

Total No. of Questions : 8]

SEAT No. :

PD-4042

[Total No. of Pages : 2

[6402]-1
S.E. (Civil Engineering)
BUILDING TECHNOLOGY AND ARCHITECTURAL
PLANNING
(2019 Pattern) (Semester - III) (201001)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

- Q1) a)** Illustrate the procedure of Door Installation. **[6]**
b) What are basic functional requirement of flooring? **[6]**
c) Enlist any four types of roofing materials and explain galvanized iron sheets. **[6]**

OR

- Q2) a)** What are the functions of arches and lintels? **[6]**
b) Enlist any four types of floor finishes and explain mosaic flooring. **[6]**
c) Enlist any six types of doors and explain paneled door with neat sketch. **[6]**

- Q3) a)** List out the documents and drawings required for submitting plan to the plan Sanctioning authorities. **[6]**
b) Explain steps for design of dog legged staircase. **[6]**
c) Write a short note on green building certification process. **[5]**

OR

- Q4) a)** Mention Functional requirements and dimensions of Residential Buildings of Row house and Apartment. **[6]**
b) What do you understand by Leadership in Energy and Environmental Design (LEED)? **[5]**
c) Explain with a suitable example, design of dog legged staircase. **[6]**

- Q5) a)** Draw a line plan of School building. [6]
b) It is proposed to construct a bungalow with the following are the requirements for accommodation: [12]
i) A drawing hall - 15m^2
ii) Living room - 20m^2
iii) Kitchen cum dining room - 15m^2
iv) Guest bedroom - 15m^2
v) Children's room - 20m^2
vi) Master bedroom - 20m^2
Provide adequate verandahs, passages, sanitary units, staircase etc.
The structure may be planned as G +1 RCC framed structure. Draw detailed ground floor plan.

OR

- Q6) a)** Draw a line plan for a single storeyed hostel building- [12]
i) Number of students - 100
ii) 20 rooms are two seated with 7.5 sq.m. area per student and 10 single seated with 9.5 sq.m area.
iii) Recreation room approx. area - 45 m^2
iv) Gymnasium approx. area - 20m^2
v) Office space approx. area - 12m^2
vi) Store room approx. area - 10m^2
vii) Verandah, passage, staircase, WC, bath, etc. of suitable size should be provided
b) Enlist design elements of auditorium building. [6]

- Q7) a)** Explain Necessity of town planning. [6]
b) Write note on: acoustical defects. [6]
c) Write a note on 7/12 extract, its importance. [5]

OR

- Q8) a)** What is Sabine's formula, sound absorbents, planning for good acoustics? [6]
b) Explain 1 pipe and 2 pipe plumbing system with sketches. [6]
c) Write a short note: RERA act. [5]



[6402]-2
S.E. (Civil Engineering)
MECHANICS OF STRUCTURE
(2019 Pattern) (Semester - III) (201002)

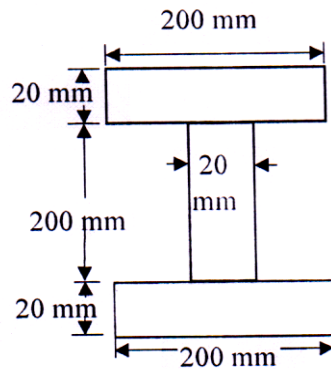
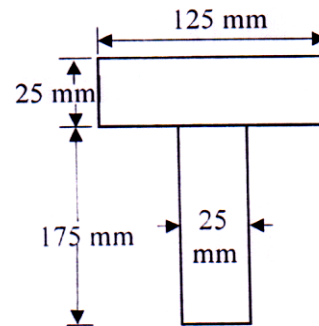
Time : 2 ½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4. Q.5. or Q.6 Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume Suitable data if necessary.
- 5) Use of scientific calculator is allowed.
- 6) Assessment will be based on complete solution and not on final answer.

- Q1) a)** Three wooden planks 200 mm × 20 mm each are connected to form a Symmetrical I section of a beam as shown in Figure 1. A moment of 7 kN.m is applied around the horizontal neutral axis. Find the bending stresses at both extreme fibers of cross section. **[8]**

**Figure-1****Figure -2**

- b)** A simply supported beam carries a uniformly distributed load of 30 kN/m over the entire span of 2 m. The cross section of beam is a T section, with its top flange of 125 × 25 mm and web of 175 × 25 mm as shown in Figure 2. Obtain the maximum shear stress and plot a shear stress distribution. **[10]**

OR

P.T.O.

- Q2) a)** A simply supported beam carries a point load of 100 kN at mid span of the beam of span 2 m. The cross section of beam is a T section, with its top flange of 150×30 mm and web of 30×200 mm as shown in figure 3. Obtain the maximum shear stress and plot a shear stress distribution. **[10]**
- b)** The cross section of simply supported beam of span 6 m long is shown in figure 4. If permissible stresses are 100 MPa in compression 40 MPa in tension, find safe udl the beam can carry. **[8]**

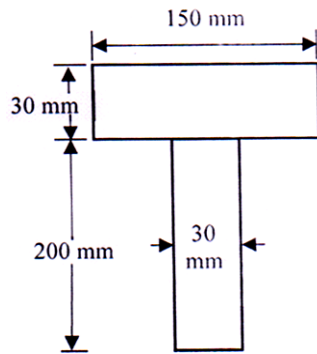


Figure -3

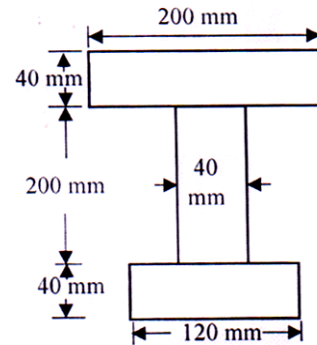


Figure - 4

- Q3) a)** Find maximum torque that can be safely applied to a shaft of 100 mm diameter. The permissible angle of twist is 2° in a length of 4 m and shear stress not to exceed 50 MPa. $G = 80 \times 10^3 \text{ N/mm}^2$. **[8]**
- b)** The plane element in a body is subjected to a tensile normal stresses of 25 N/mm^2 in X direction and shear stress of magnitude 100 N/mm^2 . Calculate the normal, tangential and resultant stresses on a plane inclined at 30° with vertical direction anticlock wise. **[9]**

OR

- Q4) a)** A hollow shaft with ratio of internal diameter to external diameter $3/5$ is required to transmit 400 kW at 60 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 50 N/mm^2 and the twist in a length of 3 m must not exceed 1° . Taking $G = 85 \times 10^3 \text{ N/mm}^2$, determine the minimum external diameter of the shaft satisfying above two conditions. **[9]**
- b)** The principal tensile stresses at a point are 150 N/mm^2 and 100 N/mm^2 . Find normal and tangential and resultant stress on a plane at 30° with major principal plane. What is angle of obliquity. **[8]**
- Q5) a)** State the assumptions made in Euler's theory. A 4 m length of tube has buckling load 2 kN when used as a column hinged at both ends. Calculate buckling load for 4.5 m length of the same tube when used as column if,
 (i) Both ends are fixed. (ii) One end fixed and another end is hinged. **[9]**

- b) A short masonry pillar $600 \text{ mm} \times 600 \text{ mm}$ in section. The pillar carries an eccentric load of 1200 kN . Acting at an eccentricity of 30 mm from the longitudinal axis as shown in figure 5. Find the maximum and minimum stresses on the section column. [9]

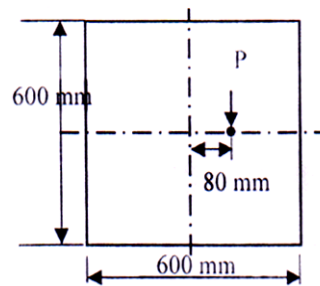


Figure -5

OR

- Q6) a) A hollow C.I. column whose outer diameter is 300 mm has a thickness of 25 mm . It is 4 m long and fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 3. Calculate slenderness ratio and Rankine's critical load. Take $\sigma_c = 500 \text{ N/mm}^2$, $\alpha = \frac{1}{7500}$ and take $E = 2 \times 10^5 \text{ N/mm}^2$. [9]

- b) A column $1.2 \text{ m} \times 1.2 \text{ m}$ is subjected to eccentric load 600 kN as shown in figure 6. Find The stresses at the corner A, B, C and D. Draw stress distribution diagram. [9]

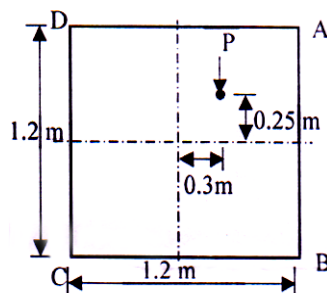


Figure-6

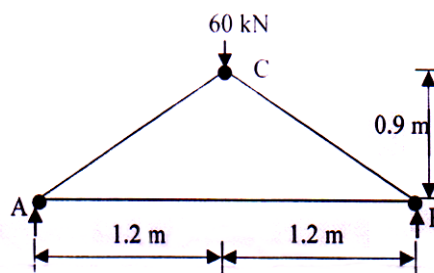


Figure-7

- Q7) a) Calculate the slope and deflection of Simply supported beam of span l carrying a point load at mid span. [8]
- b) Determine the horizontal displacement of the joint C of the pin jointed frame as shown in figure 7. The cross-sectional area of AB is 500 mm^2 and AC and BC is 750 mm^2 . Assume $E = 200 \text{ kN/mm}^2$. [9]

OR

- Q8) a)** A simply supported beam having uniform section is 14 m long and is simply supported at its ends. It carries concentrated load of 12 kN and 8 kN at 3 m and 4.5 m from the two ends respectively as shown in figure 8. I for the beam is $16 \times 10^4 \text{ m}^2$ and $E = 2.1 \times 10^4 \text{ kN/m}^2$. Calculate the deflection of the beam at points under the two loads by Macaulay's method. **[9]**

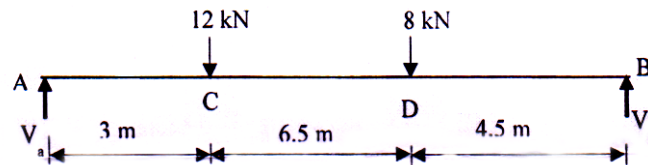


Figure - 8.

- b)** Determine the slope and deflection at free end of cantilever beam of span 'L' meter subjected udl 'w' on entire span. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD-4044

[Total No. of Pages : 3

[6402]-3
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) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right side indicate marks.*
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.*
- 5) Assume suitable data, if necessary.*
- 6) Answers to the all questions should be written in single answer book.*

- Q1) a)** Explain Buckingham π theorem method of dimensional analysis. **[6]**
- b) List out the various Non dimensional numbers along with their mathematical expression. **[5]**
- c) The drag force F on a partially submerged body depends upon relative velocity V between body and fluid linear dimension l , height of surface roughness k , fluid density ρ , viscosity μ , acceleration due to gravity 'g', using Buckingham π theorem develop an expression for drag force. **[6]**

OR

- Q2) a)** Explain boundary layer development on flat plate. **[6]**
- b) What is boundary layer separation. Explain any two methods to avoid boundary layer separation. **[6]**
- c) A flat plate has a length of 3m and width of 0.8m is moving in a stationary air at an velocity of 3m/s. If the kinematic viscosity of air is 0.10 stokes, find the thickness of boundary layer at the trailing edge. **[5]**

- Q3) a)** What are characteristics of laminar flow and list out any 4 practical examples of laminar flow. [6]
- b)** Explain 1. Instantaneous velocity, 2. Temporal mean velocity, 3. Intensity of turbulence. [5]
- c)** A laminar flow occurs through a pipe of 20cm diameter. The velocity of flow at a radial distance of 2 cm from axis of pipe was found to be 0.5m/s, find. [6]
- Maximum velocity of flow
 - Mean velocity of flow
 - Discharge flowing through pipe

OR

- Q4) a)** What is the difference between major loss and minor loss of energy in flow through pipe. List out all the types of minor loss along with relevant equations. [5]
- b)** Two pipe of diameter 10cm and length 5m, diameter 15cm and length 7.5m length respectively are connected in series, what is the total loss of energy when fluid flow from one end to another. Also draw the hydraulic gradient and total energy line. [6]
- c)** Three pipes 40cm diameter, 1200m length, 30cm diameter, 1000m length, 20cm diameter, 500m length, are connected in series. [6]
- If the pipe system is to be replaced by an equivalent pipe of 30 cm diameter, what would be the equivalent length.
 - What will be the equivalent diameter for the pipe of length 2700m length.

- Q5) a)** What is an open channel flow, its characteristics and what are the different types of flow that occur in an open channel? [6]
- b)** Derive condition for most economical rectangular channel section. [6]
- c)** A trapezoidal channel 2.5m wide and side slope 1.5 horizontal to 1 vertical carries water at a depth of 1.2m. If the channel bed slope is 0.0050 and manning coefficient is 0.020, [6]
- Calculate
- Velocity of flow
 - Discharge carried by channel
 - Average shear stress at the boundary

OR

- Q6)** a) What is specific energy? Explain with neat sketch specific energy curve? [6]
b) A rectangular channel is 3m wide and carries water at a normal depth of 0.5m. The channel has a longitudinal slope of 1 in 200. If manning coefficient of roughness is 0.018 find [6]
i) Discharge per unit width
ii) Flow is laminar or turbulent
iii) Critical depth
iv) Specific energy and specific force
v) Minimum specific energy
c) Explain the following with respect to open channel flow [6]
i) Prismatic channel
ii) Discharge diagram
iii) Specific force diagram
- Q7)** a) A flat plate $2.5\text{m} \times 2.5\text{m}$ is moved in a stationary air at 35 km/hr. If the coefficient of drag and lift is 0.10 and 0.50 respectively find [6]
i) Drag force
ii) Lift force
iii) Resultant force and its inclination
iv) Power required to keep plate in motion
Take density of air 1.2 kg/m^3
b) What are the different type of drag and explain each type. [6]
c) What is Magnus effect, and explain how lift can be generated on cylinder using Magnus effect. [6]

OR

- Q8)** a) What are the different channel types and the possible flow profile in each type of channel? [6]
b) Sketch the water surface flow profile in mild slope channel. [4]
c) A rectangular channel 15m wide carries water at a normal depth of 1.5m with a bed slope of 1/5000. At a certain section the depth of flow is 2.5m. How far upstream or downstream of this section the depth of flow would be 2.1 m. Use step method and take 2 steps. [8]



Total No. of Questions : 9]

SEAT No. :

PD-4045

[Total No. of Pages : 5

[6402]-4

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.*
- 2) *Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7 and Q.8 or Q.9.*
- 3) *Assume Suitable data if necessary.*
- 4) *Neat diagrams must be drawn whenever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of electronic pocket Calculator is allowed.*

Q1) a) If $f(x) = \frac{1}{\sqrt{6\pi}} e^{-x^2/6}$, $x \in (-\infty, \infty)$ then the mean μ and variance σ^2 are [1]

- i) $\mu = 1, \sigma^2 = 3$
- ii) $\mu = 0, \sigma^2 = 3$
- iii) $\mu = 0, \sigma^2 = \sqrt{3}$
- iv) $\mu = 3, \sigma^2 = 1$

b) The regression lines y on x is given by $2x - 3y + 5 = 0$. The slope b_{xy} of the regression line x on y satisfies. [2]

- i) $b_{xy} = 1$
- ii) $b_{xy} < 3/2$
- iii) $b_{xy} b_{yx} = 1$
- iv) $b_{xy} b_{yx} > 1$

P.T.O.

- Q2)** a) The first three moments $\mu_1^1, \mu_2^1, \mu_3^1$ about the value 2 of a distribution are 2, 32 and -80 . Find the mean, standard deviation and the coefficient of skewness of the distribution. [5]
- b) A set of 10 coins are tossed 4096 times. Assuming that the coins are identical and fair, in how many cases do you expect: [5]
- i) 8 heads and 2 tails?
- ii) at least 8 heads?

- c) Fit a Poisson distribution to the following data and find the χ^2 value.

x	0	1	2	3	4
f	122	60	15	2	1

Here f denotes frequency Take $e^{\frac{-1}{2}} = \frac{3}{5}$. Round off frequencies to the immediate higher integer values. [5]

OR

- Q3)** a) 10% rivets produced by a machine are defective. Find the probability that out of 10 rivets chosen at random.

- i) none will be defective.
- ii) one will be defective
- iii) at least one will be defective.

Apply the Poisson random variable theory to solve this question. [5]

- b) In every 30 days rain falls on 10 days on an average. Obtain the probability that [5]

- i) rain will fall on at least 3 days of a week.
- ii) the first 3 days of a week will be dry and the remaining 4 days wet.

- c) The monthly wages of 10,000 workers in a factory follows normal distribution with mean and standard deviation as ₹17000 and ₹1000 respectively. Find the expected number of workers whose monthly wages are between ₹16000 and ₹20,000. Take area $(0 < z < 1) = 0.34$ and area $(0 < z < 3) = 0.49$ where z is the standard normal variate. [5]

- Q4)** a) Prove the following identities (any one) [5]

i) $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$

ii) $\nabla^4 (r^2 \log r) = \frac{6}{r^2}$

- b) Find Directional derivative of $\phi = xy^2 + yz^2$ at $(2, -1, 1)$ along the line $2(x-2) = y+1 = z-1$. [5]

- c) Show that $\vec{F} = (2xz^3 + 6y)\hat{i} + (6x - 2yz)\hat{j} + (3x^2z^2 - y^2)\hat{k}$ is irrotational.

