.3 for compression and expansion processes find? **[10]**

　　 i) Cylinder volume at the various salient points of in cycle.

　　 ii) Flow rate in m3/min at 720 rpm

　　 iii) The volumetric efficiency.

b) Differentiate between Reciprocating and Rotary Compressors. **[7]**

Q7) a) A plane brick wall 25cm thick, if faced with 15 cm thick concrete layer. If temperature of the exposed brick face is 70°C and that of the concrete is 25°C, Find out the heat lost per hour through a wall of 15m × 10m. Also determine the interface temperature. Thermal conductivity of brick and concrete are 0.7 W/mK and 0.95 W/mK resp. **[10]**

b) Derive general three-dimensional heat conduction equation in Cartesian coordinates. Also, deduce the equation in simplified forms. **[8]**

Q8) a) A 2m long and 0.3cm diameter electric wire extends across a room at 15°C. Heat is generated in the wire as a result of resistance heating and surface temperature of wire is measured to be 152°C in steady operation. Also the voltage drop and electric current through the wire are measured to be 60 V and 1.5 A, respectively. Disregarding any heat transfer by radiation, determine the convection heat transfer coefficient for heat transfer between the outer surface of the wire and the air in the room. **[10]**

b) State Fourier's law of heat conduction with assumptions? Explain the concept of Thermal conductivity and thermal diffusivity. **[8]**

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[6179]-336

S.E. (Automation & Robotics Engineering)
ELECTRICAL TECHNOLOGY
(2019 Pattern) (Semester-III) (202521)

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) Explain the construction and working of a linear induction motor with the help of suitable diagrams. **[6]**

b) Obtain the expression for torque developed in a three phase induction motor. **[6]**

c) Draw a neat schematic of star- delta starter for three phase induction motor and explain its operation. **[6]**

OR

Q2) a) Distinguish between squirrel cage and slip ring induction motors. **[6]**

b) Draw and explain the torque-speed characteristic curve of a three phase induction motor. **[6]**

c) Write any two applications each in case of following motors. **[6]**

   i) Linear induction motor

   ii) Slip ring induction motor

   iii) Permanent Magnet Synchronous Motor

Q3) a) What is a brushless alternator? Explain its working principle. **[6]**

b) Derive the emf equation of an alternator in steps. **[6]**

c) Write the steps in selecting a particular motor for an industrial application. **[5]**

OR

P.T.O.

Q4) a) What are synchronous machines? Describe construction of a synchronous machine with the help of suitable diagrams. **[6]**

b) Explain construction and working of any one type of stepper motors. **[6]**

c) What is meant by a duty cycle in case of electric motors? State types of duty cycles for electric motors. **[5]**

Q5) a) Compare the DC and AC systems for transmission and distribution. **[6]**

b) Explain the necessity of EHV transmission lines in power systems. **[6]**

c) Draw typical layout of power systems structure involving generation and utilisation of electrical power. **[6]**

OR

Q6) a) Explain the typical Electric Supply System with the help of neat diagram. **[6]**

b) Classify the types of HVDC links. Discuss the applications of each of these links. **[6]**

c) Briefly discuss the advantages and operational problems of HVDC transmission system. **[6]**

Q7) a) Differentiate between a field controlled DC servomotor with an armature controlled DC servomotor. **[6]**

b) Using the block diagram reduction technique, determine the transfer function C(s)/R(s). **[6]**


Fig. Q. 7 b)

[6179]-336   2
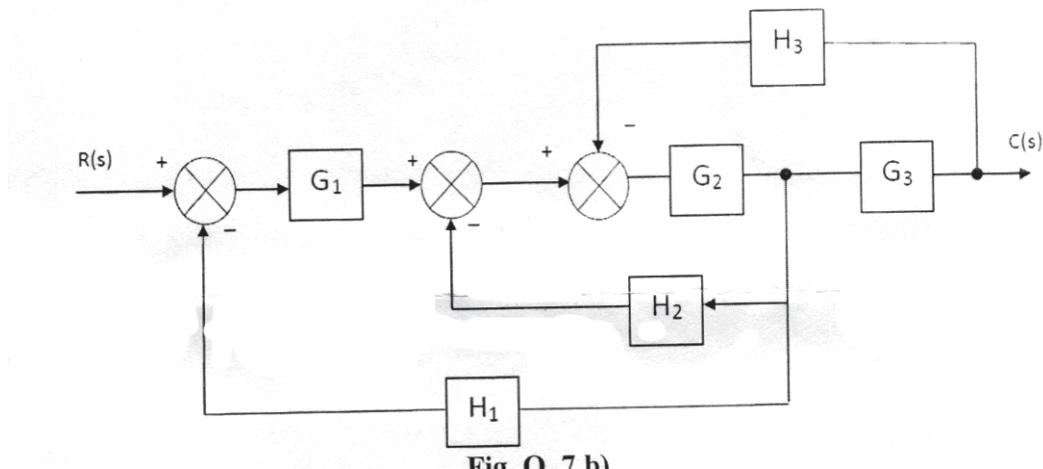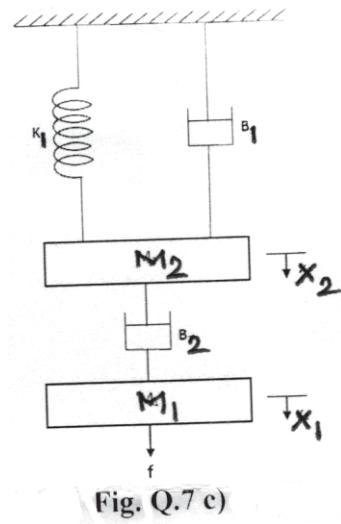
c) Represent the following mechanical system by node representation method and hence write the node equations. **[5]**

Fig. Q.7 c)

OR

Q8) a) What are the three basic elements of an electrical system which are used for modelling? Represent each of these three elements along with their relevant equations. **[6]**

b) Draw the signal flow graph for the block diagram shown in Fig.Q.7b. and using Masons gain formula, determine the transfer function C(s)/R(s).**[6]**

c) Write a short note on ac servomotor used as an actuator in control system. **[5]**

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[6179]-337

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)   Explain Bit type instructions- XIC, XIO, OTE, OTL, OTU, OSR.   **[6]**

      b)   Explain the ON Delay Timer and OFF Delay Timer with timing diagram.**[6]**

      c)   Draw a ladder diagram for stepper motor control.   **[6]**

<div align="center">OR</div>

Q2) a)   Explain ladder logic programming with symbols of PLC.   **[6]**

      b)   List types of counters available in PLC. Explain any one.   **[6]**

      c)   Draw a ladder diagram for following function table Inputs: I1, I2 Outputs: Q1, Q2, Q3.   **[6]**

I1	I2	Q1	Q2	Q3
0	0	0	0	0
0	1	0	0	1
1	0	0	1	0
1	1	1	0	0

Q3) a)   Discuss about RS485 Serial Communication.   **[6]**

      b)   Explain with neat diagram hierarchical level in Industrial Communication Networks.   **[6]**

   c)   State the advantages of HMI.   **[5]**

<div align="center">OR</div>
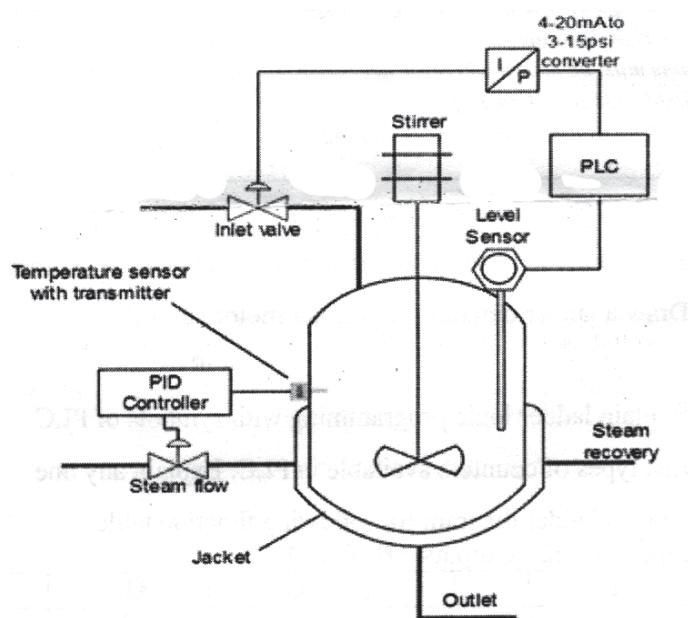
Q4) a) Explain the types of HMI? [6]

b) Discuss about ControlNet Protocol. [6]

c) Explain the function of HMI. [5]