Find ϕ such that $\vec{F} = \nabla\phi$. [5]

OR

- Q5) a)** For a solenoidal vector field $\vec{F}$, show that $\text{curl curl curl curl } \vec{F} = \nabla^4 \vec{F}$ [5]

- b) Find the directional derivative of $\phi = x^2 - y^2 - 2z^2$ at the point P(2, -1, 3) in the direction PQ where Q is (5, 6, 4). [5]

- c) Show that $\vec{F} = (y^2 \cos x + z^2)\hat{i} + (2y \sin x)\hat{j} + 2xz\hat{k}$ is irrotational Find ϕ such that $\vec{F} = \nabla\phi$. [5]

- Q6) a)** Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = x^2\vec{i} + xy\vec{j}$ and C is straight line $y = x$ joining points (0,0) and (1,1). [5]

- b) By using Gauss divergence theorem evaluate $\iint_S \vec{F} \cdot d\vec{s}$ for vector field $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ where S is curved surface of cone $x^2 + y^2 = z^2$, $z = 4$. [5]

- c) Use Stoke's theorem to evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = e^x\vec{i} + 2y\vec{j} - \vec{k}$ where 'C' is curve $x^2 + y^2 = 4$, $z = 2$. [5]

OR

- Q7) a)** Find work done in moving a particle around ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ in plane $z = 0$ where $\vec{F} = (3x - 2y)\vec{i} + (2x + 8y)\vec{j} + y^2\vec{k}$. [5]

- b) Use Gauss divergence theorem to show that $\iint_S \frac{\vec{r}}{r^2} \cdot d\vec{s} = \iiint_V \frac{dv}{r^2}$ [5]

- c) Evaluate $\iint_S (\nabla \times \vec{F}) \cdot d\vec{S}$ where $\vec{F} = (x^2 + y - 4)\vec{i} + 3xy\vec{j} + (2xz + z^2)\vec{k}$ over the surface of hemisphere $x^2 + y^2 + z^2 = 16$ above XOY plane. [5]

- Q8) a) A taut string of length $2l$ is fastened at both ends, the midpoint of the string is taken to the height 'b' and the released from the rest in this position.

Obtain the displacement $y(x, t)$ if $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$. [8]

- b) Solve the one dimensional heat equation, $\frac{\partial u}{\partial t} = K \frac{\partial^2 u}{\partial x^2}$, subject to conditions. [7]

i) u is finite $\forall t$

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

iii) $u(100, t) = 0$,

iv) $u(x, 0) = \begin{cases} x & \text{if } 0 \leq x \leq 50 \\ 100 - x & \text{if } 50 \leq x \leq 100 \end{cases}$

OR

- Q9) a) If a string of length 4cm is initially at rest in its equilibrium position is set to vibration by giving each point a velocity,

$$\left. \frac{\partial y}{\partial t} \right|_{t=0} = \begin{cases} 3x & \text{if } 0 \leq x \leq 2 \\ 3(4-x) & \text{if } 2 \leq x \leq 4 \end{cases}$$

find the displacement $y(x, t)$

[8]

- b) An infinitely long uniform metal plate is enclosed between two parallel edges $x = 0$ and $x = \pi$ For $y > 0$. The temperature is zero along the edges $x = 0$, $x = \pi$ and at infinity. If edge $y = 0$ is kept at a constant temperature V_0 . Find the temperature distribution. $V(x, y)$. [7]



Total No. of Questions : 8]

SEAT No. :

PD-4046

[Total No. of Pages : 3

[6402]-5
S.E. (Civil Engg.)
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)** Describe various types of concordant and discordant igneous intrusions. **[6]**
- b)** Define fold and explain any three types of folds. **[6]**
- c)** Perpendicular distance between any two successive strike line is 3.0 cm, scale of the map is 1cm = 100m and contour interval is 30m. Calculate amount of dip (True Dip). **[5]**

OR

- Q2) a)** What is mountain building process? Describe types of mountains. **[6]**
- b)** Define fault and explain the significance of fault in Civil Engineering. **[6]**
- c)** Perpendicular distance between any two successive strike line is 3.0cm, scale of the map is 1cm = 100m and contour interval is 50m. Calculate amount of dip (True Dip). **[5]**
- Q3) a)** Explain how GIS is an important tool for civil engineers. **[6]**
- b)** Define Remote Sensing? Explain its applications in civil engineering. **[6]**
- c)** Calculate RQD recovery and Core recovery from following table. **[6]**

Run in m	Piece No.	Length in cm	Nature of fracture
0-3 m	1	20	J
	2	15	J
	3	40	M
	4	50	M
	5	60	M
	6	13	J
	7	50	J
3-6 m	8	60	M
	9	80	M
	10	09	M
	11	10	M

OR

- Q4)** a) What is GIS? Explain components of GIS. [6]
b) Explain methods of subsurface investigation. [6]
c) Calculate RQD recovery and Core recovery from following table. [6]

Run in m	Piece No.	Length in cm	Nature of fracture
0-3 m	1	16	J
	2	12	J
	3	60	M
	4	50	M
	5	30	M
	6	13	J
	7	9	J
	8	6	J
	9	8	J
3-6 m	10	71	M
	11	82	M
	12	9	M

- Q5)** a) Explain Preliminary Geological Investigations carried out for Tunneling. [6]
b) Explain tunneling conditions in Deccan trap region. [6]
c) A site is proposed for excavation of tunnel along A-B and M-N, passing through axial and limb region of fold respectively. Justify the suitability of tunnel in such conditions. [5]

OR

- Q6)** a) Discuss on the dam located in folded geological structure. [6]
b) Explain with appropriate example the feasibility of dam alignment which is crossing DYKE. [6]
c) What are the geological requirements for the foundation of dam? [5]
- Q7)** a) What is landslide? Describe in brief the various types of landslides. [6]
b) Discuss engineering properties of building stones. [6]
c) Define aquifers. Explain in brief the types of aquifers. [6]

OR

- Q8)** a) Explain geological conditions favorable for natural springs and artesian wells. [6]
- b) What are the causes of an earthquakes. [6]
- c) Explain in brief the geological work done by groundwater. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4047

[Total No. of Pages : 3

[6402]-6
S.E. (Civil Engg.)
GEOTECHNICAL ENGINEERING
(2019 Pattern) (Semester - IV) (201008) (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 whenever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Assume suitable data, if necessary and mention it clearly.*
- 5) Use of non-programmable calculator is allowed.*

- Q1) a)** Describe the effect of compaction on properties of soil. **[5]**
- b) Explain how compaction control is achieved in the field using a proctor needle. **[6]**
- c) What is pressure bulb? Explain its significance and draw a neat sketch of pressure bulb for concentrated point load. **[6]**

OR

- Q2) a)** Explain Boussinesq's theory with neat sketch. State its Assumptions and formula for stress in soil by point load, with description of each term. **[6]**
- b) Differentiate between Light Compaction & Heavy Compaction test. **[5]**
- c) A load of 1000 kN acts as a point load at the surface of a soil mass. Estimate the stress at a point 3m below and 4m away from the point of action of the load by Boussinesq's formula. Compare the value with the result from Westergaards's theory. **[6]**

- Q3) a)** Explain how shear tests are conducted with different drainage conditions? **[5]**
- b) Explain vane shear test procedure with a neat sketch and formula. **[6]**
- c) Define total and effective stress. Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 KN/m² and the pore water pressure is 80 KN/m². The effective stress shear strength parameters for the soil are $c' = 16 \text{ KN/m}^2$ and $\phi = 39^\circ$. **[6]**

P.T.O.

OR

- Q4)** a) A sample of dry cohesionless soil was tested in a triaxial machine. If the angle of internal shearing resistance was 36° & the confining pressure 100kN/m^2 , determine the deviator stress at which the sample failed. [6]
- b) Describe the procedure for Direct Shear Test. [5]
- c) Explain briefly the procedure of conducting Unconfined Compression Test on Clayey soil sample. Draw Mohr's circle for the test. [6]
- Q5)** a) Explain Rebhann's graphical method for determination of earth pressure on retaining wall. [6]
- b) Derive the expression for active state of pressure at any point for dry cohesionless backfill with uniform surcharge. [6]
- c) A smooth vertical wall retains a level surface with $\gamma = 18\text{kN/m}^3$, $\Phi = 30^\circ$, to a depth of 8 m. Draw the lateral pressure diagram and compute the total active pressure in dry condition and when water table rises to the GL. Assume $\gamma_{\text{sat}} = 22\text{kN/m}^3$. [6]

OR

- Q6)** a) Determine the relation for lateral earth pressure in active state for submerged cohesionless backfill. [6]
- b) Discuss Culmann's graphical method for the determination of active earth pressure. [6]
- c) In a cohesionless soil deposit having unit weight of 15 kN/m^3 and angle of internal friction Φ of 30° . Determine the active and passive lateral pressure intensities at depth of 10 m. [6]
- Q7)** a) Discuss "Taylor's Stability Number" for stability analysis of finite slope. [6]
- b) Enlist factors of safety used in stability analysis of slopes. Calculate the factor of safety w.r.t. cohesion of clay slope laid at 1 in 2 to a height of 10 m, if the angle of internal friction $\Phi = 10^\circ$ and $c = 25\text{kN/m}^2$ and $\gamma = 19\text{kN/m}^3$. What will be the critical height of the slope in this soil. Assume $S_n = 0.064$ for $\Phi = 10^\circ$. [6]
- c) Discuss the causes and remedial measures of Landslides. [6]

OR

- Q8)** a) Derive the expression for factor of safety for dry infinite slope in sandy soil. [6]
- b) Explain with neat sketch different modes of slope failure. [6]
- c) Discuss “Swedish Slip Circle Method” for stability analysis of finite slope. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4048

[Total No. of Pages : 3

[6402]-7
S.E. (Civil Engg.)
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 sketches must be drawn wherever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Assume suitable data if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Use of cell phone is prohibited in examination hall.*

- Q1)** a) Explain with sketch the fixed hair method of tacheometry, when line of sight is inclined upward (elevation) and staff is held vertical? **[6]**
- b) State characteristics and uses of contour lines. **[5]**
- c) A tacheometer was set at an intermediate point between two stations A & B and the following observations were made on the staff held vertical. **[7]**

Staff Station	Instrument Station	Vertical angle	Staff reading
A	Intermediate between A & B	+ 8°30'	2.220, 2.400, 2.580
B		- 5°45'	1.250, 1.930, 2.560

Compute the length AB and RL of point B, if that of A is 250.560 m. The instrument and staff are in one line. (take multiplying constant as 100 and Additive constant as 0)

OR

P.T.O.

- Q2) a)** A tacheometer with analytic lens. Having the value of constant 100 was used and the following observations were made on staff held vertical.

Instrument station	H.I. (m)	Vertical Angle	Staff at	Staff Reading
O	1.650	+5°45'	M	1.250, 2.250, 3.25
O	1.650	– 6°20'	Q	1.45, 1.85, 2.30

R.L of station M is 125.00 m Calculate the R.L. of O & Q, distance OQ and gradient of MQ line. **[8]**

- b) State the different uses of toposheets. **[4]**
 c) Explain the procedure for tacheometric contouring. **[6]**

- Q3) a)** Write a note on necessity and types of transition curves. **[5]**

- b) Tabulate the data required for setting out the circular curve by the deflection angle method using the following information : **[8]**

Chainage of intersection point 1580 m

Angle of intersection = 150°

Radius of curve = 360 m

Peg Interval = 30 m

- c) Draw neat sketch of combined curve with its notations. **[4]**

OR

- Q4) a)** Two tangents intersect at a chainage of 1250.5 m the deflection angle 25° calculate the following quantities for setting out all curves of radius 315m.

Calculate : **[8]**

- Tangent length
 - Length of long chord
 - Length of the curve
 - Apex Distance
 - Chainage of Curve point & tangency point
 - Versed sine of curve
 - Angle of intersection
- b) Enlist various linear methods of setting out curves and explain anyone with sketch. **[5]**
 c) State different types of curves, Explain compound curve with sketch. **[4]**

- Q5)** a) Define Control survey & write a short note on establishing of horizontal and vertical controls. [6]
b) Write a note on setting out Building layout with neat sketch. [6]
c) Write down the applications of space-based positioning system (SBPS). [5]

OR

- Q6)** a) Explain in brief various segments in Space based positioning system. [6]
b) Explain in brief procedure of setting out of Culvert. [6]
c) Write a short note on checking verticality of tall building. [5]

- Q7)** a) Explain triangulation method and trilateration method of geodetic survey. [6]
b) State the classification and applications of Photogrammetry in surveying. [6]
c) What are the objectives of hydrographic survey? [6]

OR

- Q8)** a) Define hydrographic survey & write a short note on stream gauging. [6]
b) State the working and uses of Electronic Total Station. [6]
c) Differentiate between Map and aerial photograph. [6]



Total No. of Questions : 8]

SEAT No. :

PD4049

[Total No. of Pages : 4

[6402]-8

S.E. (Civil)

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 wherever necessary.
- 4) Use of non programmable calculator is allowed in the examination.
- 5) Your answers will be valued as a whole.
- 6) If necessary assume suitable data and indicate clearly.
- 7) Use of IS codes 10262,456 is not allowed.

- Q1)** a) Explain the compressive strength of concrete. How it is determined in laboratory? [6]
- b) Explain the relationship between compressive strength and tensile strength of concrete. [6]
- c) State the various types of non-destructive tests carried, on hardened concrete. Explain ultrasonic pulse velocity test with its limitations. [6]

OR

- Q2)** a) Explain rebound hammer test with its limitations. [6]
- b) Explain the stress-strain relationship of concrete with neat sketch. [6]
- c) Define creep of concrete. What are the factors affecting on creep of concrete? [6]

- Q3)** a) What do you mean by concrete mix design? What are the objectives in mix design? [6]
- b) Explain the factors affecting the concrete mix design. [5]
- c) Explain DOE method of concrete mix design. [6]

OR

P.T.O.

Q4) a) Using IS code method design a concrete for grade M35 for following data: **[13]**

Parameter : Details
 Grade designation : M35
 Standard deviation,s : 5.00
 Factor based on the grade of concrete,x : 6.50
 Type of cement : OPC 53 grade conforming to IS 8112
 Workability : 75 mm(slump)
 Exposure conditions : Very 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 : 2.70
 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 to Table 7 of IS 383
10	2.80	78.30	1.4	39.15	40.55	
4.75	0	8.70	0	4.35	4.35	

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

Water content per m³ of concrete of 50 mm slump:

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

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

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

Approximate air content:

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

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

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

b) What do you mean by: [4]

- Mean strength
- Variance
- Standard deviation
- Coefficient of variation

Q5) a) Describe the cold and hot weather concreting. [6]

b) What is light weight concrete? How it can be achieved in practice? [6]

c) Describe the types of vibrators used for compaction of concrete. [6]

OR

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

- Fiber reinforced concrete
- Geo-polymer concrete

b) Enlist special concreting techniques? Explain under water concreting. [5]

c) Explain the ferrocement technology with its applications. [5]

- Q7)** a) Explain the durability of concrete? What effect the 'water- cement ratio makes on durability? [5]
- b) Write short note on: [12]
- i) Sulphate attack on concrete
 - ii) Chloride attack on concrete
 - iii) Carbonation of concrete

OR

- Q8)** a) What are the symptoms and diagnosis of distress of concrete? [5]
- b) Explain in detail corrosion monitoring techniques of reinforcement and preventive measures against corrosion. [6]
- c) What do you meant by retrofitting of concrete? Discuss the use of fiber reinforced polymer concrete for retrofitting. [6]



[6402]-9
S.E. (Civil)
STRUCTURAL ANALYSIS
(2019 Pattern) (Semester - IV) (201011)

Time : 2½ Hours]

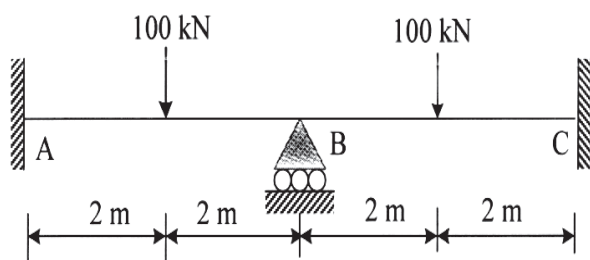
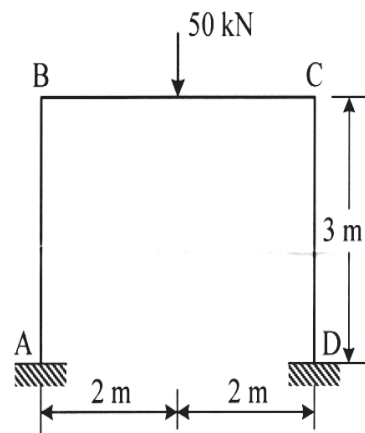
[Max. Marks : 70

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 diagram 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.
- 6) Use of cell phone is prohibited in the examination hall.

Q1) a) Analyze the continuous beam by slope deflection method as shown in Fig. 1a. **[8]**

b) Analyze the portal frame by slope deflection method as shown in Fig. 1 b. **[10]**

**Fig. 1 a****Fig. 1 b**

OR

P.T.O.