Q5) a) What is Extrusion? Explain in detail types of extrusion? [6]

b) Develop PLC Programming Batch Process ladder logic program according to logic given below. [6]

    i) When the start button is pushed, the process starts. On SV1 and SV2 if the level is low.

    ii) Off SVI and SV2, when the level is high. And on motor for 30 seconds to mix the ingredient A and ingredient B.

    iii) Off Motor and on SV3 after 30 seconds

    iv) Off SV3 when the level is low. This is the end of one batch. Again on SV1 and SV2.

    v) The cycle continues till, stop push button is pressed.

    vi) When stop/reset button is pushed, the process resets/stops. But when SV3 is on, stop button action should not affect the process.

c) Define recipe as per ANSI/ISA S88 standard. Explain its types. [6]

OR

Q6) a) What is Batch? Explain the control equipment of used for Batch control.[6]

b) Develop ladder logic program to control Continuous Stirred Tank Reactor in PLC. [6]

c) What are the types of models in Batch Process? Explain any two. [6]

Q7) a) What is logic family? Give comparisons between TTL, ECL and CMOS
logic families. **[6]**

b) Define the following terms: **[6]**

i) Power Dissipation

ii) Propagation delay

iii) Noise Margin

c) Explain with a neat diagram CMOS inverter. **[5]**

OR

Q8) a) Compare CMOS and TTL logic family. **[6]**

b) Explain the concept of Tristate logic. **[6]**

c) Explain with a neat diagram CMOS NOR gate. **[5]**

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S.E. (Mechatronics Engineering)
KINEMATICS OF MACHINERY
(2019 Pattern) (Semester - IV) (217547)
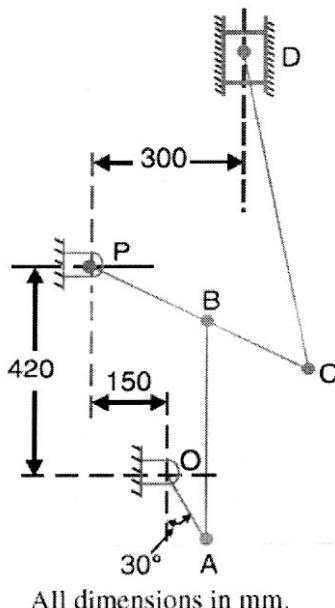
Time : 2½ Hours]   *[Max. Marks : 70*

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 drawing instruments, electronic pocket calculators are allowed.

　　4)　Figures to the right indicate full marks.

　　5)　Assume suitable data, if necessary.

Q1) a)　Explain Method of Locating Instantaneous Centres in a Mechanism.**[8]**

　　b)　Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism shown in Fig. The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are: OA = 150 mm ; AB = 450 mm; PB = 240 mm ; BC = 210 mm ; CD = 660 mm. **[10]**


All dimensions in mm.

OR
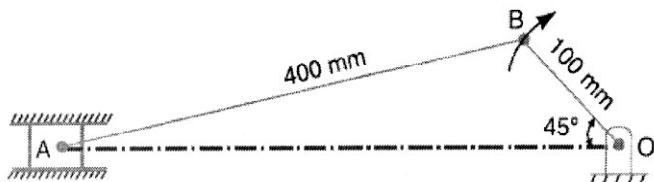
Q2) a) Locate all the instantaneous centres of the slider crank mechanism as shown in Fig.. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: **[10]**

    i) Velocity of the slider A and

    ii) Angular velocity of the connecting rod AB.

    b) Explain Three Centres in Line Theorem. **[8]**

Q3) a) Explain. **[6]**

    i) Type synthesis,

    ii) Number synthesis,

    iii) Dimensional synthesis

    b) Synthesize a slider crank mechanism so that the displacement of the slider is proportional to the square of the crank rotation in the interval $45° \le \theta \le 135°$. Use three precision points with Chebyshev's spacing.**[11]**

<div align="center">OR</div>

Q4) a) Explain with neat sketches three position synthesis of four bar chain mechanism by relative pole method. **[9]**
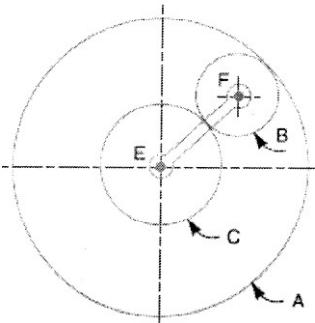
    b) Derive the frudenstein's equation of four bar mechanism. **[8]**

Q5) a) Draw neat labeled diagram of gear tooth Terminology. **[8]**

    b) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. **[10]**

<div align="center">OR</div>

[6179]-338   2

Q6) a) An epicyclic gear consists of three gears A, B and C as shown in Fig., The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C. **[10]**

b) Explain Types of Gear Train with neat diagram. **[8]**

Q7) a) What Is Industrial Automation? And explain its types. **[5]**

b) A cam is to give the following motion to a knife-edged follower: **[12]**
  i) Outstroke during 60° of cam rotation;
  ii) Dwell for the next 30° of cam rotation;
  iii) Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation.

  The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

OR

Q8) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: **[17]**
a) To raise the valve through 50 mm during 120° rotation of the cam;
b) To keep the valve fully raised through next 30°;
c) To lower the valve during next 60°; and
d) To keep the valve closed during rest of the revolution i.e. 150°;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, the velocity and the acceleration diagrams for one complete revolution of the cam.

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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 Pipes in series, Pipes in parallel and concept of Equivalent Pipe with fig and formula. **[8]**

b) Derive an expression of Velocity & Shear Stress distribution for laminar flow passing through parallel plates. **[8]**

OR

Q2) a) Prove that, in case of steady laminar flow through a circular pipe average velocity is half of the maximum velocity. **[8]**

b) Define Displacement thickness, Momentum thickness and Energy thickness with mathematical expression. **[6]**

c) Write a short note on laminar flow. **[2]**

Q3) a) Write a short note on Following : **[6]**

i) Reynolds Number

ii) Froude Number

iii) Euler's Number

b) Determine the dimensions of the quantities given below. **[6]**

i) Acceleration

ii) Dynamic Viscosity

iii) Power

P.T.O.

c) State and explain Buckingham's Pi theorem along with selection criteria method of repeating variables. **[6]**

OR

Q4) a) A Pelton wheel has mean bucket speed of 10 m/s with jet of water flowing at the rate of 700 liters/s under head of 30 meters. The buckets deflect jet through an angle of 160º. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. **[8]**

b) The pressure difference ΔP in a pipe of diameter D and length l, due to viscous flow depends upon the velocity V, viscosity μ, density ρ. Using Buckingham's π - theorem obtain an expression for ΔP. **[10]**

Q5) a) A reaction turbine works at 450 r.p.m. under a head of 120 meters. Its diameter at inlet is 120 cm and flow area is 0.4 m². The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Assume whirl at outlet to be zero. **[8]**

Determine :

i) The Volume flow rate

ii) The power developed and

iii) Hydraulic Efficiency

b) Explain working principle of Francis Turbine with its constructional details with neat sketch. **[6]**

c) Write difference between impulse turbine and reaction turbine. **[4]**

OR

Q6) a) Explain the following for hydraulic turbine. **[4]**

i) Hydraulic Efficiency

ii) Mechanical Efficiency

b) Explain the working principle of Kaplan turbine with neat sketch. **[6]**

c) A Kaplan turbine develops 24647.6 kW power at an average head of 39 meters. Assuming speed ratio of 2, flow ratio of 0.6, diameter of boss is equal to 0.35 times the diameter of runner and overall efficiency of 90 %. Calculate diameter, speed and specific speed of runner. **[8]**