- Q2) a)** Analyze the propped cantilever by slope deflection method as shown in Fig. 2 a. [8]
b) Analyze the portal frame by slope deflection method as shown in Fig. 2 b. [10]

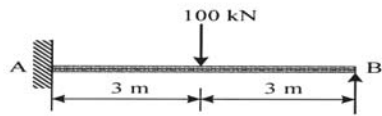


Fig. 2 a

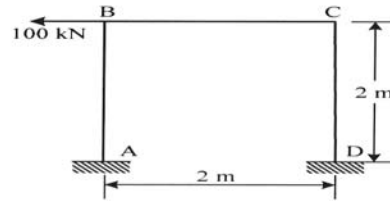


Fig. 2 b

- Q3) a)** Analyze the continuous beam by moment distribution method as shown in Fig.3 a. [8]
b) Analyze the portal frame by moment distribution as shown in Fig.3 b. [10]

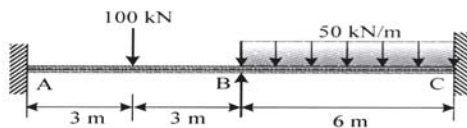


Fig. 3 a

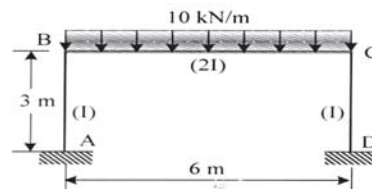


Fig. 3 b

OR

- Q4) a)** Analyze the propped cantilever by moment distribution method as shown in Fig.4 a and draw bending moment diagram. [8]
b) Analyze the portal frame by moment distribution method as shown in Fig.4 b. [10]

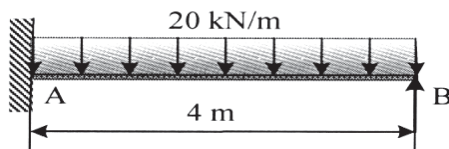


Fig. 4 a

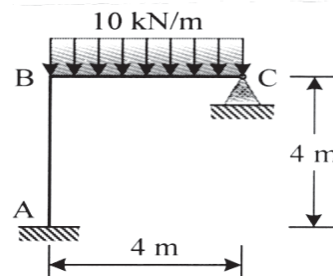


Fig. 4 b

- Q5) a) Analyze the continuous beam by stiffness method as shown in Fig. 5 a. [12]
 b) Generate the stiffness matrix for the bent as shown in Fig. 5 b. [5]

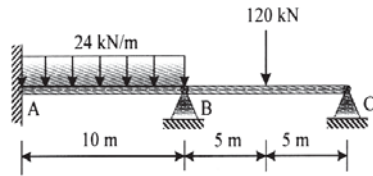


Fig. 5 a

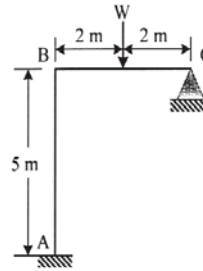


Fig. 5 b

OR

- Q6) a) Analyze the frame by stiffness method as shown in Fig. 6 a. [12]
 b) Generate the stiffness matrix for the beam as shown in Fig. 6 b. [5]

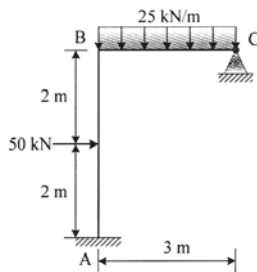


Fig. 6 a

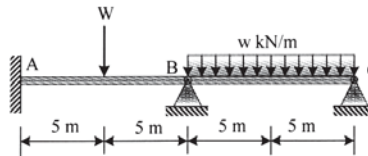


Fig. 6 b

- Q7) a) State the assumption of plastic analysis. [5]
 b) Find the plastic moment for the beam loaded with ultimate loads as shown in Fig. 7 b. [12]

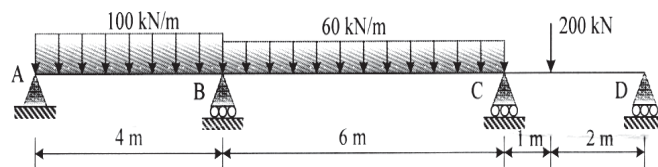


Fig. 7 b

OR

- Q8) a) State and explain plastic collapse load, plastic moment and plastic section modulus. [5]
 b) A beam of T (Flange : 120mm × 12mm and web 168 mm × 12mm) cross-section is subjected to sagging moment, find the shape factor if permissible yield stress in compression and tension is 230 MPa and 280 MPa respectively. [12]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4051

[Total No. of Pages : 2

[6402]-10

S.E. (Civil)

PROJECT MANAGEMENT

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a)** Yearly requirement of cement by large firm is 300 bags. The cost of a bag is Rs. 300/-. Lead time is one month and ordering cost per order is Rs. 200/-. Assume annual carrying cost for inventory is 20% of average inventory management. Find EOQ and total inventory cost. [6]
- b) Explain the merits and demerits of ERP system. [5]
- c) Define inventory and list out its types. Explain any method of inventory control. [6]

OR

- Q2) a)** Segregate the items as per their annual usage and plot ABC Curve. [6]

Sr. No.	Item	Annual Usage in Rs.
1	Cement	1,50,000
2	Sand	80,000
3	Wash basin	44,000
4	Steel	1,15,000
5	Aggregate	90,000
6	Paint	50,000

- b) What are the functions of Materials Manager? [5]
- c) What are the points to be considered while preparing safety programme of construction site. [6]
- Q3) a)** What do you understand by resource smoothing and resource levelling? Explain their significance. [5]
- b) What do you mean by updating the network? Write steps to update the network. [6]
- c) Explain the use of Project Management software in construction industry. [6]

OR

P.T.O.

- Q4)** a) What do you mean by EVA? Explain any one in detail. [5]
 b) What is project monitoring? State its advantages. [4]
 c) Following table shows the cost duration data for a small construction project. Carry out step by step crashing and how much you save by crashing the network. Indirect cost is Rs. 300/week. [8]

Activity		1-2	2-3	2-4	3-5	4-5	5-6
Normal	Cost	4000	2000	5500	200	2200	4000
	Duration (weeks)	3	4	5	7	4	8
Crash	Cost	4200	4800	6400	1200	2600	4200
	Duration (weeks)	1	2	2	3	2	4

- Q5)** a) Explain importance of project economics in construction industry. [6]
 b) Explain difference between cost and value with suitable examples. [6]
 c) Define annuities. What are the kinds of annuities. [6]

OR

- Q6)** a) What are the types of elasticities? Explain in brief. [6]
 b) Explain Law of Demand and Supply with proper Sketch. [6]
 c) Explain law of substitution with the help of a neat sketch. [6]

- Q7)** a) What are the different types of appraisals required to undertake any project? Explain any one in detail. [6]
 b) Explain in detail role of project Management Consultant in Civil Engineering field. [8]
 c) Write a short note on payback period. [4]

OR

- Q8)** a) "Technical and economical appraisals are a must to check project profitability". Comment. [4]
 b) Following data pertains to 2 projects. Rank the projects based on B/C ratio & NPV values. [8]

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

- c) Write a short note on ARR method and IRR method. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4052

[Total No. of Pages : 2

[6402]-11
S.E.
ELECTRICAL ENGINEERING
Power Generation Technology
(2019 course) (Semester - III) (203141)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q-7 or Q-8*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable additional data, if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1)** a) Explain advantages and disadvantages of Hydroelectric power plant. [5]
- b) List the turbines used in hydroelectric power plant and describe the factors governing their choice. [5]
- c) With the help of simple diagram explain working of hydroelectric power plant. [8]

OR

- Q2)** a) Write down factors which affect the location of site of a hydropower station. [4]
- b) Write a short note on [6]
- i) Hydrograph
- ii) Pumped storage hydro power plant
- c) With neat diagram describe high head power plant. [8]

P.T.O.

- Q3)** a) Wind turbine with 10m dia. Rotor, assume air density as 1.293kg/m^3 and wind speed is 20m/s. What is expected power in watt? [4]
b) Differentiate between horizontal axis and vertical axis wind turbine. [6]
c) Explain yaw control and pitch control method used in wind energy system. [7]

OR

- Q4)** a) If wind speed is 30m/s and rotor diameter is 15m find power available in wind. assume air density as 1.293kg/m^3 . [4]
b) Explain how the wind pattern affects power generation in wind energy systems. [6]
c) Write a short note on generators used in Wind energy system. [7]
Q5) a) Differentiate between non concentric and concentric type collectors. [4]
b) Explain any two solar thermal applications with neat diagram. [6]
c) Explain the working of PV cell and Simplest Equivalent Circuit for a Photovoltaic Cell. [8]

OR

- Q6)** a) Why measurement of solar radiation is important? Which equipments are used for measurement? [4]
b) Explain impact of insolation and temperature on I-V curves of PV cells [6]
c) Explain any two solar collectors along with their applications. [8]
Q7) a) Write a short note on 'Ocean thermal Energy' [4]
b) Explain standalone, hybrid stand alone and grid connected renewable energy sources. [6]
c) Explain the process Biomass energy conversion. [7]

OR

- Q8)** a) What is a geothermal energy? How can it be used for power generation? [4]
b) Explain the process of municipal solid waste to energy conversion. [6]
c) Explain grid connected renewable systems and their requirements [7]



Total No. of Questions : 8]

SEAT No. :

PD-4054

[Total No. of Pages : 2

[6402]-13
S.E. (Electrical)
203143: Analog and Digital Electronics
(2019 Pattern) (Semester - III)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 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 side indicate full marks.*

Q1) a) Explain working of SRAM with diagram. **[6]**

b) Explain Programmable Logic Array. Implement the following Boolean functions using PLA: **[6]**

$$A=XY+XZ'$$

$$B=XY'+YZ+XZ'$$

c) Write a short note on FPGA **[6]**

OR

Q2) a) Explain working of DRAM with diagram. **[6]**

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

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

Q3) a) Explain OPAMP as voltage to current converter. **[5]**

b) Explain working of OPAMP as instrumentation amplifier. **[5]**

c) Explain the working of OPAMP as a comparator along with circuit diagram and input and output waveforms. **[8]**

OR

P.T.O.

- Q4)** a) With the help of neat diagrams, explain OPAMP as peak detector. [5]
b) Define the characteristics of practical OPAMP. [5]
c) Explain generation of saw tooth waveform using OPAMP. Draw input & output waveforms. [8]
- Q5)** a) Explain High pass filter using op-amp with its frequency response. [5]
b) Explain the function of LM 317 as adjustable voltage regulator. [5]
c) Draw the diagram of IC 555 configured in monostable mode. Draw necessary waveforms. [7]

OR

- Q6)** a) What is the difference between fixed and variable voltage regulators? Explain IC78XX and IC 79XX series regulators. [5]
b) Explain the operation of IC555 as astable multivibrator along with waveforms. [5]
c) Draw and explain frequency response characteristic of ideal and practical Low Pass Filter. [7]
- Q7)** a) Explain working of single phase full wave bridge rectifier supplying R-L load. [5]
b) Draw neat diagram and explain single phase half wave rectifier with pure resistive load. Also define peak inverse voltage. [5]
c) Explain in detail the working of center tapped rectifier connected to the R-L load. [7]

OR

- Q8)** a) Explain working of single phase half wave rectifier with RL load. [5]
b) Explain the working of single-phase full wave centre tapped rectifier with pure resistive load. Also draw the input and output waveforms. [5]
c) With the help of circuit diagram and relevant waveforms, explain the operation of a 3-phase bridge rectifier with resistive load. [7]



[6402]-14
S.E. (Electrical)
ELECTRICAL MEASUREMENTS &
INSTRUMENTATION
(2019 Pattern) (Semester - III) (203144)

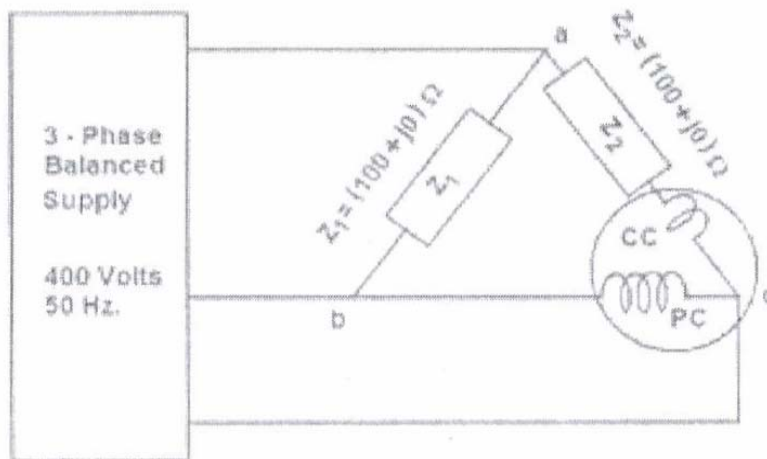
Time : 2½ Hours]

[Max. Marks : 70]

Instructions to the candidates:

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

- Q1)** a) Draw neat circuit diagram for measurement of power in three phase circuit using two wattmeter method with star connected R-L series load [4]
- b) The figure shows a three-phase delta connected load supplied from a 400V, 50Hz, 3-phase balanced source. The pressure coil(PC) and current coil(CC) of a wattmeter are connected to the load as shown, with the coil polarities suitably selected to ensure a positive deflection. The wattmeter reading will be [8]



- c) Explain various errors produced in wattmeter [6]

OR

P.T.O.

- Q2)** a) Draw neat circuit diagram for measurement of power in three phase circuit using one wattmeter method with two-way switch for star connected R-L series load [4]
- b) Explain working of 3 phase 3 element wattmeter. [8]
- c) In an experiment for measurement of power by two wattmeter method for a load of 415V, 20 A, one wattmeter reads 100 kW and other reads 80 kW. Calculate power factor of the load, total active and reactive power consumed. [6]

- Q3)** a) State following statements are true or False : [3]
- i) Energy meter is indicating type of instrument.
- ii) In induction type energy meter, driving torque produced is proportional to power consumed.
- iii) Recorded energy can be calculated from energy meter constant.
- b) A 230 V, single phase, energy meter has constant load of 5 A passing through it for 6 hours at unity power factor. If the meter disc makes 2760 revolutions during this period, what is meter constant in revolutions per kWh. Also calculate power factor of the load if the number of revolutions made by the meter are 1800 when operating at 230 V and 6 A for 4 hours [6]
- c) Derive the torque equation of single phase induction type energy meter. [8]

OR

- Q4)** a) Draw the block diagram of electronic energy meter. [3]
- b) A 230 V, 50 Hz, 1 ph energy meter has a constant of 200 rev/kwh. While supplying a non-inductive load of 4.4 A at normal voltage. The meter takes 3 minutes for 10 revolutions. Calculate the percentage error of the meter? [6]
- c) With neat circuit diagram and necessary phasor diagram, explain how 1 phase static energy meter can be calibrated at 0.5 lagging power factor by use of resistive load, three phase supply and two way switches. [8]

- Q5) a)** Give 2 examples of each of following types transducers. [4]
- i) Active transducers
 - ii) Passive transducers
 - iii) Primary transducers
 - iv) Secondary transducers
- b) With neat diagram, Explain Cathode Ray Oscilloscope. [6]
- c) Explain detailed classification of pressure. [8]

OR

- Q6) a)** Give any four differences between CRO and DSO. [4]
- b) With neat diagram, explain working of Mcleod gauge. [6]
- c) Explain various front panel controls of CRO. [8]

- Q7) a)** Draw and explain following methods of level measurement, state any 1 application of the same
- i) Sight glass method
 - ii) Float gauge method [8]
- b) With neat diagram, explain working of RVDT. [6]
- c) List applications of level measurement in electrical engineering [3]

OR

- Q8) a)** Explain with neat diagram, bonded and unbonded strain gauge. [8]
- b) With neat diagram, explain hydraulic method of level measurement. [6]
- c) Define strain hence state importance of displacement measurement. [3]



Total No. of Questions : 9]

SEAT No. :

PD-4056

[Total No. of Pages : 5

[6402]-15

S.E. (Electrical Engineering)

ENGINEERING MATHEMATICS -III

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Question no. 1 is compulsory.
- 2) Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7 and Q.8 or Q.9.
- 3) Assume Suitable data if necessary.
- 4) Neat diagram must be drawn whenever necessary.
- 5) Figures to the right side indicate full marks.
- 6) Use of electronic pocket Calculator is allowed.

Q1) a) A throw is made with two dices. The probability of getting a score of at least 10 points is, [1]

- i) $1/6$
- ii) $1/4$
- iii) $1/12$
- iv) $5/6$

b) Analytic function with constant amplitude is, [1]

- i) function of x
- ii) function of y
- iii) function of x, y
- iv) constant

P.T.O.