Q7) a) Explain working principle of centrifugal pump with figure. **[7]**

b) A centrifugal pump is to discharge 0.118 m³/s at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm, and manometric efficiency is 75 % Determine vane angle at the outer periphery of the impeller. **[7]**

c) Explain in detail classification of hydraulic pump. **[4]**

OR

Q8) a) Explain the following efficiency for centrifugal pump. **[6]**

i) Manometric Efficiency

ii) Mechanical Efficiency

iii) Overall Efficiency

b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40 at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine : **[8]**

i) Vane angle at inlet

ii) Work done by the impeller on water per second

iii) Manometric efficiency

c) Draw Velocity diagram for centrifugal pump. **[4]**

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[6179]-340

S.E. (Mechatronics Engineering)

ELECTRICAL MACHINES AND DRIVE

(2019 Pattern) (Semester - IV) (217549)

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) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

5) *Use of non-programmable calculator is allowed.*

Q1) a) Compare a three phase synchronous motor with a three phase induction motor with the help of any six significant points. **[6]**

b) Explain the development of the circuit model of a synchronous machine in steps. **[6]**

c) A star connected, 3 phase, 200 kVA, 13.5 kV, 50 Hz synchronous generator has full load armature resistance drop and synchronous reactance drop of 11.12 V and 171.1 V respectively. Calculate : **[6]**

   i)   full load current

   ii)   phase and line value of induced emf at 0.8 lagging power factor

<div align="center">OR</div>

Q2) a) Differentiate between a salient pole and a non-salient pole synchronous machine stating any six points. **[6]**

b) Explain the construction and working of a permanent magnet synchronous motor (PMSM) with the help of a suitable sketch. State its any two applications. **[6]**

c) A 1000 kVA, 3300 V, 50 Hz, 3 phase, star connected synchronous generator has armature resistance of 0.25 ohm per phase. A field current of 30 A produces a short circuit current of 250 A and an open circuit voltage of 1100 V line to line. Calculate : **[6]**

   i)   synchronous impedance and synchronous reactance

   ii)   full load current

   iii) phase value of emf generated at full load, 0.8 pf lagging

P.T.O.

Q3) a) What is an electrical drive? State and explain any four major advantages of an electrical drive. **[6]**

b) Explain the Motor-Load dynamics in the context of electrical drives with the help suitable mathematical equations. **[6]**

c) Elaborate the steady state stability of an electrical drive. **[5]**

OR

Q4) a) List and explain the components of an electrical drive system with the help of suitable diagram. **[6]**

b) What are Load Torque components? Classify Load Torque. **[6]**

c) Explain multiquadrant operation of a drive. **[5]**

Q5) a) Explain in detail braking methods of DC motors. **[6]**

b) Explain the operation of a single phase fully controlled rectifier fed DC motor. **[6]**

c) Describe the closed loop speed control of a DC motor with the help of block diagram. **[6]**

OR

Q6) a) Explain the operation of Ward-Leonard Drive with the help of suitable diagram. **[6]**

b) Explain regenerative braking of DC motor **[6]**

c) Explain plugging and dynamic braking in detail. **[6]**

Q7) a) Differentiate between a PMAC motor and a BLDC motor. **[6]**

b) Explain advantages and disadvantages of stepper motor. **[6]**

c) Explain in detail rotor resistance speed control method of induction motor **[5]**

OR

Q8) a) Explain regenerative braking method of induction motor **[6]**

b) Draw the generalized diagram of closed loop control of induction motor drives and explain the process of speed control. **[6]**

c) State whether a single phase induction motor is self-starting. Explain in brief any one method of braking a single phase induction motor. **[5]**

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S.E. (Mechatronics)
SENSORS AND ACTUATORS
(2019 Pattern) (Semester - IV) (217550)

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 significance of Temperature measurement in Industry? What are different electrical methods of temperature measurement? **[6]**

b) Explain Bernoulli's Principle/theorem for flow measurement Techniques? **[6]**

c) What is basic Principle of working of Pressure transducers? Explain working of piezoelectric pressure sensors **[6]**

OR

Q2) a) How higher range of Vacuum pressure measurements? Explain any one method of Vacuum pressure measurement. **[6]**

b) What is basic principle of working ultrasonic flow meter? **[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

P.T.O.

Q4) a) How solenoid Works? What are the applications of Solenoid? **[6]**

b) Explain working and Characteristics of Induction motors? **[5]**

c) Explain Electrical model of energized coil. What is step angle? **[6]**

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) What are filters hydraulic Systems? Explain in detail. **[6]**

OR

Q6) a) How pressure regulation is done pneumatic circuits? **[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 is selection criteria of actuator selection? **[6]**

b) Write a short note on tradeoffs between torque/speed. **[5]**

c) Write a short note on control system and electronics. **[6]**

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[6179]-342

T.E. (Mechatronics Engineering)
APPLICATIONS OF INTEGRATED CIRCUITS
(2019 Pattern) (Semester - IV) (217551)

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) Explain the working of Non-Inverting Comparator. **[6]**

b) Draw and explain sample and hold circuit using op-amp. **[6]**

c) Draw and Explain Triangular wave Generator using OP-Amp. **[6]**

OR

Q2) a) Draw and Explain Zero cross detector and Window Detector with necessary waveform. **[6]**

b) Draw and Explain Square wave Generator using OP-Amp. **[6]**

c) Explain with neat circuit diagram working of Inverting and Non - Inverting Schmitt Trigger. **[6]**

Q3) a) Explain the operation of Dual Slope ADC. **[5]**

b) Explain with Diagram binary weighted resistor type of DAC. **[5]**

c) Write a short note on Performance parameter of ADC. **[8]**

OR

Q4) a) With the help of neat Diagram, Explain of Flash ADC. **[5]**

b) Draw ADC using DAC 6 Marks. **[5]**

c) Draw the circuit diagram of R/2R Ladder type DAC. **[8]**

Q5) a) Explain the working of functional block diagram of IC 555 Timer. **[5]**

b) Draw circuit diagram of multiplier 534. **[5]**

c) Write a short note on Basic operation of Power Amplifier LM 380. **[7]**

OR

Q6) a) What is Voltage controlled Oscillator 566 and write its application. **[5]**

b) Draw circuit diagram of waveform generator XR 2206. **[5]**

c) Calculate the change in the output frequency if the supply

voltage is varied between 9v to 11v. Assume $Vcc = 12$ v, $R t = 6.8$ KΩ, $Ct=75pf$, $RT = 15KΩ$ and $R2 = 100$ KΩ **[7]**

Q7) a) Design the voltage regulator for the following specification $V_0 = 18\pm3$ volts and $IL = 50Ma$ **[10]**

b) What are the Switching regulator topologies? **[7]**

OR

Q8) a) Draw the functional diagram of 723 regulator and function of Voltage Regulator. **[10]**

b) What voltage options are available in 78XX and 79XX Voltage regulator.**[7]**

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[6179]-344

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 drawng instruments and electronic pocket calculator is allowed.*

4) *Figure to the right indicate full marks.*

5) *Assume suitable data, if necessary.*

Q1) a) State the following engine nomenclature with neat sketch   **[8]**

   i)   Cylinder Bore

   ii) TDC

   iii) BDC

   iv) Compression ratio

   b) Explain the Otto cycle with a neat diagram. Derive an expression for its efficiency.   **[9]**

<p align="center">OR</p>

Q2) a) Explain a four stroke SI engine with neat sketch.   **[8]**

   b) Draw and explain PV and TS diagram for the following cycles :   **[9]**

   i)   Diesel cycle

   ii) Dual cycle

Q3) a) State Fourier's law of heat conduction. Derive an expresèion for rate of heat transfer through the composite wall.   **[8]**

   b) Define and give significance for following terms :   **[9]**

   i)   Thermal conductivity

   ii) Thermal diffusivity

<p align="center">OR</p>

Q4) a) Explain critical radius of insulation and its significance. **[8]**

b) Explain the various modes of heat transfer with suitable real life examples. **[9]**

Q5) a) Explain significance of any three dimensionless numbers used in various modes of heat transfer for thermal analysis. **[6]**

b) Explain Plank's law and Lambert's cosine law of heat transfer in radiation. **[6]**

c) Write a short note on Shape factor. **[6]**

OR

Q6) a) State and explain with mathematical expressions of the following laws in radiation heat transfer : **[6]**

i) Kirchhoff's law

ii) Stefan's Boltzrnann's law

b) Differentiate natural convection and forced convection. **[6]**

c) Explain Laminar flow heat transfer in circular pipe with neat sketch. **[6]**

Q7) a) Explain the six regimes of the pool boiling curve with the help of a neat diagram. **[6]**

b) Differentiate counter flow and parallel flow heat exchanger. **[6]**

c) Explain Effectiveness-NTU method of heat exchanger. **[6]**

OR

Q8) a) Write difference between film condensation and drop wise condensation with examples **[6]**

b) Give detail classification of heat exchangers. **[6]**

c) Derive an expression for LMTD for counter flow heat exchanger with neat sketch. **[6]**

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S.E. (Mechatronics Engineering)
DIGITAL ELECTRONICS
(2019 Pattern) (Semester - III) (217543)

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 diagram must be drawn wherever necessary.*

   4)   *Assume suitable data if necessary.*

1) a) Explain the difference between Combinational and Sequential Circuit. Also convert J-K Flip-Flop to T Flip-Flop. **[9]**

    b) Design a sequence generator using J-K flip-flop sequence is:

        1-> 3-> 5-> 6-> 7->l. **[9]**

OR

2) a) Design i) MOD 5   ii) MOD 24 Counter using IC 7490. **[9]**

    b) What is race-around condition? Explain with the help of timing diagram. How is it removed in basic flip flop circuit? **[9]**

3) a) Draw ASM chart for 3-bit octal number sequence with up-down conditions **[8]**

    b) Design BCD to Excess-3 code converter using PLA. **[9]**

OR

4) a) What is ASM chart. Explain the components of ASM. What is the difference between ASM chart and conventional flow chart. **[8]**

   b) Implement the following functions using PLA: **[9]**
   F1(A,B,C) = SOP(1,2,4,6)
   F2(A,B,C) = SOP(0,l,6,7)

5) a) Differentiate TTL and CMOS logic family. **[9]**

   b) Define the following terms & mention the standard values for TTL logic family: **[9]**
   (i)   Noise Margin
   (ii) Fan Out
   (iii) Power Dissipation

OR

6) a) Explain the working of three input TTL NAND gate with Totempole output. **[9]**

   b) Explain with neat diagram two input CMOS NAND gate. **[9]**

7) a) What is microprocessor? Explain 8086 microprocessor with diagram. **[8]**

   b) Write a short note on Memory organization. **[9]**

OR

8) a) What is ALU? Explain with IC 74181. **[8]**

   b) What is the bus? Explain its type. **[9]**

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[6179]-346

S.E. (Mechatronics Engineering)
ANALYSIS OF MECHANICAL STRUCTURE
(2019 Pattern) (Semester - III) (217544)

*Time : 2½ Hours]*   *[Max. Marks : 70*
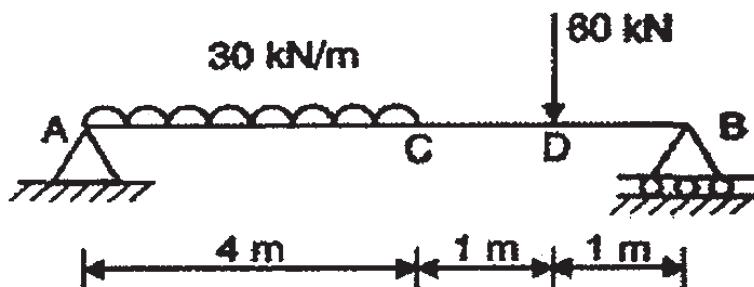
Instructions to the candidates:

1) *Attempt Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 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) 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 × 10⁴ kN-m². **[10]**
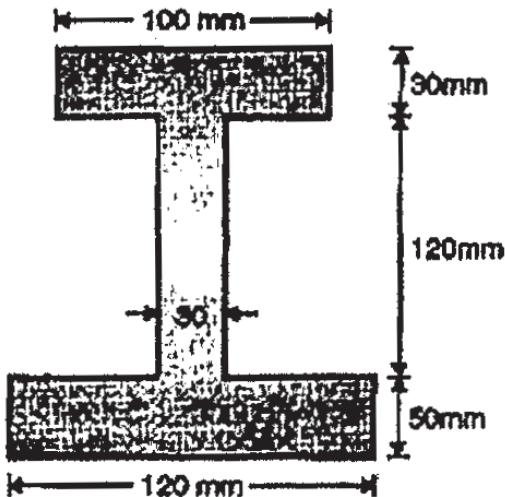

Q2) a) Derive the flexural formula.   **[8]**

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

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 38mm and internal diameter 33 mm. Strut is fixed at one end and hinged at another end. Yield stress for steel **[10]**

$$335 \text{MPa}, E = 205 \text{GPa}, \ \alpha = \frac{1}{7500}$$

Q4) a) i)   State the assumptions made in Euler's theory. **[7]**

ii) Define :

A) Crushing Load

B) Crippling Load

C) Slenderness Ratio

b) A hollow marine propeller shaft turning at 110rpm 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 anticlockwise 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]**

Q6) a) A solid circular shaft is subjected to a bending moment of 40kN-m and a torque of 10 kN-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.
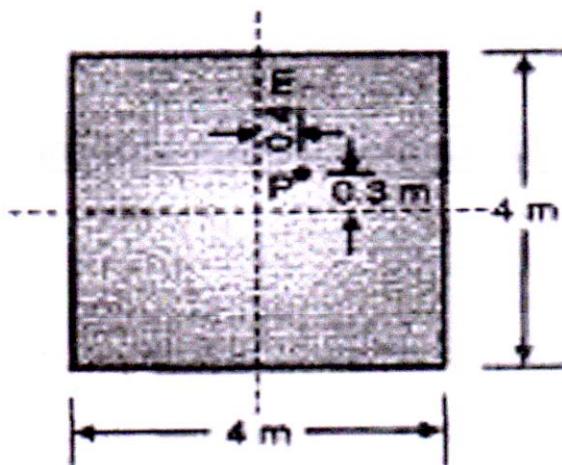
 Take $\mu = 0.25$, Stress at elastic limit $= 200$ N/mm^2 and factor of safety $= 2$

 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]**
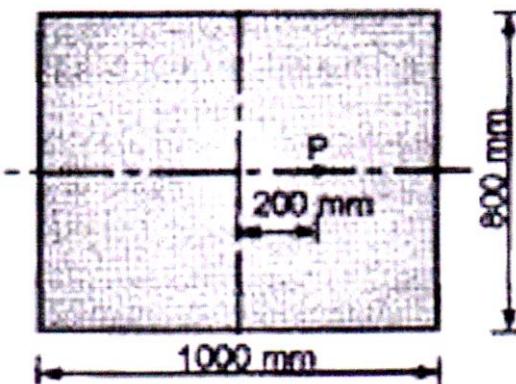
Q7) a) Explain combined Direct and Bending Stress with : **[7]**

 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]**

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]**

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S.E. (Mechatronics)
ENGINEERING MATERIAL
(2019 Pattern) (Semester - III) (217541)

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) *Assume Suitable data if necessary*

Q1) a) Explain cooling curve with its importance and draw the diagram of cooling curves for pure metal and.binary solid solution.   **[7]**

b) Draw FE-C diagram and label the temperature, composition and phases.**[7]**

c) Explain solid solution and factors that governs Hume Rothery's rule of solid solubility.   **[4]**

OR

Q2) a) Explain solidification of pure metal and discuss how nucleation and grain growth effect on solidification.   **[7]**

b) List out the transformation reaction in Fe- C diagram and explain in details.   **[7]**

c) Define the terms :   **[4]**
i)   Phase
ii) Proeutectic
iii) Hypoeutectic
iv) Hypereutectic

Q3) a) What is retained austenite? Explain the effects of retained austenite.   **[7]**

b) Distinguish between full annealing and process annealing.   **[7]**

c) Define tempering. What are the effects of tempering on mechanical properties of steel?   **[4]**