OR

Q3) a) Attempt any one: [5]

i) Find Z- transform of $f(k) = 2^k (0) (3k+2), k \geq 0$

ii) Find inverse Z-transform of $f(Z) = \frac{Z}{(Z-2)(Z-3)}: 2 < |Z| < 3$

b) Find Fourier integral representation of the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ and

hence evaluate $\int_0^\infty \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda$ [5]

c) Using inverse sine transform. Find $f(x)$ if $F_s(\lambda) = \frac{1}{\lambda} e^{-a\lambda}$ [5]

Q4) a) The first four moments about the value 2 are 2,20,40 and 50. Find first four moments about mean, coefficient of skewness and Kurtosis. [5]

b) Find correlation coefficient for following distribution,

x	5	7	9	11	13
y	9	6	12	3	15

[5]

c) The probability of a man hitting a target is $2/3$. If he fires 5 times, what is the probability of his hitting the target at most thrice? [5]

OR

Q5) a) Given the information; and if the correlation coefficient is 0.9, find the line of regression of x on y & estimate y for $x = 10$. [5]

	x	y
A. mean	8.2	12.4
S.D.	6.2	20

b) Between 2 & 3 p.m. the average number of phone calls per minute coming into the company are 2. Find the probability that during one particular minute there will be

i) No call at all

ii) 3 or less calls. [5]

- c) If X is normally distributed and the mean of X is 15, standard deviation is 5. Determine the probability of
- $0 \leq X \leq 10$
 - $X \geq 25$
- [Given : $A(1) = 0.3413$, $A(2) = 0.4772$, $A(3) = 0.4987$] [5]

- Q6)** a) Find directional derivative of $\phi = x^2 - y^2 - 2z^2$ at the point (2, -1, 3) towards the point [5, 6, 4] [5]
- b) Show that the vector field $\vec{F} = ye^{xy} \cos z \hat{i} + xe^{xy} \cos z \hat{j} - e^{xy} \sin z \hat{k}$ is irrotational and find scalar field such that $\vec{F} = \nabla \phi$. [5]
- c) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = (2xy + 3z^2) \hat{i} + (x^2 + 4yz) \hat{j} + (2y^2 + 6xz) \hat{k}$ and C is the curve $x = y = z$ from (0, 0, 0) to (1, 1, 1). [5]

OR

- Q7)** a) Find Directional derivative of $\phi = e^{2x} \cos yz$ at the origin in the direction tangent to the curve $x = a \sin t$, $y = a \cos t$, $z = at$, at $t = \pi/4$ [5]
- b) Show that (any one)
- $\nabla^4 (r^2 \log r) = 6 / r^2$
 - $\nabla \left(\frac{\vec{a} \cdot \vec{r}}{r^n} \right) = \frac{\vec{a}}{r^n} - \frac{n(\vec{a} \cdot \vec{r})}{r^{n+2}} \vec{r}$ [5]
- c) Using Green's theorem evaluate $\oint_C (xy - x^2) dx + x^2 y dy$ along the closed curve bounded by $y = 0$, $x = 1$ and $y = x$ [5]
- Q8)** a) Let $f(Z) = u(r, \theta) + iv(r, \theta)$ be an analytic function and $u = -r^3 \sin 3\theta$, then construct the corresponding analytic function F(Z) in terms of Z. [5]
- b) Evaluate $\int_C \frac{Z}{(Z^2 - 3Z + 2)} dZ$ where C is $|Z - z| = \frac{1}{2}$. [5]
- c) Find the bilinear transformation which maps the points $Z = 0, -1, i$ onto $\omega = i, 0, \infty$. [5]

OR

- Q9)** a) If $u - v = (x - y)(x^2 + 4xy + y^2)$ & $f(Z) = u + iv$ is an analytic function of $Z = x + iy$, find $f(Z)$ in terms of Z . [5]
- b) Evaluate $\int_C \frac{4 - 3z}{Z(Z-1)(Z-2)} dZ$ where C is the circle $|Z| = \frac{3}{2}$. [5]
- c) Find the bilinear transformation which maps the points $1, i, -1$ from Z -plane onto the points $i, 0, -i$ of ω plane. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4057

[Total No. of Pages : 3

[6402]-16
S.E. (Electrical)
POWER SYSTEM - I
(2019 Pattern) (Semester - IV) (203145)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable additional data, if necessary.*
- 4) *Draw neat & clean diagrams if necessary.*
- 5) *Use of non-programmable calculator is allowed.*

- Q1)** a) Define span length. State the factors to be consider for selection of span length. **[4]**
- b) Discuss any two types of line supports used in overhead lines and their advantage and disadvantages. **[6]**
- c) A transmission line has a span of 150 m between level supports. The conductor has a cross-sectional area of 2cm^2 . The tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9.9 gm/cm^3 and wind pressure is 1.5 kg/m length, Calculate
- i) sag ii) vertical sag. **[8]**

OR

- Q2)** a) Define pin type and shackle type insulator with their application. **[4]**
- b) Describe any two methods for improving string efficiency in overhead line insulators. **[6]**
- c) In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 11% of self-capacitance of each insulator, find (i) Voltage across string (ii) the distribution of voltage over 3 insulators and (iii) string efficiency. **[8]**
- Q3)** a) State skin effect, enlist the factors responsible for skin effect. **[3]**
- b) A single phase line has two parallel conductors 2m apart. The diameter of each conductor is 1.2cm. Calculate the loop inductance per km of the line. **[6]**
- c) Derive an expression for flux linkages due to single current carrying conductor. **[8]**

P.T.O.

OR

- Q4) a)** Define concept of self and mutual G.M.D. [3]
- b) Calculate the inductance of each conductor in a 3-phase, 3-wire system when the conductors are arranged in horizontal plane with spacing such that $D_{31} = 4\text{m}$, $D_{12} = D_{23} = 2\text{m}$. The conductors are transposed and have a diameter of 2.5cm. [6]
- c) Derive an expression for the inductance of three phase overhead transmission line with symmetrical spacing considering transposition. [8]

- Q5) a)** What is the need of transposition for capacitance calculation? [4]
- b) A 3-phase overhead transmission line has its conductors arranged at the corners of an equilateral triangle of 2 m side. The diameter of each conductor is 1.25cm. Calculate capacitance of each line conductor per km. [6]
- c) Derive the expression of capacitance of 3-phase overhead line with unsymmetrical spacing considering transposition. [8]

OR

- Q6) a)** Explain the concept of G.M.R. for capacitance calculation. [4]
- b) Derive expression for capacitance of a single phase overhead line. [6]
- c) A 3-phase, 50 Hz, 66kV overhead line conductors are placed in horizontal line. The conductor diameter is 1.25 cm. If the line length is 100km, Calculate capacitance per phase. [8]

- Q7) a)** Classify transmission lines based on length and voltage levels. [3]
- b) Obtain the relationship between sending end voltage and current in terms of receiving end voltage and current for a medium transmission line using 'nominal T' method. Draw a neat phasor diagram. [6]
- c) A 3-phase, 50 Hz, 150 km line has a resistance, inductive reactance and capacitive shunt admittance of 0.1Ω , 0.5Ω and 3×10^{-6} per km per phase. If the line delivers 50 MW at 110kV and 0.8 p.f. lagging, determine the sending end voltage and current. Assume a nominal π circuit for the line. [8]

OR

- Q8)** a) State and explain in short Ferranti effect? [3]
- b) Derive an expression for ABCD constants of short transmission line. [6]
- c) An overhead 3-phase transmission line delivers 5000 kW at 22 kV at 0.8 p.f. lagging. The resistance and reactance of each conductor is 4Ω and 6Ω . Respectively. Determine i) sending end voltage ii) percentage regulation iii) transmission efficiency. [8]



Total No. of Questions : 8]

SEAT No. :

PD-4058

[Total No. of Pages : 3

[6402]-17

S.E. (Electrical Engineering)

ELECTRICAL MACHINES - I

(2019 Pattern) (Semester - IV) (203146)

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.
- 5) Use of non-programmable calculator is allowed.

- Q1)** a) Compare simple Lap & wave winding. [4]
- b) Draw the power flow diagram of DC motor. [6]
- c) A 4P, 250 V wave connect DC shunt motor gives 11.190 kW when running at 1000 rpm & drawing armature & field current 50 A & 1 A respectively. It has 540 arm conductors & $R_a = 0.12 \Omega$. Assume voltage drop 1 V / brush calculate [8]
- i) Total torque
 - ii) Useful torque
 - iii) Rotational losses &
 - iv) Efficiency

OR

- Q2)** a) State the parts of Stator & Rotor of DC machine. [4]
- b) Derive the equation for : [6]
- i) Armature torque &
 - ii) Shaft torque of DC motor
- c) Draw the connection diagram of shunt , series & separately excited DC motors. State their current & back emf equations. [8]

P.T.O.

- Q3) a)** State any two applications of- [3]
i) DC shunt
ii) Series &
iii) Cumulative compound motor
- b)** Sketch & explain the Torque- Armature current characteristics of [6]
i) DC shunt motor &
ii) Series motor.
- c)** A 220 V DC series motor takes 40 A when running at 700 rpm. Calculate the speed which motor will run & current taken from the supply if the field is shunted by resistance equal to field resistance & torque is increased by 50 %. Take $R_a = 0.12 \Omega$ & $R_{se} = 0.1 \Omega$. Assume unsaturated magnetic field. [8]

OR

- Q4) a)** State the possible ways to reverse the direction of rotation of DC shunt motor. [3]
- b)** Sketch the circuit diagram & explain the methods of speed control of DC series motor by flux control. [6]
- c)** Draw the connection diagram of 3 point starter used for DC shunt motor & explain the function of [8]
i) Hold on coil &
ii) Over load coil

- Q5) a)** Draw the power flow diagram of 3-ph Induction motor. [4]
- b)** Prove that; rotor Cu loss = slip x rotor input. [6]
- c)** A 30 kW, 4P, 50 Hz, 3-ph Induction motor has stator losses equal to rotor losses & rotational losses of 1.5 % of output power. Full load slip is 4 %. [8]

Calculate;

- i) Rotor Cu loss
ii) Rotor input power
iii) Efficiency

OR

- Q6)** a) Calculate the slip & frequency of rotor current of a 3-ph, 50 Hz induction motor when running at 720 rpm. [4]
- b) Obtain the torque equation of induction motor under running condition & there of derive the condition of maximum torque. [6]
- c) Sketch the family of torque-slip characteristics of 3-ph induction motor & explain [8]
- i) operating region
 - ii) maximum torque &
 - iii) when slip is one
- Q7)** a) State the types of starters used for induction motors. [3]
- b) Demonstrate the IS Std 325 for testing of 3-ph induction motor. [6]
- c) Draw the connection diagram of star-delta starter & explain the starting and running operation of 3-ph induction motor. [8]

OR

- Q8)** a) Obtain the approximate equivalent circuit diagrams of 3-ph induction motor step by step. Label it & state the meaning of each nomenclature used. [7]
- b) Using data from No load & Blocked rotor test on 3-ph induction motor, Draw the circle diagram & write the procedure to find full load current, pf, full load slip, rotor Cu loss, stator Cu loss, locate the points for slip = 0, 1 & infinity. [10]



[6402]-18

S.E. (Electrical Engineering)

NETWORK ANALYSIS

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) What is time constant? Explain time constant in case of series R-L and series R-C circuit. [7]
- b) Explain the behaviour of R, L and C elements for transients. Mention the representation at the instant of switching. [5]
- c) Obtain the expression for voltage across capacitor in series RL circuit connected to a d. c. voltage V for $t > 0$. Assume initial charge across capacitor is zero. [5]

OR

- Q2)** a) $R = 1 \Omega$, $L = 1 \text{ H}$, and $C = 0.5 \text{ F}$ are connected in series with a switch across C. 2 V supply is connected to the circuit. At $t = 0^-$ the switch is in closed position. At $t = 0$ the switch is opened. Find the voltage across the switch at $t = 0^+$. [7]

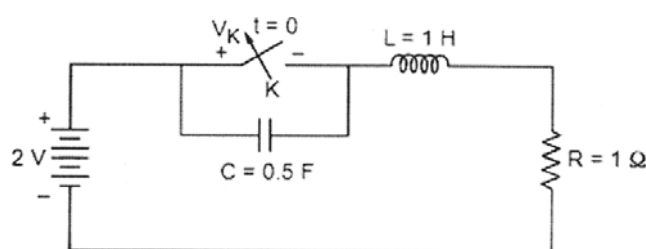


Fig. No. 1

- b) Explain the behaviour of R, L and C elements at the time of switching, at $t = 0$, at $t = 0^+$ and at $t = \infty$. [10]
- Q3)** a) Find the Laplace Transform of a ramp function. [6]
- b) State and explain the convolution theorem of Laplace Transform. [6]
- c) State ant six properties of Laplace Transform. [6]

OR

P.T.O.

- Q4)** a) Derive the relation between unit step function and unit Impulse function. [6]
 b) Find the Laplace transform of $e^{-at} \sin \omega t$. [6]
 c) Obtain $F(s)$ for the signal shown in fig. no. 2. Also determine its Laplace transform. [6]

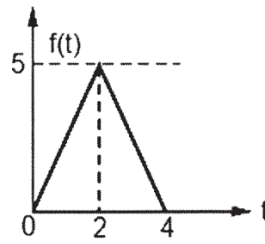


Fig. No. 2

- Q5)** a) Express impedance parameters in terms of transmission line parameters. [9]
 b) Find Z parameters of the network shown in figure no. 3. [8]

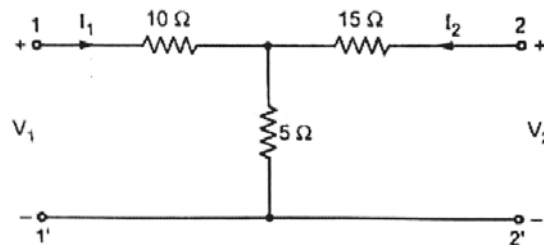


Fig. No. 3

OR

- Q6)** a) Define the following terms in relation with filter and give significance of each. [9]
 i) Pass band
 ii) Stop band
 iii) Cutoff frequency
 b) What is high pass filter? Derive the expression for the cutoff frequency of prototype low pass filter in terms of L and C. [8]
- Q7)** a) Explain the necessary conditions for transfer function. [9]
 b) Determine the driving point impedance voltage ratio transfer function for the network shown in fig. No. 4. [9]

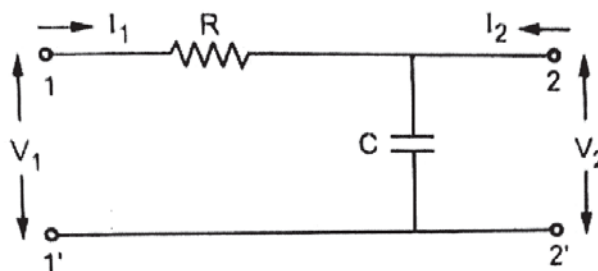


Fig. No. 4

OR

- Q8)** a) What is pole-zero plot? Explain with suitable example. [9]
- b) Obtain the pole zero plot of transform impedance for the network shown in fig. no.5. [9]

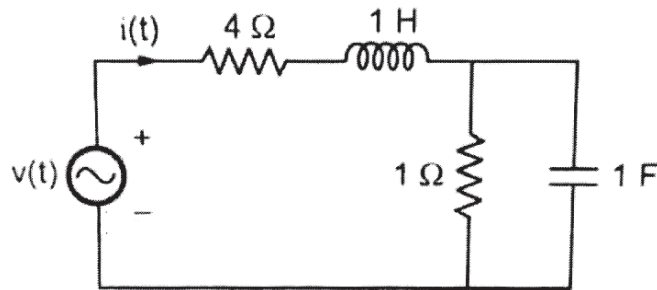


Fig. No. 5



[6402]-19

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) 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) With the usual notation, prove the following. [4]

$$(1 + \Delta)(1 - \nabla) = 1$$

$$\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$$

- b) For the data given below, construct the forward difference table and hence find the value of $f(-1.5)$ [6]

x	-2	-1	0	1	2	3
$f(x)$	15	5	1	3	11	25

- c) Find the missing term in the table using Newton's divided difference interpolation method. [8]

x	0	1	2	3	4
y	1	3	9	--	81

OR

Q2) a) Derive the Newton's backward interpolation formula for equally spaced points. [4]

- b) Given that $f(0) = 1$, $f(1) = 3$ and $f(3) = 55$, find a unique polynomial of degree 2 that fits the given data using Lagrange interpolation technique. [6]

- c) Estimate the value of $f(42)$ from the following available data using Newton backward interpolation formula. [8]

x	25	30	35	40	45
y	332	291	260	231	204

P.T.O.

Q3) a) Derive trapezoidal rule for numerical integration from the Newton Cotes formula. [3]

b) Evaluate the given integral using Simpson's 1/3rd rule. Take 6 sub-intervals. [6]

$$\int_0^6 \frac{e^x}{1+x} dx$$

c) The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire data. [8]

Time (sec)	0	5	10	15	20
Velocity (m/sec)	0	3	14	69	228

OR

Q4) a) Derive Simpson's 1/3rd rule for numerical integration from the Newton Cotes formula. [3]

b) Find from the following table, the area bounded by the curve $f(x)$ and the x-axis from $x = 7.47$ to $x = 7.53$ using [6]

i) Trapezoidal rule and

ii) Simpson's 3/8th rule.