OR

Q4) a) List out case hardening processes. Describe carburizing and induction hardening with neat sketch.   **[7]**

b) Describe the various transformation of austenite at different temperature with TTT diagram.   **[7]**

c) Explain austempering and martempering.   **[4]**

Q5) a) What are the effects of following alloying elements on steel? (Any 6) **[6]**

    i) Carbon

    ii) Chromium

    iii) Manganese

    iv) Sulfur

    v) Tungsten

    vi) Nickel

    vii) silicon

  b) What is IS, AISI and SAE? Explain in details. **[6]**

  c) Write a short note on nodular cast iron. **[5]**

<div align="center">OR</div>

Q6) a) Compare between white cast iron and gray cast iron. **[6]**

  b) Give classification of ferrous alloy and their applications. **[6]**

  c) Write note on stainless steel. **[5]**

Q7) a) State and explain properties of copper and its applications. **[6]**

  b) Explain aluminium alloys **[6]**

    i) Duralumin

    ii) LM5

    iii) Y alloy

  c) Suggest suitable non ferrous materials for following materials and write their composition i) bell ii) coins **[5]**

<div align="center">OR</div>

Q8) a) Describe materials used in additive manufacturing **[6]**

  b) Explain any three cobalt alloys with composition and application. **[6]**

  c) Write a short note on bearing materials. State any two materials. **[5]**

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S.E. (Instrumentation & Control Engineering)
CONTROL SYSTEMS
(2019 Pattern) (Semester-IV) (206268)

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 non-programmable calculators/Log table is allowed.*

Q1) a) Apply the block digram reduction rules to reduce the following system into canonical form and determine its control ratio. **[10]**
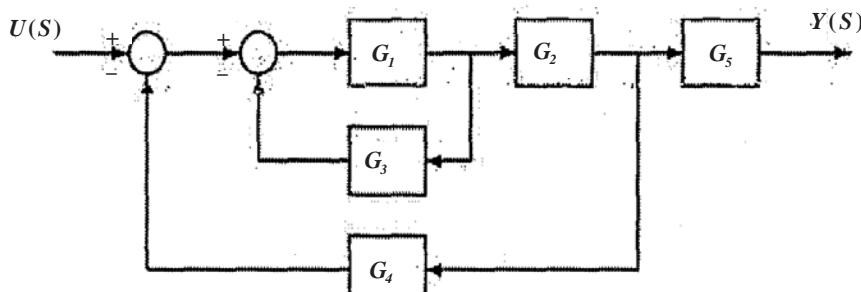

Figure 1

b) Define the following SFG terminologies using suitable example **[8]**

- Branch

- Forward Path

- Loop

- Source Node

OR

P.T.O.

Q2) a) Convert the given block diagram into equivalent signal flow graph and use Masons gain formula to obtain the transfer function $Y(s)/U(s)$. **[10]**
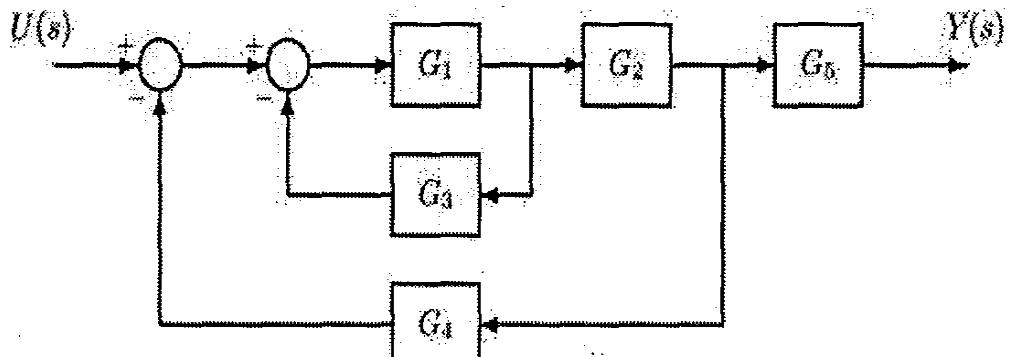
Figure 2

b) Define the following SFG terminologies using suitable example **[8]**

- Sink Node
- Self-Loop
- Common Node
- Dummy Node

Q3) a) Derive the transient response of first order system for unit step input.**[7]**
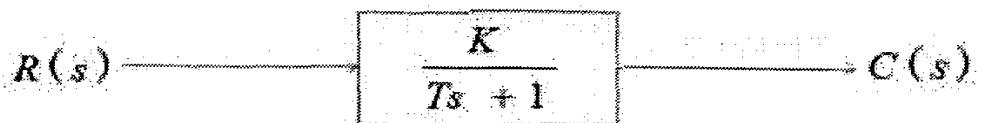
Figure 3

b) A certain feedback system is described by the following transfer function

$G(s) = \dfrac{16}{s^2 + 4s + 16}, H(s) = Ks$ Determine the value of K, peak overshoot and corresponding peak-time, settling time of the system if the damping ratio is 0.8. **[10]**

OR

Q4) a) A feedback control system is described as **[7]**

$G(s) = \dfrac{50}{s(s+2)(s+5)}, H(s) = \dfrac{1}{s}$ For a unit step input, determine K_p, K_v and K_a.

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b) A servo system is represented by the equation. $\dfrac{d^2\theta}{dt^2}+10\dfrac{d\theta}{dt}=150E$,

where $E=(r-\theta)$ an actuating signals. Calculate the value of damping ratio, undamped and damped frequency of oscillations. **[10]**

Q5) Plot the root locus pattern of a system whose forward path transfer function is

$$G(s)=\dfrac{k}{s(s+2)(s+5)}.$$ **[17]**

OR

Q6) a) The open-loop transfer function of a unity feedback system is given by.**[17]**

$$G(s)=\dfrac{K}{s(s+3)(s^2+s+1)}$$

Determine the values of K that will cause sustained oscillations in the closed loop system. Also find oscillation frequency.

Q7) a) Sketch the Magnitude and Phase plot and determine the gain cross-over and phase cross over frequencies **[10]**

$$G(s)=\dfrac{10}{s(1+s)(1+0.02s)}$$

b) The forward path transfer function of a unity feedback control system is

$$G(s)=\dfrac{100}{s(s+6.54)}$$

Find the resonance peak M_r, resonant frequency ω_r and bandwidth of the closed loop system. **[8]**

OR

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Q8) a) Sketch the bode plot and determine the gain cross-over and phase cross over frequencies $G(s) = \dfrac{1000}{s(1+0.1s)(1+0.001s)}$. **[10]**

b) Sketch the polar plot for **[8]**

$$G(s) = \dfrac{10}{(s+1)}$$

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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 Q. No. 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) Design BCD to seven segment display decoder driver circuit.   **[9]**

b) Design full adder circuit by using K Map.   **[9]**

OR

Q2) a) Design full subtractor circuit by using K Map.   **[9]**

b) Explain the working of magnitude comparator.   **[9]**

Q3) a) Convert T flipflop to D flipflop.   **[8]**

b) Write short note on types of memory devices used in Digital Circuits.
                                                                     [9]

OR

Q4) a) With a neat logic diagram, explain the working of positive edge triggered D flip Hop. Also draw the timing diagram.   **[8]**

b) Convert JK Flipflop to D Flipflop.   **[9]**

Q5) a) Draw and explain 3 bit synchronous counter.   **[9]**

b) Draw and explain 3 bit ring counter.   **[9]**

OR

P.T.O.

Q6) a) Explain PIPO and PISO shift register with relevant logic diagrams. **[9]**

   b) Design MOD 10 asynchronous counter. **[9]**

Q7) a) Write short note on PLDs. **[9]**

   b) Describe the operation of TTL logic circuit working as NAND gate. **[8]**

<div align="center">OR</div>

Q8) a) Explain following parameters of logic families **[8]**

   i) Propagation delay

   ii) Power dissipation

   iii) Fan-out

   iv) Basic gate

   b) Design frequency counter by using counter ICs. **[9]**

<div align="center">■■■</div>

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S.E. (Instrumentation and Control)
PROCESS LOOP ELEMENTS
(2019 Pattern) (Semester - IV) (206270)

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)   *Use of non programmable calculator is allowed.*

   5)   *Assume suitable data, if necessary.*

Q1) a) Process error lies within the neutral zone with controller output at 25%. At $t = 0$, the error falls below the neutral zone. If controller gain is +2% per second, find the time when the output saturates. **[6]**

b) Explain single speed and multiple speed floating control mode. State basic difference between floating and two position control mode. **[12]**

OR

Q2) a) Explain proportional control mode in detail with all relevant terms. Draw the response of process when controller gain is set at 7%/%, 9%/% and 12%/%. Initial controller gain is 5%/%. **[12]**

b) Explain any three control system parameters. **[6]**

Q3) a) Explain process reaction curve method of controller tuning in detail. State the advantages of tuning of controller. **[9]**

b) Draw faceplate of digital PID controller and state functions of each key on it. State advantages of digital PID controller. **[8]**

OR

Q4) a) Draw and explain block diagram of digital PID controller. State advantages of digital PID controller. **[10]**

b) Explain Z-N closed loop method of controller tuning with neat diagrams. **[7]**

P.T.O.