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
$y = f(x)$	1.93	1.95	1.98	2.01	2.03	2.06	2.09

c) The following data represents the function $f(x) = e^{2x}$.

x	0	0.3	0.6	0.9	1.2
$f(x)$	1	1.8221	3.3201	6.0496	11.0232

Find $f'(1.2)$ and $f''(1.2)$ using Newton backward difference formula. [8]

Q5) a) Explain the Gauss elimination method used for solving linear simultaneous equations. [4]

b) Apply the Gauss-Jacobi method to solve the equations up to 5 iterations. [6]

$$5x - y + z = 10$$

$$2x + 4y = 12$$

$$x + y + 5z = -1$$

Choose initial values : $x_0 = 2, y_0 = 3$ and $z_0 = 0$.

c) Apply the Gauss-Jordan method to solve the equations. [8]

$$x + y + z = 3$$

$$2x - y - z = 3$$

$$x - y + z = 9$$

OR

- Q6) a)** Explain the Jacobi iterative method for solving linear simultaneous equations. [4]
- b)** Find the inverse of the given matrix using Gauss Jordan method. [6]

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

- c)** Solve the given system of equations using Gauss Elimination method with partial pivoting. [8]

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

$$4x - 6y = -2$$

$$-2x + 7y + 2z = 9$$

- Q7) a)** Explain the Taylor series method of solving ordinary differential equations. [5]
- b)** Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with the initial condition $y = 1$ at $x = 0$. Find y at $x = 0.1$ using Euler's method. Take step size $h = 0.02$. [6]
- c)** Solve the given differential equation using Runge-Kutta fourth order method and hence find $y(0.1)$ $\frac{dy}{dx} = y - x; y(0) = 2$ [6]

OR

- Q8) a)** Explain the Euler's method of solving ordinary differential equations. [5]
- b)** Solve the differential equation given below using Taylor Series method and find the value of y at $x = 0.1$ taking $h = 0.1$ and considering terms up to the 4th derivative. $\frac{dy}{dx} = x^2y - 1; y(0) = 1$ [6]
- c)** Using the Runge-Kutta method, solve the second order differential equation $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ and find the value of y for $x = 0.2$. The initial conditions are $x = 0, y = 1, \frac{dy}{dx} = 0$. [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4061

[Total No. of Pages : 2

[6402]-20

S.E. (Electrical)

**FUNDAMENTALS OF MICROCONTROLLER AND APPLICATIONS
(2019 Pattern) (Semester - IV) (203149)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Draw neat diagrams wherever necessary.
- 3) Figures to the right indicate full marks.

- Q1)** a) Write a short note on C Data types for 8051 microcontroller. [5]
b) Write a program in C to configure Port 1 as input port and Port pin P2.0 as input pin. [5]
c) Draw the TCON and TMOD register and explain use of individual bits of TMOD register in detail. [8]

OR

- Q2)** a) Explain the function of bit TF0 in TCON register and Write a program in C language to start timer 0 [5]
b) Write a program in C language to copy the contents of Port 2 to Port 1. [5]
c) Write a program in C language to generate a square wave form on pin 5 of port 1. The frequency of the waveform is 125Hz. Use timer 1 in mode 1. Assume crystal frequency = 11.0592 MHz. [8]

- Q3)** a) Write a program in C language to enable hardware interrupts INT0 and INT1. [5]
b) Write down the steps to program ADC 0809. [5]
c) Write a short note on interrupt structure of 8051. [8]

OR

- Q4)** a) Draw the IE register and explain the functions of bits EA, ET0 and EX0. [5]
b) Write down the steps in executing on an interrupt. [5]
c) Draw and explain interfacing diagram of ADC with 8051. [8]

P.T.O.

- Q5)** a) Write down the steps to be followed to receive a data serially using 8051 microcontroller. [5]
- b) Write down a short note on interfacing of a GSM module with 8051 microcontroller. [5]
- c) Write a program to transfer a character “P” serially at baud rate of 9600, Use serial port in Mode 1. Crystal frequency is 11.0592 MHz. [7]

OR

- Q6)** a) Draw the SCON register and explain use of individual bits of the register in detail. [5]
- b) Write down the steps to be followed to transfer a data serially using 8051 microcontroller. [5]
- c) Program the 8051 in C to receive bytes of data serially and put them in P1. Set the baud rate at 4800, 8-bit data, and 1 stop bit. [7]
- Q7)** a) With a neat block diagram explain AC voltage measurement using 8051 microcontroller. [7]
- b) Draw an interfacing diagram of stepper motor with 8051. Assuming the motor is controlled through most significant 4 bits of port 1, Write a program in C language to run the stepper motor continuously in anticlockwise direction. Assume suitable step sequence. [10]

OR

- Q8)** a) Explain the function of an electromechanical relay and draw an interfacing diagram of relay with microcontroller 8051 with suitable driver circuit. [7]
- b) Draw and explain interfacing of LED in common anode and common cathode configurations. Write a program in C language for blinking display of a LED connected to port pin P1.0. Use a suitable delay. [10]



Total No. of Questions : 9]

SEAT No. :

PD-4062

[Total No. of Pages : 4

[6402]-21

S.E. (Electronics /E&TC/Electronics & Comp. Eng./Electronics

Engg.(VLSI Design & Tech.)/Electronics & Comm.(A.C.T.))

ENGINEERING MATHEMATICS - III

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Attempt 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.*
- 7) *Write numerical calculations correct upto four decimal places.*

Q1) Write the correct option for the following multiple choice questions.

i) If $\phi = x^2 - y^2 + 2z^2$ then $\nabla\phi$ at the point (1, 2, 3) is _____ [2]

- | | |
|--------------------|--------------------|
| a) $2i - 4j - 12k$ | b) $2i - 4j + 12k$ |
| c) $2i + 4j + 12k$ | d) $2i + 4j - 12k$ |

ii) If $f(x) = x^2$, $h = 2$ then $\Delta^2 f(x)$ is given by [2]

- | | |
|------|-------|
| a) 6 | b) 12 |
| c) 4 | d) 8 |

iii) If $f(z) = \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2 (z-2)}$ then residue of $f(z)$ at $z = 2$ is _____ [2]

- | | |
|------|----------|
| a) 0 | b) -1 |
| c) 1 | d) π |

P.T.O.

OR

Q3) a) Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, Find $\sin 58^\circ$ using Newton's backward difference formula. [5]

b) Given $\frac{dy}{dx} = x^2 - y$, $y(0)=1$, find $y(0.1)$ using Runge-Kutta method of fourth order (Take $h = 0.1$) [5]

c) Use Trapezoidal rule to evaluate $I = \int_{-3}^3 x^4 dx$ using six equal subintervals. [5]

Q4) a) Find the directional derivative of $\phi = xy + yz + zx$ at $(1, 1, 1)$ along the vector $\vec{i} + 2\vec{j} + 2\vec{k}$ [5]

b) Show that the vector field

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

c) Find angle between tangents to the curve $x = t, y = t^2, z = t^3$ at $t = 1$ and $t = -1$. [5]

OR

Q5) a) Find the directional derivative of $\phi = xyz$ at $(1, 2, -1)$ in the direction normal to the surface $x \log z - y^2 = -4$ at $(-1, 2, 1)$ [5]

b) Prove that $\nabla^2 \left[\nabla \cdot \frac{\vec{r}}{r^2} \right] = \frac{2}{r^4}$ [5]

c) The position vector of a particle at time t is

$\vec{r} = \cos(t-1)\vec{i} \sin h(t-1)\vec{j} + mt^3\vec{k}$. Find the condition on m . So that at any time $t = 1$ the acceleration is normal to the position vector. [5]

Q6) a) Apply Green's Theorem to evaluate $\int_C (3ydx + 2xdy)$

where C is boundary of $0 \leq x \leq \pi, 0 \leq y \leq \sin x$ [5]

b) Using Gauss-divergence theorem, prove that

$$\iint_S (\phi \nabla \psi - \psi \nabla \phi) \cdot d\vec{s} = \iiint_V (\phi \nabla^2 \psi - \psi \nabla^2 \phi) dV \quad [5]$$

- c) Using Stoke's theorem, evaluate : [5]

$$\int_C [3(x-y)dx + 2xzdy + xydz]$$

Where C is the curve of intersection of paraboloid $x^2 + y^2 = 2z$ and the plane $z = 2$

OR

- Q7) a) Evaluate $\int_C \vec{F} \cdot d\vec{r}$, $\vec{F} = (2x + y^2)\vec{i} + (3y - 4x)\vec{j}$ where C is the parabolic arc $y = x^2$ joining (0, 0) & (1, 1) [5]

- b) Using Gauss-Divergence Theorem, evaluate $\iint_S \vec{F} \cdot \hat{n} ds$ for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ where S is the surface of the cube bounded by the planes $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$ [5]

- c) Evaluate $\iint_S (\nabla \times \vec{F}) \cdot d\vec{s}$ for $\vec{F} = y\vec{i} + z\vec{j} + x\vec{k}$ where S is the surface of the paraboloid $z = 1 - x^2 - y^2, z \geq 0$ [5]

- Q8) a) If $u = x^4 - 6x^2y^2 + y^4$, find V such that $f(z) = u + iv$ is analytic function. Express $f(z)$ in terms of z. [5]

- b) Use Cauchy's integral formula to evaluate $\oint_C \frac{e^z}{z+2} dz$ where C is the circle $|z + 2| = 2$ [5]

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

OR

- Q9) a) Show that analytic function $f(z)$ with constant amplitude is constant. [5]

- b) Apply residue theorem to evaluate $\oint_C \frac{4z^2 + z}{z^2 - 1} dz$ where C is the contour $|z| = \frac{1}{2}$ [5]

- c) Show that the transformation $W = z + \frac{1}{z} - 2i$ maps the circle $|z| = 2$ into an ellipse. Find centre, semi-major and semi-minor axes of ellipse. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4063

[Total No. of Pages : 3

[6402]-22

S.E.

(Electronics/E&TC/Electronics (VLSI & Design & Technology) Electronics & Communication Advanced Communication Technology)

ELECTRONIC CIRCUITS

(204181) (2019 Pattern) (Semester - III)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 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) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary

Q1) a) Enlist the advantages and disadvantages of SMPS over linear power supply. Draw the block diagram of SMPS and explain each block in detail. [8]

b) Design an adjustable voltage regulator using LM317 for output voltage 5 V to 15 V and draw necessary connection diagrams. Assume $R_1 = 240 \Omega$, $I_{adj} = 100 \mu A$. [9]

OR

Q2) a) Draw the block diagram of a regulated DC power supply and explain the function of each block in detail. [9]

b) Explain the following performance parameters of DC power supply [8]

- | | |
|---------------------------|----------------------|
| i) Load regulation | ii) Line regulation, |
| iii) Ripple rejection and | iv) Efficiency. |

P.T.O.

Q3) a) Explain the following op-amp parameters: [8]

- i) Input offset Voltage
 - ii) CMRR
 - iii) Slew Rate
 - iv) Unity gain bandwidth.
- b) What is current mirror circuit? Draw and explain working of differential amplifier with current mirror circuit. Why current mirror circuit is used in Op Amp? [6]
- c) State the values of all ideal parameters of Op Amp. [3]

OR

Q4) a) Draw block diagram of Op-Amp. Explain the functions of each block in detail. [8]

- b) A dual input, balanced output (DIBO) differential amplifier has following specifications: $R_{C1} = R_{C2} = 2.2 \text{ k}\Omega$, $R_E = 4.7 \text{ k}\Omega$, $R_{in1} = R_{in2} = 50 \Omega$, $+V_{CC} = 10\text{V}$, $-V_{EE} = -10\text{V}$, $\beta_{dc} = \beta_{ac} = 100$ and $V_{BE} = 0.7 \text{ V}$. [6]

Calculate : i) I_C ii) V_{CEQ} iii) Voltage gain : A_d
iv) Input and output resistance

- c) Explain how to improve CMRR in Op Amp. [3]

Q5) a) What are the limitations of ideal integrator? How these are overcome in practical integrator? Draw the circuit diagram of practical integrator and its frequency response. Write equation for output voltage V_o and explain its operation. [9]

- b) Draw an inverting summing amplifier with three inputs. Derive an expression for its output voltage. [6]

- c) Draw square wave generator using Op Amp with relevant waveforms [3]

OR

- Q6)** a) Explain with a neat circuit diagram, working of inverting symmetric Schmitt trigger with its input output waveform and hysteresis plot. [9]
- b) Enlist the requirements of instrumentation amplifier. Draw and explain instrumentation amplifier using three Op Amp. [6]
- c) Draw full wave precision rectifier with relevant waveforms. [3]
- Q7)** a) Draw circuit diagram and explain successive approximation ADC. [6]
- b) Explain the following characteristics of DAC [6]
- i) Resolution, ii) Accuracy and iii) Settling time.
- c) Draw the block diagram of PLL and explain each block in detail. [6]

OR

- Q8)** a) Draw and explain circuit diagram for 3-bit weighted resistor D/A converter, and give output voltage equation for the same. [6]
- b) Calculate the output frequency f_o , lock range and capture range of PLL if $R_T = 10 \text{ k}\Omega$, C_T (Timing capacitor) = $0.01 \mu\text{F}$, C_F (Filter capacitor) $10 \mu\text{F}$, R (Internal filter resistor) $3.6 \text{ k}\Omega$. [6]
- c) Draw and explain the block diagram of frequency multiplier with relevant output waveforms. [6]



Total No. of Questions : 8]

SEAT No. :

PD-5277

[Total No. of Pages : 2

[6402]-23R

**S.E. (Electronics & Computer) (Electronics/E&TC)
(Electronics-VLSI Design & Technology/
Electronics & Comm.-(A.C.T.))
DIGITAL CIRCUITS**

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

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) Design a full adder using 2 half adders. [7]
- b) Design and implement one bit comparator. [5]
- c) Design 16:1 multiplexer using two 8:1 multiplexer. [5]

OR

- Q2)** a) Design and explain 1:4 DEMUX with block diagram, truth-table, equation and logic diagram. [7]
- b) Implement the full subtractor using a 1:8 demultiplexer. [5]
- c) Draw and explain the look-ahead carry generator. [5]

- Q3)** a) Design a sequence generator using T FFs for sequence 1101. [8]
- b) Distinguish between synchronous counter and asynchronous counter. [5]
- c) Explain with diagram the working of D type Flip-flop. Give its truth table. [5]

OR

P.T.O.

- Q4)** a) Draw and explain 3 bit asynchronous counter using JK FF. [8]
 b) Design a 3 bit twisted ring counter. Draw logic diagram. [5]
 c) Compare Moore and Mealy machines. [5]

- Q5)** a) What do you mean by excitation table of flip flop? Write the excitation table of [9]
 i) D flip flop
 ii) J-K flip flop
 b) Explain : [8]
 i) State Table
 ii) State Diagram
 iii) State Assignment
 iv) ASM chart

OR

- Q6)** a) Design a sequence detector to detect a sequence 1101 using D FF (Use Moore machine) [9]
 b) Explain in short:
 i) Moore Machine
 ii) Mealy Machine [8]

- Q7)** a) Explain block diagram of FPGA with its basic characteristics. [8]
 b) Write short notes on memories. [10]

OR

- Q8)** a) Implement following Boolean function using PAL. [8]
 $F1 = \sum m (0, 2, 3, 4, 5, 6, 7, 8, 10, 11, 15)$
 $F2 = m \sum (1, 2, 8, 12, 13).$
 b) Describe with neat diagram AND-OR structure of PLA and PAL. [10]



[6402]-24

S.E. (Electronics /E&TC)

ELECTRICAL CIRCUITS

(2019 Pattern) (Semester - III) (204183)

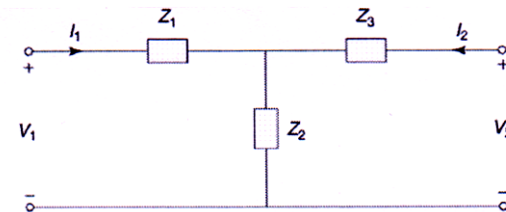
Time : 2½ Hours]

[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) Assume Suitable data if necessary.

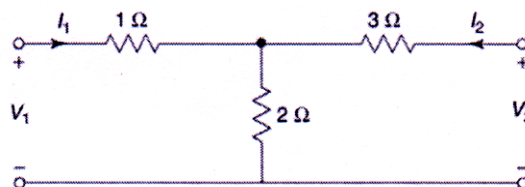
- Q1) a) What are the short circuit admittance parameters? [6]
 b) Find the Z parameters following network. [6]



- c) What is the condition for reciprocity in two port network in terms of Z parameters? [6]

OR

- Q2) a) What are the hybrid parameters-define the parameters. [6]
 b) Find the Y parameters for following network. [6]



- c) What is the condition for symmetry in two port network in terms of Y parameters? [6]

P.T.O.

- Q3)** a) Explain the construction of DC machine with suitable diagram. [6]
b) What are the speed control methods in dc series motor. [6]
c) Derive torque equation of DC motor. [5]

OR

- Q4)** a) What are the advantages and disadvantages of permanent magnet DC motor. [6]
b) What are the different types of starters for dc shunt motor? Explain any one. [6]
c) What is power flow diagram in DC motors and generators. [5]

- Q5)** a) Explain the construction and working of 3 phase induction motor. [6]
b) What do you mean by slip? What is its effect on rotor parameters? [6]
c) Derive torque equation for 3 phase induction motor and state the condition for maximum torque. [6]

OR

- Q6)** a) Explain the construction and working of 1 phase induction motor. [6]
b) What is need of starter? explain any one starter in detail induction motor. [6]
c) Explain speed control of 3 phase motor using v/f method. [6]

- Q7)** a) Explain the construction and working principle of BLDC motor. [6]
b) Explain the torque speed characteristics of BLDC motor and give any three applications. [6]
c) Write a short note on electrical vehicle. [5]

OR

- Q8)** a) Explain the construction and working of stepper motor. [6]
b) What are the different modes of operation of stepper motor? [6]
c) Explain electrical vehicle with neat block diagram. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4066

[Total No. of Pages : 3

[6402]-25

S.E. (E & TC/Electronics)

DATA STRUCTURES

(2019 Pattern) (Semester - III) (204184)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Compare Stack and Queue. What are the advantages of circular queue over liner queue? [6]

b) Write a function PUSH and POP in 'C' for stack using linked list. [6]

c) Write a short note on circular queue. Compare it with linear queue. [5]

OR

Q2) a) What are the applications of Queue? Explain two applications in detail. [5]

b) Convert the following prefix expression into infix form. Show all the steps and stack contents:

*-A/BC-/AKL [6]

c) Write ADD and DELETE function in 'C' for Queue using array. [6]

Q3) a) Compare array and linked list. [5]

b) Write a 'C' function to delete a number from singly linked list. [6]

c) Differentiate singly linked list and doubly linked list. [6]

OR

P.T.O.