Q5) a) What is control valve coefficient? An ethylene glycol is flowing through a control valve with flow rate of 90 gpm. The pressure drop is 3.897 psi across it. The specific gravity of ethylene glycol is 1.07. Find the control valve flow coefficient. **[6]**

b) Explain control valve selection criteria. **[4]**

c) Explain the characteristics of control valve with neat diagram. Also draw the plug shapes for each characteristic. **[8]**

OR

Q6) a) Explain in detail, the cavitation phenomenon in control valve. **[8]**

b) Explain control valve selection criteria. Explain with suitable examples fail safe action for AO and AC control valve. **[10]**

Q7) a) Explain volume booster with neat diagram. **[8]**

b) Explain Working of positioner with neat diagram and also state its effect on control valve. **[9]**

OR

Q8) a) Explain the following with neat diagrams. **[9]**

   i) Pneumatic actuator

   ii) Hydraulic actuator

   iii) Electric actuator

b) List different types of accessories used with CV. Explain air lock system with neat diagram. **[8]**

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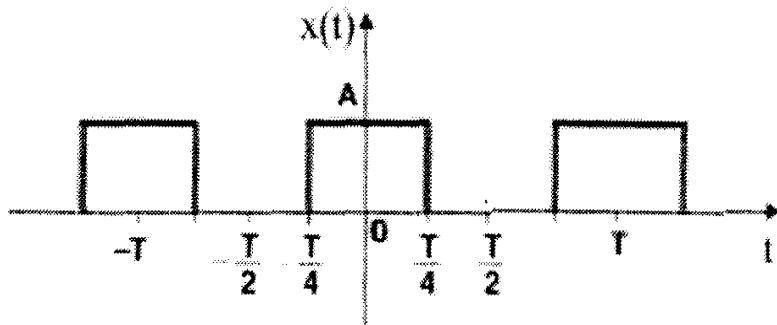
[6179]-351

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 diagrams 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.
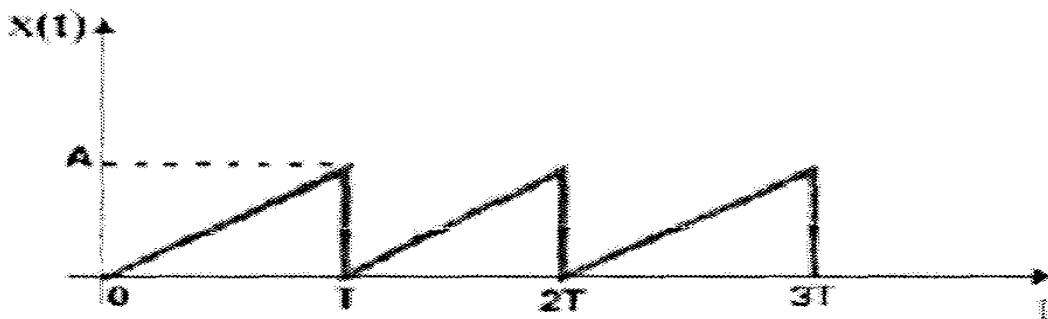
Q1) a) Determine the trigonometric form of Fourier series of the waveform as shown in fig **[10]**

    b) List any 7 properties of Fourier series. **[7]**

<center>OR</center>

Q2) a) Determine the exponential form of Fourier series of the waveform as shown in fig **[10]**

b) What is Fourier series. What are the methods of finding Fourier series. Write their expressions. **[7]**

Q3) a) State and prove following properties of Fourier transform. **[9]**

 i) Time scaling

 ii) time reversal

 iii) Frequency Shifting property

b) State equation of Fourier transform. Find Fourier transform of **[9]**

 i) $x(t) = e^{at} \cos(\Omega_0 t) u(t)$

 ii) $x(t) = Ae^{at}$ for all t

OR

Q4) a) Find Fourier transform of unit step signal **[5]**

b) State conditions under which Fourier transform exists? **[3]**

c) Find Fourier transform of **[10]**

 i) $x(t) = e^{-j\Omega_0 t}$

 ii) $x(t) = u(t)$

Q5) a) Find the Laplace Transform and ROC of Unit step function and Unit Ramp function. **[10]**

b) Find inverse Laplace transform. **[7]**

 i) $X(s) = \dfrac{1}{(s+2)(s+4)}$

 ii) $X(s) = \dfrac{s}{(s+5)(s+3)}$

OR

Q6) a) State and prove any two properties of Laplace Transform. **[7]**

b) Find Laplace transform and draw ROC of same. **[10]**

 i) $x(t) = t\, u(t)$

 ii) $x(t) = e^{(-3t)}\, u(-t)$

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Q7) a) Explain following terms with example. **[9]**

    i)   Experiment,

    ii)   Sample space,

    iii) Event

b) Define PDF and CDF, Also, state the properties of CDF and PDF. **[9]**

<div align="center">OR</div>

Q8) a) Define Random Variables? Explain Discrete random variable with example along with discrete probability distribution. **[9]**

b) Find the probability that a single toss of a die will result **[9]**

    i)   In a number less than 4 if no information is given

    ii)   In a number less than 4 if toss result in an old number

    iii) In a number grater that 3.

<div align="center">◑◑◑◑</div>

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S.E. (Instrumentation and control)
DATA STRUCTURE
(2019 Pattern) (Semester-IV) (206272)

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 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) Find the output for the code given below from array import.   **[9]**
arry 1= array ('f', [15, 25, 35, 45, 55, 65, 75])

$$\text{for } x \text{ in array 1 :}$$

Print (*x*, end = ' ' "\t")

  b) Write the instructions in python to perform various operations on two matrices A and B   **[9]**

<p align="center">OR</p>

Q2) a) Write a python program to- make a list of first 10 letters of alphabets, then using the slice operation do the following operations.   **[9]**
   i)   Print first three letters.
   ii) Print the letters from any particular index to the end of the list.

  b) Write a program to create two lists namely L_1 & L_2, print them and extend list L_2 & L_1 **[9]**

Q3) a) Explain briefly maps structure in python. What is the difference between a map and a dictionary?   **[12]**

  b) Compute the index of the element '38' in the array as shown in the below table.   **[5]**

4	75	82	18	22
9	73	44	38	52
12	64	77	23	43

<p align="center">OR</p>

<p align="right">*P.T.O.*</p>

Q4) a) Explain set ADT in Python. What are the different operations which can be performed on sets. **[11]**

b) Determine the output if following code is executed in python. **[6]**

Set 1 = {24, 38, 42, 12, 1978; 'PYTHON'}

Print (set 1)

List 2 = {'INDIA', 0.58, 66.39, 'Earth'}

Set 2 = set (list 2)

Print (Set 2)

Set 3 = Set 2/Set1

Print (Set 3)

Q5) a) Explain implementation of Bag ADT using linked list. **[9]**

b) How to append nodes in case of a linked list using tail reference? (Assume suitable linked list) **[9]**

OR

Q6) a) Differentiate between python list and linked list. **[8]**

b) What are the limitations of arrays and list in Python? what is linked list structure? Which are the types of linked lists? **[10]**

Q7) a) Describe the implementation of queues using circular array. **[8]**

b) Explain stacks in python along with operations on it. **[9]**

OR

Q8) a) Explain the concept of priority queues in python. What do you mean by unbounded and bounded priority queuee. **[8]**

b) Describe the conversion of an expression from infix to post fix with appropriate examples. **[9]**

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S.E. (Instrumentation and Control)
SENSORS AND TRANSDUCERS
(2019 Pattern) (Semester - III) (206261)

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

Q1) a) Discuss the various types of elastic sensors (minimum 3) with diagrams and their advantages and disadvantages. **[9]**

b) How will you use LVDT as a secondary sensor for the measurement of pressure. Explain with diagram. **[8]**

OR

Q2) a) What are the various types of manometers. Discuss one with detail diagram and equation. **[9]**

b) How will you use strain gauge as a secondary sensor for the measurement of pressure? Explain with diagram. **[8]**

Q3) a) What is lead wire compensation? Discuss the different configurations for it. **[9]**

b) What is seeback effect. How does thermocouple work? Discuss the cold junction compensation. **[9]**

OR

Q4) a) Draw and discuss the principle of operation and applications of pyrometers for non-contact temperature measurement. **[9]**

b) Discuss with diagrams if necessary. **[9]**

i) Thermocouple

ii) Thermowell

iii) Cold junction compensation

P.T.O.