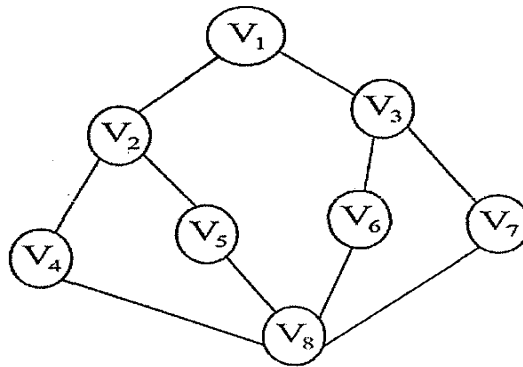
- Q4)** a) Draw and explain circular linked list. State the limitations of single linked list. [5]
- b) Write a 'C' function to insert a number at end in to the singly linked list. [6]
- c) Explain doubly linked list (DLL). What are the advantages of DLL over SLL. [6]

- Q5)** a) Construct Binary search tree for the following
MAR, OCT, JAN, APR, NOV, FEB, MAY, DEC, JUN, AUG. JUL, SEP [6]
- b) Write a pseudo code to search an element in binary search tree using arrays. [6]
- c) Define binary tree. Name and explain with suitable example the following terms [6]
- i) Root node
 - ii) Left sub tree and right sub tree
 - iii) Depth of tree

OR

- Q6)** a) Define BST? Create a BST for the following data: [6]
14,15,4,9,7,18,3,5,7.
- b) Explain with suitable example how binary tree can be represented using: [6]
- i) Array
 - ii) Linked List
- c) Construct the binary search tree from the following elements: [6]
15,4,16,8,2,18,14
Also show preorder, inorder and postorder traversal for the same.

Q7) a) Draw adjacency list and adjacency matrix for the following graph: [6]

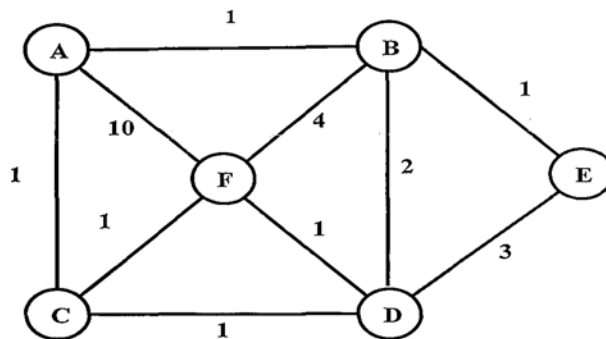


b) What is MST? Explain with suitable example Kruskal's Algorithm to find out MST. [6]

c) Define DFS and BFS graph with example. [6]

OR

Q8) a) Explain Kruskal algorithm? Find the minimum spanning tree for below figure. Using Kruskal's Algorithm. [6]



b) Explain Dijkstra's algorithm with example. [6]

c) Explain with suitable example the techniques to represent a Graph. [6]

Note: consider graph of minimum 6 vertices



[6402]-26

S.E. (Electronics (VLSI Design & Technology))/
(Electronic/E & TC)/Electronics & Communication - Advanced
Communication Technology)
SIGNALS AND SYSTEMS
(2019 Pattern) (Semester - IV) (204191)

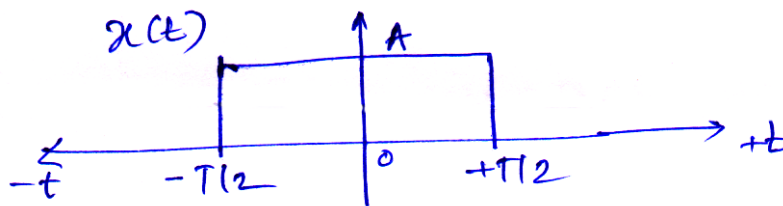
Time : 2½ Hours]

[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) Use of logarithmic tables, slide - rule, mollier charts, electronic packet calculator and steam table is allowed.
- 5) Assume Suitable data if necessary

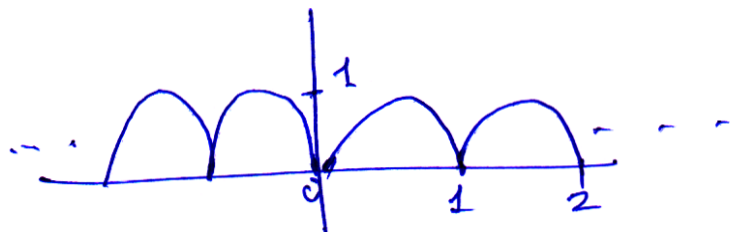
- Q1) a) State any six properties of Fourier series. [6]
 b) Obtain the Fourier series of Rectangular pulse given below. [6]



- c) Explain Gibb's phenomenon [6]

OR

- Q2) a) Draw the magnitude and phase spectrum of the signal. [6]
 $x(t) = 5 \cos(2\pi \times 10t + 30) - 10 \cos(2\pi \times 20t + 60)$
 b) Determine the FS representation for the signal given by $x(t) = \sin(\pi t)$. [8]
 The periodic wave is shown in fig. below.



Full wave Rectifier o/p signal

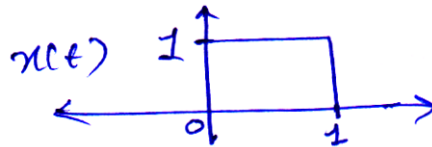
- c) Define magnitude response and phase Response. [4]

P.T.O.

- Q3) a)** Write the formula for the Fourier Transform and Inverse Fourier Transform. Also, obtain Fourier Transform of Impulse function $x(t) = \delta(t)$ [6]
- b) Find the Fourier Transform of cosine wave signal and sketch magnitude response. [6]
- c) Find the Fourier Transform of unit step signal $x(t) = u(t)$. [5]

OR

- Q4) a)** Find the Fourier Transform of convolution of 2 signals $x_1(t) = e^{-at} u(t)$ and $x_2(t) = e^{-bt} u(t)$ using the CTFT properties. [6]
- b) Find the Fourier Transform of sinewave signal and sketch magnitude response. [5]
- c) Find the Fourier Transform of $x(t)$ given. [6]



- Q5) a)** Compare Fourier Transform and Laplace Transform. [6]
- b) Obtain the Laplace Transform of $x(t) = e^{-at} u(t)$ and $-e^{-at} u(-t)$ Also sketch ROC for both the signals. [8]
- c) State Linearity and Time shifting property of Laplace Transform. [4]

OR

- Q6) a)** Find the Initial and Final value of $X(S) = \frac{0.9}{S(S^2 + 5S - 7)}$. [6]
- b) Find the Laplace Transform of [6]
- i) $u(t - 1)$
- ii) $u(2t)$

Using properties.

- c) Find the Inverse Laplace Transform of $X(S) = \frac{3S + 7}{(S^2 - 2S - 3)}$. [6]

Q7) a) Define the following terms of probability [6]

i) Sample space

ii) Event

iii) Probability

b) Let these be balls in a box. There are balls of two colors namely Red and Blue. There are 3 Red Balls and 2 Blue Balls. Find the probability of picking up of Red Ball first and A Blue Ball on second pick. [5]

c) Define CDF and PDF. Write the properties of CDF and PDF. [6]

OR

Q8) a) A random variable has probability density function given by the following equation $f_x(x) = 0.1x$ $3 \leq x \leq y$ [8]
 $= 0$ otherwise

i) Find the mean value

ii) Find the mean square value

iii) Find the variance

iv) Standard deviation

b) A certain random variable has the CDF given by [9]

$$\begin{aligned} f_x(x) &= 0 \text{ for } x \leq 0 \\ &= kx^2 \text{ for } 0 < x \leq 10 \\ &= 100k \text{ for } x > 10 \end{aligned}$$

Find the value of

i) K

ii) $p(x \leq 5)$

iii) $p(5 \leq x \leq 7)$

plot corresponding PDF.



[6402]-27

**S.E. (Electronics /E&TC/Electronics & Comp. Eng./
Electronics Engg.(VLSI Design & Tech.)/Electronics &
Comm.(A.C.T.))**

CONTROL SYSTEM**(2019 Pattern) (Semester - IV) (204192)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates :**

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) Figures to the right side indicate full marks.
- 3) Assume the suitable data, if necessary.

Q1) a) Investigate the stability of the system with characteristics equation [8]

$$G(s) = s^4 + 3s^3 + 2s^2 + 6s + 4 = 0$$

b) A unity feedback system with open loop transfer function [10]

$$G(s) = \frac{k}{s(s+1)(s+3)(s+5)} \cdot \text{Sketch the root locus}$$

OR**Q2) a) The unity feedback system has open loop transfer function [8]**

$$G(s) = \frac{k}{s(s+2)(s+5)(s+10)} \cdot \text{Determine the range of 'k' for the system stability, value of 'k' and frequency of oscillation at marginal stability.}$$

b) Plot a root locus for the system $G(s)H(s) = \frac{k}{s(s^2+6s+25)}$. [10]**Q3) a) The unity feedback system has open loop transfer function**

$$G(s) = \frac{1}{s(s+1)(s+2)} \cdot \text{Sketch the Nyquist plot. Also Comment on Stability. [9]}$$

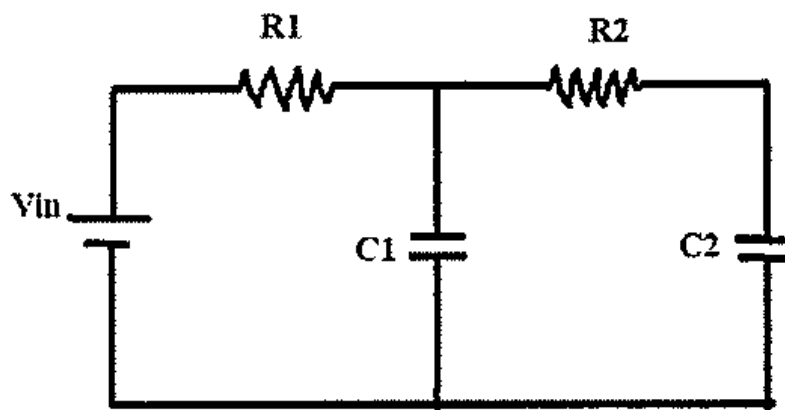
b) Derive the expression for resonant peak (M_r) and resonant frequency (ω_r) [8]**OR****P.T.O.**

Q4) a) Draw Bode plot of the system with open loop transfer function : [9]

$G(s) = \frac{10}{s(s+2)(s+5)}$ and determine gain margin, Phase margin, Gain crossover frequency, Phase crossover frequency. Also comment on Stability.

b) The unity feedback system has open loop transfer function $G(s) = \frac{10}{(s+1)(s+5)}$, sketch the polar plot. Also find Y-intercept, gain crossover frequency and phase margin. [8]

Q5) a) Find the state model of the network [9]



b) Write the advantages of state space analysis over classical control. [9]

OR

Q6) a) Find transfer function of the system with state space model matrices [9]

$$A = \begin{bmatrix} -3 & -3 \\ 0 & -2 \end{bmatrix}, B = \begin{bmatrix} 2 \\ 1 \end{bmatrix}, C = [2 \quad 0]$$

b) Determine the State transition matrix if $A = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix}$ in $\dot{x} = Ax$. Also find

$$x(t) \text{ if } x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}. \quad [9]$$

- Q7) a)** Explain ON-OFF control system with suitable example. **[9]**
- b)** How IoT helps in Industrial Automation? What are the essentials of an Industrial IoT solution? Give one examples of Industrial IoT. **[8]**

OR

- Q8) a)** Explain DCS with suitable block diagram and write advantages over analog system. **[9]**
- b)** Compare the Proportional mode, Integral mode and Derivate mode. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD4069

[Total No. of Pages : 2

[6402]-28

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

PRINCIPLES OF COMMUNICATION SYSTEMS

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

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 pre-emphasis in FM with circuit diagram and frequency Response. **[6]**
- b) Compare frequency modulation with phase modulation. **[6]**
- c) The maximum deviation allowed in FM broadcast system is 75KHz. If modulating signal in single tone sinusoidal of 8KHz Determine bandwidth of FM signal. What will be bandwidth when modulating signal frequency is doubled. **[6]**

OR

- Q2) a)** With the help of block diagram explain superheterodyne FM Receiver. **[6]**
- b) Differentiate between NBFM and WBFM. **[6]**
- c) A single tone FM is represented by voltage equation as $V(t) = 12 \cos (6 \times 10^8 t + 5 \sin 1250t)$ **[6]**
- Determine
- i) Carrier frequency
 - ii) Modulating frequency
 - iii) Modulation index
 - iv) Maximum deviation
 - v) Dissipated power in 10Ω resistor

- Q3) a)** With the help of neat diagram, describe Generation of pulse width Modulation. **[6]**
- b) Explain the types of sampling with waveform. **[6]**
- c) Compare pulse Amplitude Modulation and pulse position Modulation. **[5]**

OR

P.T.O.

- Q4)** a) State sampling theorem in time domain. Explain sampling process with block diagram. [6]
b) State types of multiplexing. Explain time division multiplexing (TDM) in detail. [6]
c) With the help of neat diagram explain detection of PPM. [5]

- Q5)** a) Compare Analog and Digital communication. [6]
b) State types of quantization. Explain uniform quantization with neat diagram. [6]
c) With the help of neat diagram, explain transmitter of pulse code Modulation. [6]

OR

- Q6)** a) Explain working of Adaptive Delta Modulation with block diagram. [6]
b) Describe A law and μ law companding. [6]
c) What are the Drawbacks of Delta Modulation? Explain in detail. [6]

- Q7)** a) State different synchronization technique and explain any one in detail. [6]
b) What is scrambling? Explain working principle of scrambling and unscrambling. [6]
c) What is eye diagram? Explain the use of eye diagram to measure ISI. [5]

OR

- Q8)** a) Describe concept of multiplexer and Demultiplexer with necessary diagram. [6]
b) What is Intersymbol Interference. Explain its causes and remedies to avoid it. [6]
c) Define Equalizer. Explain Adaptive equalization with block diagram. [5]



Total No. of Questions : 8]

SEAT No. :

PD4070

[Total No. of Pages : 2

[6402]-29

**S.E.(Electronics/E & T.C/Electronic and Computer Eng./Electronics
Engineering (VLSI Design & Technology)/Electronics and
Communication -Advanced Communication Technology
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) Give a programming example that overloads == operator with its use. [6]
- c) What is operator overloading? Write steps to overload Pre and Post increment 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) What are the rules for overloading operators? [6]

- Q3)** a) What is inheritance? How to inherit a base class as Publicly? 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

P.T.O.

- 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 array index out of bound 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 and merits in C++ with example? [6]
b) Write a C++ program using function template to swap two integers, floating- point types and character data. [6]
c) What is user defined exceptions? 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 # 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]



[6402]-30**S.E. (Electronics and 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) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of Calculator is allowed.
- 5) Assume Suitable data if necessary

- Q1) a)** Design an adjustable voltage regulator using LM317 for output voltage 15V and output current 0.5 Amp with necessary connection diagrams. Assume $R_1=240\Omega$, $I_{adj}=100\mu A$. **[6]**
- b) Draw and explain buck type switching regulator with necessary waveforms. **[6]**
- c) Draw and explain the concept of current boosting in adjustable three terminal voltage regulator. **[6]**

OR

- Q2) a)** What is need of DC regulator supply? Enlist the performance parameters of voltage regulator with ideal values. **[6]**
- b) With the help of a neat block diagram explain the operation of three terminals an adjustable voltage regulator. **[6]**
- c) What is LDO regulator? Explain in its operation. Enlist the advantages of LDO. **[6]**
- Q3) a)** Write short note on current mirror circuit. **[6]**
- b) An emitter biased Dual input balanced output differential amplifier has the following specifications : $V_{CC} = \pm 12 V$, $R_{C1}=R_{C2}=2k\Omega$ and $R_E=5k\Omega$, $\beta = 100$ & $V_{BE}=0.7V$. **[6]**
Calculate :
- i) Voltage Gain (A_d)
 - ii) Input Resistance (R_i)
 - iii) Output Resistance (R_o)
- c) What is significance of 1. Slew rate, 2. CMRR and 3. Gain bandwidth product in Op Amp. **[6]**

P.T.O.