Q5) a) Explain the variable area flowmeter (rotameter) in detail with diagram. What are the advantages and limitations of it. **[8]**

b) Discuss the flow measurement by using Coriolis flow meter with diagram and turbine flow meter with diagram. **[9]**

OR

Q6) a) Discuss the principle of working of orifice plate for flow measurement. What are the types of orifice plates, discuss with its use. **[8]**

b) Draw and discuss turbine type flowmeter with diagram. What are the advantages and disadvantages of it? **[9]**

Q7) a) Define density with SI unit. How will you measure density using Hydrostatic Head (Air bubbler)? **[9]**

b) What are the various types of level sensors? Explain the principle of ultrasonic level measurement. **[9]**

OR

Q8) a) Define Viscosity with unit. How will you measure viscosity using Cone and Plate viscometer? **[9]**

b) What are the various types of level sensors? How does a capacitive level sensor work? **[9]**

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S.E. (Instrumentation & Control)
LINEAR INTEGRATED CIRCUITS
(2019 Pattern) (Semester - III) (206262)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Attempt Q. 1 or 2, Q. 3 or 4, Q. 5 or 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) With the neat features draw the circuit diagram of Instrumentation amplifier and derive its closed loop voltage equation. **[9]**

b) Explain grounded load type V to I with neat circuit diagram and derive its output current equation. **[9]**

OR

Q2) a) Implement the following voltage equation using suitable summing amplifier along with circuit diagram. **[9]**

$V_O = 3V_1 + 2V_2 - 5V_3$. Note that V_1, V_2 and V_3 are input voltages.

b) Derive the output voltage equation for the basic integrator with neat circuit diagram and input-output waveforms. Also discuss its limitation. **[9]**

Q3) a) State Barkhausen Criteria. Draw the circuit diagrams and frequency equation of **[9]**

i) Wien bridge oscillator

ii) Phase shift oscillator

b) What is comparator? Explain Schmitt trigger with neat circuit diagram, equations and its I/O waveforms. **[8]**

OR

P.T.O.

Q4) a) Discuss the operation of precision full-wave rectifier using op-amp with neat circuit diagram, input-output waveforms. **[9]**

b) Explain working of ZCD with neat circuit diagram, input-output waveforms. **[8]**

Q5) a) Draw and explain the PIN and internal block diagram of IC LM555. **[9]**

b) Draw and explain with neat PIN and internal diagram of voltage-controlled oscillator using LM566. **[9]**

OR

Q6) a) Discuss the pin functions of timer IC LM555. Draw neat circuit, equations and waveforms for free-running multivibrator circuit. **[9]**

b) What is PLL? Discuss it with neat block diagram using LM565. **[9]**

Q7) a) What is filter circuit? Discuss the following terms related with filter : Pass band, stop band, cut off, ripple, Q and order of the filter. **[9]**

b) What is voltage regulator? Discuss performance parameters of regulator: Line regulation, Load regulation and Ripple rejection. **[8]**

OR

Q8) a) Differentiate between band pass and band reject filter with respect to types, circuit diagram, response etc. **[9]**

b) Draw and explain first-order high pass filters along with its frequency response. **[8]**

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S.E. (Instrumentation and Control)
ELECTRICAL MEASUREMENTS AND
INSTRUMENTATION
(2019 Pattern) (Semester - III) (206263)

Time : 2½ Hours] *[Max. Marks : 70*
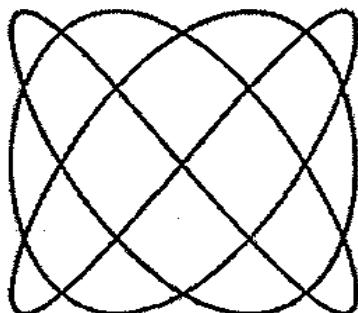
Instructions to the candidates :
  1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7or Q.8.*
  2) *Figures to the right side indicate full marks.*
  3) *Neat diagrams must be drawn wherever necessary.*
  4) *Use of Calculator is allowed.*
  5) *Assume Suitable data if necessary*

Q1) a) Write a note on Lissajous pattern and its uses. **[8]**

b) Describe briefly: delay line and sweep generator in CRO. **[6]**

c) What do you mean by deflection sensitivity and deflection factor in case of CRT. **[4]**

OR

Q2) a) With the help of suitable waveforms, explain ALT and CHOP mode in CRO. **[8]**

b) Explain the functions of any six front panel control knobs in dual trace CRO. **[6]**

c) A pattern as shown below is obtained on CRO screen. If frequency applied to X channel is 1560 Hz, determine the signal frequency applied to Y channel. **[4]**

Q3) a) Draw suitable diagram of Wheatstone bridge. Explain the measurement of unknown resistance by using this bridge. **[8]**

b) Explain D factor. State relation between Q and D factor. **[4]**

c) A Wheatstone bridge uses all equal arms and consists of a null detector having voltage sensitivity of 12 units. If the DC voltage applied to bridge is 5 V, calculate the bridge sensitivity. **[5]**

<div align="center">OR</div>

Q4) a) Explain errors in measurement of unknown resistance using Wheatstone bridge. **[5]**

b) Differentiate (three points) between Maxwell bridge and Hay bridge. Also explain Q factor. **[8]**

c) A Wien bridge uses $R_1 = R_2 = 1200$ ohms, $Cl = C2 = 0.22$ µF. determine the supply frequency. **[4]**

Q5) a) For R-2R DAC, $Rf = R = 1200$ ohms. If the reference voltage is 5 volts, calculate the analog output voltage for digital input $(10111)_2$. **[4]**

b) Draw the block diagram of general digital instrument and explain function of each block. **[8]**

c) Compare with any three points binary weighted resistor DAC and R - 2R ladder type DAC. **[6]**

<div align="center">OR</div>

Q6) a) Draw general block diagram of counter type ADC and explain its working. **[8]**

b) Draw general block diagram of digital multimeter and describe the measurement of AC voltage. **[6]**

c) Calculate the full-scale analog output voltage for 8-bit DAC operated at 5 volts. **[4]**

Q7) a) Describe the strip chart recorder with neat block diagram. What are the types of tracing system? **[9]**

b) Explain in detail the architecture of virtual instrumentation with neat block diagram. **[8]**

<div align="center">OR</div>

Q8) a) Briefly explain the advantages of Virtual Instruments over traditional instruments. **[9]**

b) Differentiate between strip chart recorder and X-Y recorder. **[8]**

<div align="center">▽ ▽ ▽ ▽</div>

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S.E. (Instrumentation & Control)
Control System Components
(2019 Pattern) (Semester-III) (206264)

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) Write down the Comparison of Pneumatic, Hydraulic & Electrical systems. **[6]**

b) Explain any one type of Pneumatic relay (Bleed & Non bleed, Reverse & Direct). **[6]**

c) What is meant by Pneumatic Circuits? List out the Standard Symbols used for developing pneumatic circuits. **[6]**

OR

Q2) a) Explain in brief the Single acting & Double acting cylinder with neat diagram. **[6]**

b) Differentiate between: Cushion, Double rod, Tandem, Multiple position, and Rotary. **[6]**

c) Explain any one: pressure reducing valve and time delay valve. **[6]**

Q3) a) What is meant by Hydraulic Circuits? List out Standard Symbols used for developing hydraulic circuits. **[6]**

b) Explain in brief any one circuit of: Meter in, Meter out. **[6]**

c) Define Hydraulic pumps and explain any one in detail. **[5]**

OR

Q4) a) Define Hydraulic supply, explain in brief. **[6]**

b) What is meant by Sequencing of cylinder? Illustrate with proper example. **[6]**

c) Explain in brief the Hydraulic valves. **[5]**

Q5) a) Write down Construction, working, characteristics, specifications and applications of SCR, UJT. **[6]**

b) Write down Construction, working, characteristics, specifications and applications of MOSFET. **[6]**

c) What is meant by Triggering and Commutation of SCR, Illustrate the same. **[6]**

OR

Q6) a) Write down Construction, working, characteristics, specifications and applications of TRIAC, DIAC. **[6]**

b) Write down Construction, working, characteristics, specifications and applications of IGBT. **[6]**

c) Give the comparison for SCR, UJT, TRIAC, DIAC. **[6]**

Q7) a) Explain with Construction, working & applications of: Synchros (Transmitter and Receiver). **[6]**

b) What is the use of Alarm annunciator? Explain with a proper diagram.**[6]**

c) Give the definition for designing for intrinsic Safety. **[5]**

OR

Q8) a) Explain in brief the square root extractor. **[6]**

b) What are Circuit Breaker and Fuses? Explain. **[6]**

c) Write down in brief Introduction to HaZOP. **[5]**

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S.E. (Instrumentation)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - III) (207008)

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 calculator is allowed.

6)   Assume suitable data, if necessary.

Q1) Choose the correct option :

i)   Fourier cosine transform of function $f(x)$ is given by   **[1]**

   a) $\int_0^\infty f(u)\sin lu\, du$

   b) $\int_0^\infty f(u)\cos lu\, du$

   c) $\frac{2}{\pi}\int_0^\infty f(u)\cos lu\, du$

   d) $\frac{2}{\pi}\int_0^\infty f(u)\sin lu\, du$

ii)   If $|z|<2, z^{-1}\left[\dfrac{1}{(z-3)(z-2)}\right]$ is given by   **[2]**

   a) $2^{k-1} + 3^{k-1},\ k \leq 0$

   b) $-2^{k-1} - 3^{k-1},\ k \leq 0$

   c) $-2^{k-1} + 3^{k-1},\ k \leq 0$

   d) $2^{k-1} - 3^{k-1},\ k \leq 0$

iii)   if $\mu_1^1, \mu_2^1, \mu_3^1$ are the first three moments of the distribution about certain number then third moment μ_3 of the distribution about the arithmetic mean is given by   **[1]**

   a) $\mu_3^1 - 3\mu_2^1\mu_1^1 + 2(\mu_1^1)^3$

   b) $\mu_3^1 - 3\mu_1^1 + (\mu_2^1)^3$

   c) $\mu_3^1 + 2\mu_2^1\mu_1^1 + (\mu_3^1)^3$

   d) $\mu_3^1 + 3\mu_2^1\mu_1^1 + (\mu_1^1)^2$

P.T.O.

iv) A box contains 100 bulbs out of which 10 are defective. A sample of 5 bulbs is drawn. The probability that none is defective is **[2]**

   a) 1   b) $1 - (0.1)^5$

   c) $(0.9)^5$ d) $(0.1)^5$

v) If vector field $\overline{v} = (x+3y)\hat{i} + (y-2z)\hat{j} + (x+lz)\hat{k}$ is solenoidal then value of λ is **[2]**

   a) 0   b) 3

   c) c   d) −2

vi) if $f(z) = u + iv$ be an analytic function where $u = 2xy$, $v = y^2 - x^2$, the value of $f(z)$ in terms of z is **[2]**

   a) $\alpha z + iz^2$ b) iz^2

   c) $-iz^2$ d) $\alpha z - iz^2$

Q2) a) Attempt any one : **[4]**

   i) Find z transform of $f(k) = \left(\dfrac{1}{4}\right)^{|k|}$, for all k

   ii) Find inverse z-transform of $f(z) = \dfrac{1}{(z-2)(z-3)}$, $|z| > 3$

   b) Obtain f(k), given that $f(k+1) + \dfrac{1}{2}f(k) = \left(\dfrac{1}{2}\right)^k$; $k \geq 0, f(0) = 0$. **[6]**

   c) Find the Fourier cosine transform of the function

$$f(x) = \begin{cases} \cos x & 0 \leq x \leq a \\ 0 & x > a \end{cases}.$$ **[5]**

OR

Q3) a) Attempt any one : **[5]**

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

   ii) Find inverse z-transform of $f(z) = \dfrac{z(z+1)}{z^2 - 2z + 1}$, $|z| > 1$.

   b) Find Fourier cosine transform of $f(x) = \begin{cases} x^2 & 0 \leq x \leq a \\ 0 & x > a \end{cases}.$ **[5]**

   c) Solve the following integral equation $\displaystyle\int_0^\infty f(x)\sin\lambda x\,dx = \begin{cases} 1 & 0 \leq \lambda \leq 1 \\ 2 & 1 \leq \lambda \leq 2 \\ 0 & \lambda > 2 \end{cases}$ **[5]**

Q4) a) The first four moments of a distribution about the value 2 are –1.1, 89, –110 and 23,300. Obtain the first four central moments, β_1 and β_2. **[5]**

b) Obtain the correlation coefficient for the following data. **[5]**

x	3	4	6	8	10
y	10	7	8	8	6

c) A fair coin is tossed 5 times. What is the probability of getting at least two tails? **[5]**

OR

Q5) a) Obtain the line of regression of *y* on *x* for the following data. **[5]**

x	3	4	6	8	10
y	2	4	5	7	8

b) The number of accidents per week on a highway follows a Poisson distribution with mean 0.5. Find the probability that during a week there will be at the most one accident. **[5]**

c) The lifetime of an article has a normal distribution with mean 400 hours and standard deviation 50 hours. Assuming normal distribution, find the expected number of articles out of 2,000 whose lifetime lies between 335 hours to 465 hours. [Given : $z = 1.3$, $A = 0.4032$]. **[5]**

Q6) a) Find the directional derivative of $\phi = xy^2 + yz^3$ at the point $(2, -1, -1)$ in the direction of vector $\bar{i} + 2\bar{j} + 2\bar{k}$. **[5]**

b) Show that the vector field $\bar{F} = (x^2 - yz)\bar{i} + (y^2 - zx)\bar{j} + (z^2 - xy)\bar{k}$ is irrotational. Also find the scalar potential ϕ such that $F = \nabla\phi$. **[5]**

c) Using the line integral find the work done by force $\bar{F} = (2y+3)\bar{i} + xz\bar{j} + (yz-x)\bar{k}$ along the curve $x = 2t^2$, $y = t$, $z = t^3$ from $t = 0$ to $t = 1$. **[5]**

OR

Q7) a) Find the directional derivative of $\phi = 5x^2y - 5y^2z + \dfrac{5}{2}z^2x$ at the point

(1, 1, 1) in the direction of line $\dfrac{x-1}{2} = \dfrac{y-3}{-2} = z$. **[5]**

b) Show that (any one) : **[5]**

i) $\nabla^2\left[\nabla\left(\dfrac{\bar{r}}{r^2}\right)\right] = \dfrac{2}{r^4}$

ii) $\nabla(r^3\bar{r}) = 6r^3$

c) Using Green's theorem evaluate $\displaystyle\int_C [(y - \sin x)\,dx + \cos x\,dy]$ where C

is the plane triangle enclosed by the lines $x = \dfrac{\pi}{2}, y = 0, y = \dfrac{2x}{\pi}$. **[5]**

Q8) a) If $u = x^4 - 6x^2y^2 + y^4$ find its harmonic conjugate V such that $f(z) = u + iv$ is analytic. Find $f(z)$ in terms of z. **[5]**

b) Evaluate, $\displaystyle\oint_C \dfrac{2z^2 + 2z + 1}{(z+1)^2(z-3)}dz$, where C is the circle $|z + 1| = 2$ using

Cauchy's Residue theorem. **[5]**

c) Find the bilinear transformation which maps the points $z = 1, i, 2i$ onto the points $w = -2i, 0, 1$. **[5]**

OR

Q9) a) Find the analytic function $f(z) = u + iv$ if $u + v = e^{-x}$ (cos$y$ – sin$y$). **[5]**

b) Using Residue theorem, evaluate $\displaystyle\oint_C \dfrac{z^3 + 2\ dz}{(z+1)^2(z-2)^2}$, where C is the

contour $|z + 1| = 2$. **[5]**

c) Find the map of the straight line $y = x$ under the transformation

$w = \dfrac{z-1}{z+1}$. **[5]**

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