OR

- Q4) a)** Explain the concept of virtual short and virtual ground with relevant diagrams. [6]
- b) A dual input balanced output differential amplifier has following specification $R_C = 2.7k\Omega$, $R_E = 4.5k\Omega$, $\pm V_{CC} = \pm 10V$, $\beta = 100$; $V_{BE} = 0.7V$; $r_e = 26.34\Omega$ [6]
- calculate
- i) Voltage gain (A_d)
- ii) R_{in}
- iii) R_o
- c) Why level shifter circuit is required in Op Amp? Explain level shifter circuit used in Op Amp. [6]
- Q5) a)** Design a practical differentiator circuit to differentiate an input signal that values in the frequency 10 Hz to 1 kHz. Assume $f_a = 10$ fb and $C_1 = 1\mu f$. [6]
- b) Draw and explain the following circuits using Op Amp [6]
- i) Difference amplifier
- ii) Voltage follower.
- c) Draw and explain working of symmetrical Schmitt trigger, with suitable waveform and hysteresis loop. [6]

OR

- Q6) a)** Draw and explain instrumentation amplifier using three Op-amps. Derive the expression for output voltage. [6]
- b) Design a practical integrator with input signal of $2 V_{pp}$ and cut off frequency of 2.5 kHz for DC voltage gain of 10. [6]
- c) Explain practical differentiator circuit with neat diagram? List limitations of ideal differentiator? [6]

- Q7) a)** Determine the output voltage produced by 4 bit R-2R ladder DAC with $V_{\text{ref}} = 5 \text{ V}$ for input bit sequence [5]
- i) 0110
 - ii) 1101
 - iii) 1000
- b) Draw 3 bit D/A convertor using Op Amp showing input bit 101. Calculate the theoretical output voltage for same. [6]
- c) Define the terms with respect to PLL [5]
- i) Lock range
 - ii) Capture range
 - iii) Pull in time
 - iv) Free running frequency

OR

- Q8) a)** Draw neat diagram of weighted resistor DAC [8]
- b) Explain the following specification of ADC [6]
- i) Resolution
 - ii) Conversion time
 - iii) Quantization error
- c) Draw diagram of any one application of IC PLL 565 in detail. [2]



Total No. of Questions : 8]

SEAT No. :

PD-4071

[Total No. of Pages : 4

[6402]-31

**S.E. (Electronics and Computer Engineering)
DATA STRUCTURES AND ALGORITHMS
(2019 Pattern) (Semester - III) (204184)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4., Q.5 or Q.6 and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data, if necessary.

- Q1)** a) Explain Stack operation PUSH and POP with example. [6]
b) Define Stack and Queue. Explain any one application of queue. [5]
c) Identify the expressions and convert them into remaining two [6]
i) $a*b/c*d-e/f$
ii) $(a+b)/(c+d)$

OR

- Q2)** a) Define Queue. Explain its implementation using any one method. [6]
b) Compare stack with queue. [5]
c) Give an algorithm for reversing a queue [6]

- Q3)** a) Write short notes on [6]
i) Circular Linked List.
ii) Doubly Link List.
b) What is the need of linked list? Explain any one application of doubly linked list with suitable example. [5]
c) Write a structure of doubly linked list. Differentiate between Array and Linked list. [6]

OR

- Q4)** a) Write a 'C' function to delete a number from singly linked list [6]
b) A doubly linked list with numbers to be created. Write algorithm to create the list. [6]
c) Explain different representation methods of polynomial. [5]

P.T.O.

- Q5) a)** Define *Binary Tree*. What are its types? Explain with suitable figures. **[6]**
- b)** Define tree and follow given terms with respect to proper tree representation. **[6]**
- i) Root node
 - ii) Parent and Child node
 - iii) Leaf node
 - iv) Depth of tree
- c)** Write Inorder, Preorder, Postorder traversal for the following tree. (Fig.1). **[6]**

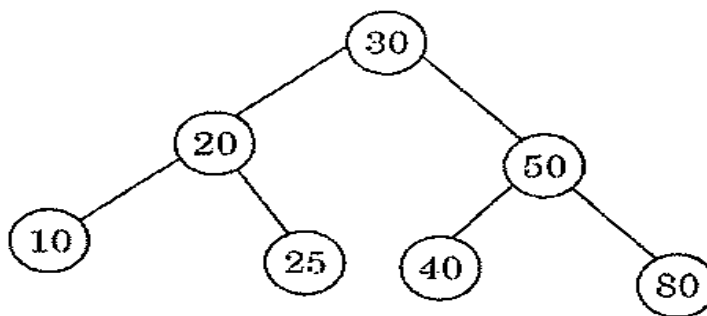


Figure. 1

OR

- Q6) a)** Define the following terms : **[6]**
- i) Root
 - ii) Subtree
 - iii) Level of Node
 - iv) Depth of Tree
 - v) Siblings
 - vi) Height of tree
- b)** Explain traversing of binary tree? **[6]**
- c)** Construct the binary search tree (BST) from the following elements : **[6]**
10, 60, 40, 28, 14, 50, 5

Q7) a) Give the adjacency matrix and adjacency list as shown in figure (1). [6]

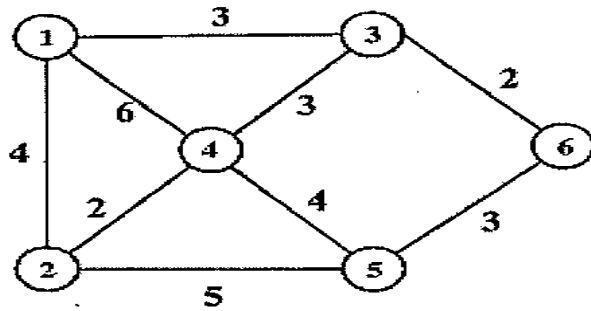
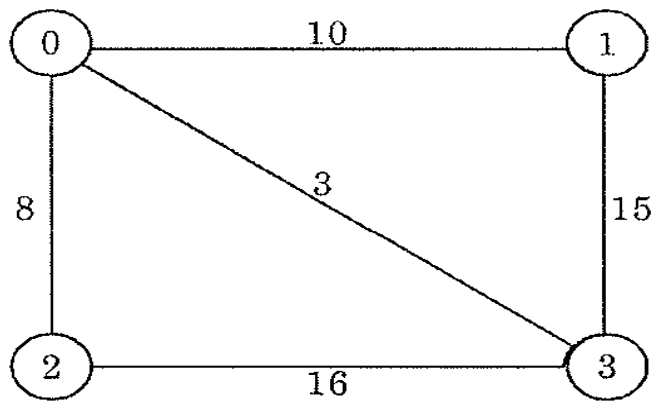


Fig. 1

- b) Explain Dijkstra's algorithm with example. [6]
 c) What do you mean by spanning tree of a graph? Find minimal spanning tree of the following graph using Kruskal's algorithm. [6]



OR

- Q8) a) Find out minimum spanning tree for the following figure A. [6]
 Using i) Prim's Algorithm
 ii) Krushkal's Algorithm

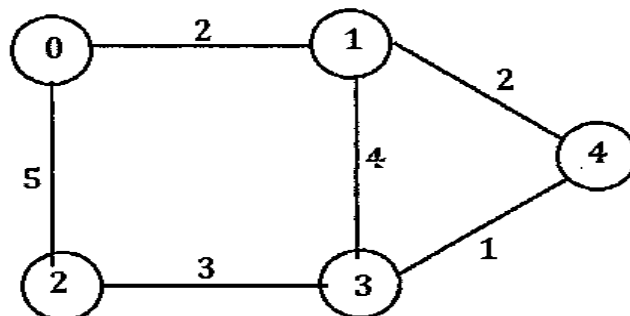


Figure : A

- b) What do you mean by adjacency matrix and adjacency list? Give the adjacency matrix for figure (1) shown below. [6]

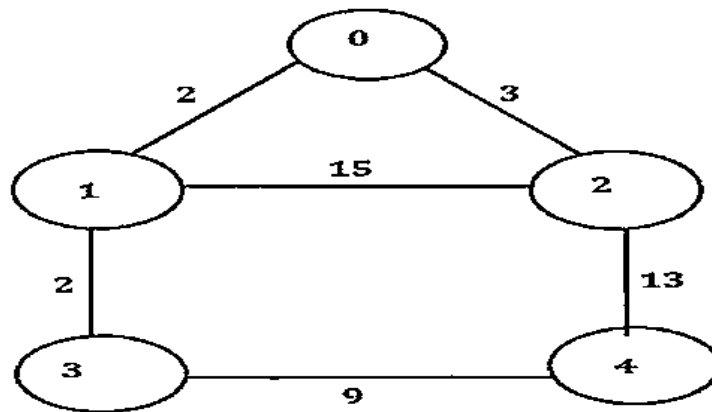


Figure (1).

- c) Explain with suitable example the techniques to represent a graph. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4072

[Total No. of Pages : 2

[6402]-32

S.E. (Electronics & Computer Engineering)

COMPUTER ORGANIZATION

(2019 Pattern) (Semester - III) (204203)

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 and Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Assume the suitable data, if necessary.

Q1) a) What is a programmable interrupt controller? Draw block diagram explain the function of each block. **[8]**

- b) Explain functions of following blocks of DMA Controller IC 8237:**[10]**
- i) Timing and control section
 - ii) Internal register structure (Any 3)

OR

Q2) a) Write short note on interrupt driven I/O. **[8]**

- b) Draw and explain blocks of I/O module. What are the key tasks of I/O modules? **[10]**

Q3) a) What are the factors that must be considered for deciding the instruction length. **[8]**

- b) Explain the following addressing modes with one example each: **[9]**
- i) Immediate
 - ii) Register Indirect
 - iii) Direct Addressing

OR

P.T.O.

- Q4)** a) Explain following addressing modes of 8086 with suitable examples. [9]
i) Register indirect addressing mode
ii) Indexed addressing mode
iii) Based addressing mode
b) What are machine instruction characteristics? State types of instructions. [8]
- Q5)** a) Discuss the process of pipelining in Pentium. [8]
b) Depict the concept of instruction level and machine parallelism. [10]
- OR
- Q6)** a) Discuss the architecture of Pentium IV processor. [8]
b) Explain in detail, pipeline performance with reference to design and execution. [10]
- Q7)** a) Explain in detail Microprogram Sequencing. [8]
b) Write a short note on fetching a word from Memory. [9]
- OR
- Q8)** a) Give difference between Hardwired Control Vs Microprogrammed Control. [8]
b) Explain in detail Multiple Bus Organization. [9]



Total No. of Questions : 8]

SEAT No. :

PD-4073

[Total No. of Pages : 2

[6402]-33

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 and Q.8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data if necessary.*

- Q1) a)** Explain the key features of procedure oriented programming language.[8]
b) Explain in detail about 1. Software design method 2. Encapsulation.[10]

OR

- Q2) a)** Explain the Pascal's features for programming in the large. [8]
b) Explain the concept of generic data structure with templates example in C++.[10]

- Q3) a)** Explain in detail why Java is platform independant programming language? [8]
b) Explain in detail about one dimensional array in Java with programming example for creating one dimensional array at five elements. [9]

OR

- Q4) a)** Explain use of switch statement in Java with suitable examples. [8]
b) Explain use of declaring loop control variables inside the for loop in Java with example. [9]

- Q5) a)** Explain about command line arguments in Java with suitable example.[8]
b) Explain concept of extending interface in Java with suitable example.[10]

P.T.O.

OR

- Q6)** a) How to create object for class in Java, explain with suitable example.[8]
b) Explain about access protection in Java with Suitable example for anyone access specifier. [10]

- Q7)** a) Write applet program to display "Hello World" in Java. [8]
b) Write a program for use of multiple catch blocks in Java. [9]

OR

- Q8)** a) Compare any eight differences between Java applet and Java application program. [8]
b) Explain in detail about reading console input in Java with suitable example for scanner class. [9]



Total No. of Questions : 8]

SEAT No. :

PD4074

[Total No. of Pages : 3

[6402]-34

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

Q1) a) What is an operating system? What are the goals or objectives of operating system? [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	2	6
P2	1	8
P3	0	3
P4	4	4

c) Draw and explain architecture of Batch Operating Systems. Write the advantages and disadvantages of it. [8]

OR

Q2) a) Explain Round Robin(RR) Scheduling, State advantages and disadvantages. [6]

b) In the following example, there are four processes named as P1, P2, P3, and P4. Their arrival time as 0 for all and burst time are given in the table below. Calculate average TAT and WT for SJF (Non-preemptive) scheduling Algorithm. [6]

Process	Burst Time
P1	21
P2	3
P3	6
P4	2

c) Draw and explain Monolithic Kernel operating system. Differentiate between Microkernel and Monolithic Kernel. [8]

P.T.O.

- 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) What is dead lock in operating system? Explain the conditions under which deadlock occur? Differentiate between Starvation and Deadlock. [8]
- b) What is semaphore? Explain different types of Semaphore. State the advantages and disadvantages of Semaphore. [9]

- Q5)** a) Explain contiguous memory allocation and non-contiguous memory allocation. Write the difference between them. [8]
- b) Explain different types of memory fragmentations? Differentiate them on following points. [8]
- i) Definition
 - ii) Occurrence
 - iii) Solution

OR

- Q6)** a) Explain concept of paging with suitable diagram. Give advantages & disadvantages of the paging mechanism. [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

- Q7)** 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 Transfer and DMA I/O Transfer. [6]
- c) Explain the following file organization techniques [6]
- i) Sequential file organization
 - ii) Random or direct file organization

OR

- Q8)** a) What is I/O buffering? Explain circular buffering and state its advantages and disadvantages. [6]
- b) Explain the following File allocation methods. [6]
- i) Contiguous File allocation
 - ii) Linked File Allocation.
- c) Explain disk scheduling concept. Why is disk scheduling needed? Explain any one disk scheduling algorithms in detail. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4075

[Total No. of Pages : 4

[6402]-35

S.E. (Computer Engg./Comp.Sc.& D.E /AI &

DS, Computer Science & Design Engg.)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester - III) (210241)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

- Q1) a)** A committee of 3 persons is to be formed from a group of 2 men and 3 women. In how many ways can this be done? **[6]**
- b) Find the number of arrangements that can be made out of the letters.
i) ASSASSINATION ii) GANESHPURI **[6]**
- c) What is the number of ways of choosing 4 cards from a pack of 52 playing cards? In how many of these i) are face cards. ii) two are red cards and two are black cards. **[6]**

OR

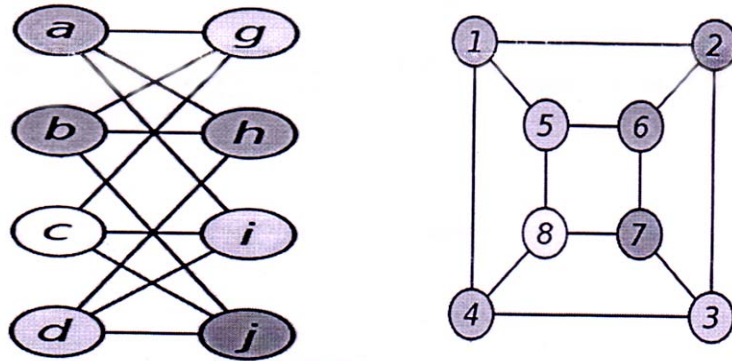
- Q2) a)** Out of 4 officers & 10 clerks, a committee of 2 officers & 3 clerks is to be formed. In how many ways committee can be done? **[6]**
- i) Any officer & clerk can be included.
- ii) A particular clerk must be in committee.
- iii) A particular officer cannot be in committee.
- b) How many words with or without meaning can be formed using the letters of the word EQUATION using each letter exactly once? **[6]**
- c) Salad is made with combination of one or more eatables, how many different salads can be prepared from onion, carrot, cabbage & cucumber. **[6]**

P.T.O.

Q3) a) Define following terms with example. [7]

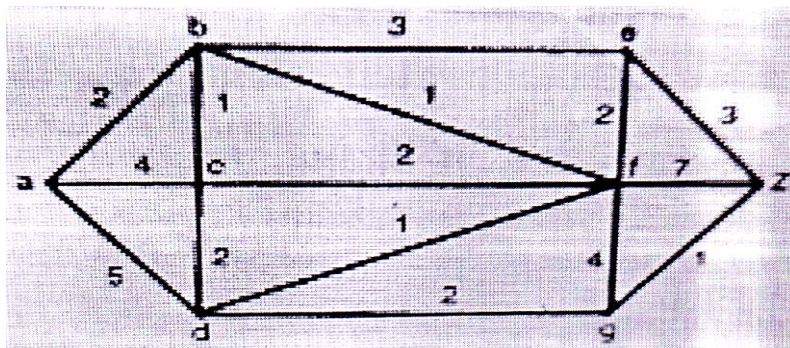
- | | |
|---------------------------|------------------------------|
| i) Complete graph | ii) Regular graph |
| iii) Bipartite graph | iv) Complete bipartite graph |
| v) Paths and Circuits | vi) Acyclic Graph |
| iv) Complement of a graph | |

b) The graphs G and H with vertex sets $V(G)$ and $V(H)$, are drawn below. Determine whether or not G and H drawn below are isomorphic. If they are isomorphic, give a function $g: V(G) \rightarrow V(H)$ that defines the isomorphism. If they are not explain why they are not. [5]

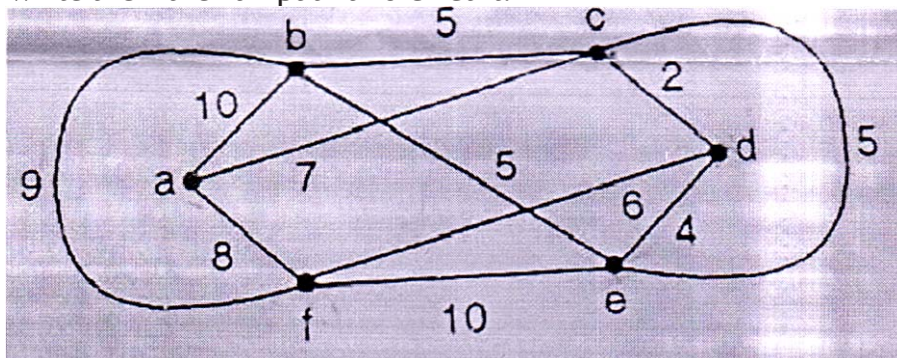


c) Is it possible to draw a simple graph with 4 vertices and 7 edges. Justify? [5]
OR

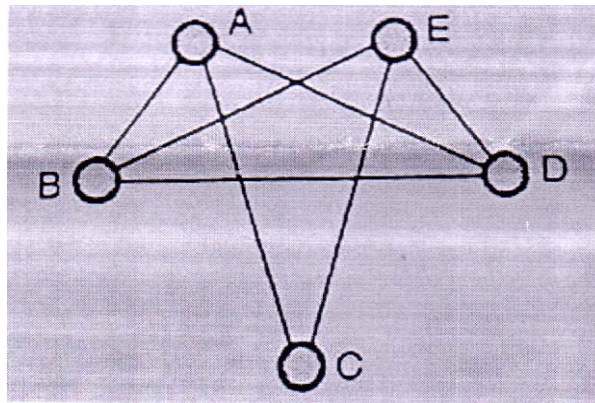
Q4) a) Find the shortest path for a to z in the following graph using Dijkstra's algorithm: [7]



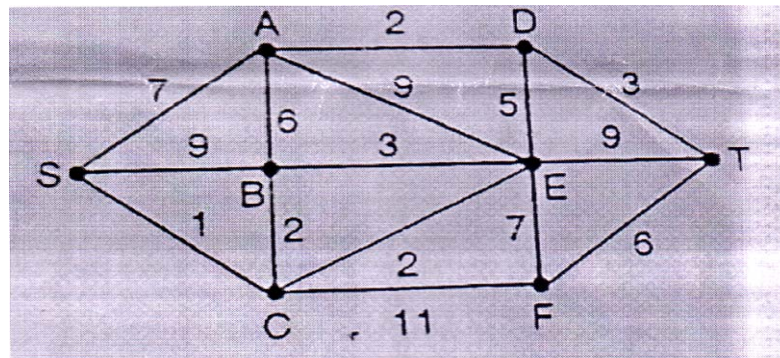
b) For the following graph find whether Eulerian graph and circuit exists. If yes write the Eulerian path and circuit. [5]



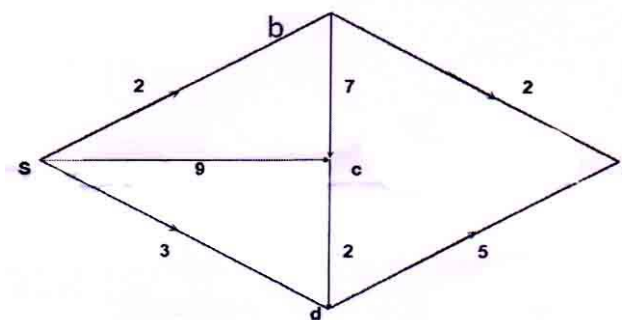
- c) Convert following non planar into planar graph. Also show the validity of Euler's formula for the given graph. [5]



- Q5) a) Construct an optimal binary tree for the set of weights as {8, 9, 10, 11, 13, 15, 22}. Find the weight of an optimal tree. Also assign the prefix codes and write the code words. [6]
 b) Use Kruskal's algorithm to find the minimum spanning tree for the connected weighted graph G as shown in fig. below. [6]



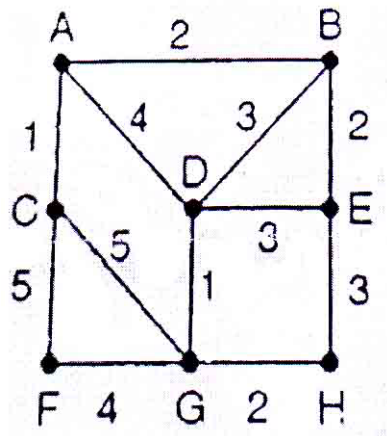
- c) Use labeling procedure to find a maximum flow in the transport network given in the following figure. Determine the corresponding minimum cut. [6]



OR

- Q6) a) Explain [6]
 i) Cut set
 ii) Complete Binary tree
 iii) Prefix code

- b) Use Prim's algorithm to find minimum spanning. Take A as starting vertex (label remaining vertices) [6]



- c) Construct binary search tree by inserting integers in order 50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24 Find [6]
 i) No of internal nodes ii) Leaf nodes

Q7) a) Define with examples : [6]

- i) Ring with unity ii) Fields
 iii) Integral Domain

b) Explain Algebraic system and properties of binary operations. [6]

c) Consider the set Q of rational numbers and let $a*b$ be the operation defined by $a*b = a + b - ab$ [5]

i) Find $3*4$

ii) $2*(-5)$,

iii) $7*(1/2)$

Is $(Q, *)$ semi group? Is it commutative?

OR

Q8) a) Define with examples : [6]

- i) Groupoid ii) Monoid
 iii) Abelian group.

b) Let $R = \{0, 60, 120, 180, 240, 300\}$ and $*$ binary operation so that for a and b in R, $a*b$ is overall angular rotation corresponding to successive rotations by a and by b. Show that $(R, *)$ is a group. [6]

c) Prove that $(I, +)$ is an abelian group, where I is a set of all integers with respect to binary operation '+'. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4076

[Total No. of Pages : 2

[6402]-36

S.E. (Computer Engineering/Computer Science & Design/AI & DS)

FUNDAMENTALS OF DATA STRUCTURE

(2019 Pattern) (Semester - III) (210242)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right side indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Draw neat & labelled diagrams if necessary.

- Q1) a) Discuss an algorithm for sentinel search. Compare linear search & sentinel search. Comment on time & space complexity of both. [7]
- b) Explain quick sort & sort the given list using quick sort. [7]
54, 26, 93, 17, 77, 31, 44, 50, 20. Analyze time complexity of quick sort.
- c) Differentiate between internal and external sort. [3]

OR

- Q2) a) Sort the following numbers using insertion sort : [7]
4, 3, 2, 10, 12, 1, 5, 6, 76, 36
Comment on efficiency, stability, in-place characteristics of insertion sort.
- b) Enlist non-comparison based sorting techniques. Explain bucket sort with suitable example. Comment on time and space complexity of it. [7]
- c) Apply sentinel search to find key = 39. [3]
34, 52, 78, 33, 67, 12, 45, 23

- Q3) a) Represent following polynomial using generalized linked list $((x^{12} + 2x^9)y^4 + 4x^9y^2)z^3 + ((x^5 + 6x^3)y^5 + 3y)z$ [8]
- b) Write an algorithm to perform following operations on singly linked list.[9]
- i) Reverse
 - ii) Merge

P.T.O.

OR

- Q4) a)** What is linked list? Enlist different types of linked list. Write pseudo C/C++ code to insert a node in a doubly linked list (3 cases). [8]
b) Explain polynomial addition using SLL with suitable example and write pseudo C/C++ code for polynomial addition using singly linked list. [9]

- Q5) a)** How to convert infix expression into postfix expression using stack & convert following expression into postfix form. (Show all intermediate steps) $A * (B - C) / E \wedge F + G$ [9]
b) Write an algorithm for converting prefix expression into postfix expression. Convert following expression into postfix. $(A + B) - (C/D - E) + (F + G/K)$ [9]
c) Write an algorithm for converting prefix expression into postfix expression. Convert following expression into postfix. $[4 + 5 = 9]$
 $(A + B) - ((C/D - E) + (F + G/K))$

OR

- Q6) a)** What is stack? Write an ADT for stack and its implementation using array. [6 + 3 = 9]
What are different applications of stack?
b) What are polish notations? What is need of it?
Evaluate below prefix and postfix expression for $a = b = c = 2$ and $d = 1$
Prefix Expression = $- + a * bcd$
Postfix Expression = $abc * + d -$ [3 + 6 = 9]

- Q7) a)** What is queue? How they are represented in memory?
write a pseudocode to implement insert & delete operation in a linear queue using array. [3 + 6 = 9]
b) What is linked queue?
Write a function for inserting & deleting a node in a linked queue. [3 + 6 = 9]

OR

- Q8) a)** Explain the concept of linear queue and circular queue. Give the advantages of circular queue over linear queue.
Write C/C++ code to implement enqueue & dequeue operation on circular queue. [4 + 5 = 9]
b) What is Deque? Explain operations of Deque.
Write C/C++ code for insertion & deletion operations of it using array. [4 + 5 = 9]



Total No. of Questions : 8]

SEAT No. :

PD-4077

[Total No. of Pages : 2

[6402]-37

**S.E. (Computer/AI & DS/Computer Science & Design/
Computer Science Engg.)**

**OBJECT ORIENTED PROGRAMMING
(2019 Pattern) (Semester - III) (210243)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Draw neat & clean diagrams if necessary.*

- Q1)** a) Compare Function Overloading and Function Overriding. [5]
b) What is Virtual Function? Explain with example. [6]
c) Write a program to overload binary operator using member function. [6]
OR

- Q2)** a) Explain Virtual destructor with Example. [5]
b) What is late binding and early binding? How are they implemented in C++? Give the difference between the two types of binding. [6]
c) Write a program to overload binary operator using friend function. [6]

- Q3)** a) The I/O system of C++ contains which set of classes for file handling? [7]
b) What are different ways to opening the file for reading and writing operations? [7]
c) 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. [4]

OR

- Q4)** a) What are cin and cout objects? Explain ios, istream, ostream and iostream classes. [7]
b) Write a program to create a file, read and write student records into it. Every record contains Student Name, Roll Number and age . Store and retrieve atleast 3 records. [7]
c) What is a file mode? Describe the various file mode options available in C++? [4]

P.T.O.

- Q5)** a) What is use of type name and export keywords? [4]
b) What is generic programming? How is it implemented in C++? [6]
c) Write a Note on 1) unexpected() function 2) terminate() function
3) User defined exception 4) Exception and inheritance. [8]

OR

- Q6)** a) Explain Rethrowing exceptions with Example. [4]
b) Explain What is Function template and Class template using program.[6]
c) How exception specifications is used in exception handling with example. [8]

- Q7)** a) What is STL? List different types of STL containers. [4]
b) How stack can be implemented using STL. Explain with program. [6]
c) Write a program to illustrate STL heap sort. [8]

OR

- Q8)** a) Explain bidirectional and random access iterators with suitable example.[4]
b) Write a program to implement binary search algorithm using STL. [6]
c) Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container. [8]



Total No. of Questions : 8]

SEAT No. :

PD-4078

[Total No. of Pages : 2

[6402]-38

S.E. (Computer Engineering) (AI & DS) (Computer Science & Design)

COMPUTER GRAPHICS

(2019 Course) (Semester-III) (210244)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2,Q.3, or Q.4,Q.5, or Q.6,Q.7, or Q.8.
- 2) Draw neat diagram wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Differentiate between Parallel projection and perspective projection.[5]
- b) What is transformation and write transformation matrix for: [5]
- i) 3D translation using homogenous coordinate system.
 - ii) 3-D rotation about X-axis.
- c) 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 origin. [8]

OR

- Q2)** a) Derive 3D transformation matrix for rotation about an arbitrary axis.[5]
- b) What are the types of projection and write in brief about any one type of projection? [5]
- c) A triangle is defined by [8]

$$\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$$

Find transformed coordinates after the following transformation.

- i) 90° rotation about the origin.
- ii) Reflection about line $y = -x$

P.T.O.

- Q3)** a) Explain backface detection and removal Algorithm. [6]
b) Explain and compare point source and diffuse illumination. [5]
c) Explain ambient light and diffuse reflection with examples. [6]

OR

- Q4)** a) Write short note on Painters Algorithm. [6]
b) Explain Halftone shading. [5]
c) Write short note on Warnock's Algorithm. [6]

- Q5)** a) Write a short note on interpolation and approximation. [4]
b) Explain Hilbert's curve with an example. [7]
c) Explain blending function for B-spline curve. [7]

OR

- Q6)** a) Explain the Bezier curve. List its properties. [4]
b) Write a short note on Interpolation. [7]
c) With suitable example write short note on the fractal lines. [7]

- Q7)** a) Draw block diagram of NVIDIA workstation and explain it in brief. [7]
b) Define Morphing and write the applications of Morphing. [3]
c) Explain architecture of i860. [7]

OR

- Q8)** a) What are the state-of-the-art Advances in Gaming? [5]
b) Enlist all the steps required to produce real time animation with suitable examples. [6]
c) Why do we need segments? Write the algorithm for changing visibility attribute of segment. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4079

[Total No. of Pages : 2

[6402]-39

S.E. (Computer Engineering)

DIGITAL ELECTRONICS & 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) Figures to the right side indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.

Q1) a) Compare asynchronous counter & synchronous counter. [6]

b) Explain how J-K Flip-Flop is converted into [6]

i) TFF

ii) DFF

c) Draw & Explain 4 bit ripple up counter. [6]

OR

Q2) a) State the different types of shift Registers & state its any two applications. [6]

b) Write a short note on Johnson counter. [6]

c) What is Mod counter? Design Mod-9 using IC7490. [6]

Q3) a) Draw a block diagram of PLA device & Explain. [6]

b) Implement the following boolean function using PAL. [6]

$$f_1 = \sum m (3,6,7,11,12,13)$$

$$f_2 = \sum m (0,1,2,4,8,9,12,13)$$

c) What is difference between PLA & PAL. [5]

OR

Q4) a) What is ASM chart? State & Explain basic component of ASM chart. [5]

b) Implement following boolean function using PLA [6]

$$f_1 = \sum m (0,2,4,7,8,10)$$

$$f_2 = \sum m (1,2,3,8,9,10,14,15)$$

c) Design & Implement BCD to Excess - 3 code converter using PAL. [6]

P.T.O.

- Q5) a)** What is logic family? Give the classification of logic family & also write important characteristics of CMOS. [6]
- b)** Draw & Explain the circuit diagram of CMOS inverter. [6]
- c)** Define the following terms & mention the standard value of TTL logic family. [6]
- i) Fan out
 - ii) Power dissipation
 - iii) Noise Immunity

OR

- Q6) a)** Compare TTL & CMOS logic family. [6]
- b)** Explain CMOS NAND Gate with neat diagram. [6]
- c)** What are the advantages of open collector output? Justify your answer with suitable circuit. [6]

- Q7) a)** What is microprocessor & list different applications of microprocessor. [6]
- b)** Explain the memory organization of microprocessor. [6]
- c)** What are the different types of buses used in microprocessor & Explain it. [5]

OR

- Q8) a)** What are the various functional units of microprocessor? Explain ALU in brief. [6]
- b)** Draw & Explain block diagram of microprocessor. [6]
- c)** Explain 4-bit multiplier circuit using ALU & shift registers. [5]



Total No. of Questions : 9]

SEAT No. :

PD-4080

[Total No. of Pages : 5

[6402]-40

**S.E. (Computer/I.T./AI & ML/Computer Science & Design/
Computer Science)**

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - IV) (207003)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q.1 is compulsory.
- 2) Attempt Q.2 OR Q.3, Q.4 OR Q.5, Q.6 Or Q.7, Q.8 OR Q.9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicates 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) X is normally distributed. The mean of X is 15 and standard deviation 3. Given that for $Z = 1$, $A = 0.3413$ then $P(X \geq 12)$ is given by : [2]
 - i) 0.3413
 - ii) 0.8413
 - iii) 0.1587
 - iv) 0.6587
- b) Among 64 off springs of a certain cross between guinea pig 34 were red, 10 were black and 20 were white. According to genetic model, these number should be in the ratio 9 : 3 : 4. Expected frequencies in the order are [2]
 - i) 36, 12, 16
 - ii) 32, 8, 24
 - iii) 36, 16, 12
 - iv) 34, 10, 20
- c) Using Newton - Raphson method, the first approximation to a root x_1 of the equation $x^3 + 2x - 5 = 0$ in (1, 2) if initial approximation $x_0 = 2$ is ____ [2]
 - i) 0
 - ii) 3
 - iii) 1.5
 - iv) 4

P.T.O.

d) If Lagrange's polynomial passes through [2]

x	0	1
y	-4	-4

then $\frac{dy}{dx}$ at $x = 1$ is given by

- i) 0
 - ii) 2
 - iii) 1
 - iv) $\frac{1}{2}$

e) The first central moment of a distribution about the mean is **[1]**

- i) 1 ii) always positive
iii) 0 iv) -1

f) If $f(x)$ is continuous 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) $\frac{a-b}{2}$ ii) $\frac{f(a)+f(b)}{2}$

iii) $\frac{a+b}{2}$ iv) $\frac{a-b}{a+b}$

Q2) a) The first four moments about the working mean 30.2 of a distribution are 0.255, 6.222, 30.211, 400.25. Calculate the first four central moments about the mean. **[5]**

b) Obtain regression line of x on y for the following data : [5]

x	2	3	5	7	9	10	12	15
y	2	5	8	10	12	14	15	16

c) Fit a linear curve $y = ax + b$ to the data : [5]

x	0	2	4	6	8	12	20
y	10	12	18	22	20	30	30

OR

Q3) a) Calculate the coefficient of correlation from the information $n = 10$, $\Sigma x = 40$, $\Sigma x^2 = 190$, $\Sigma y^2 = 200$, $\Sigma xy = 150$, $\Sigma y = 40$ [5]

b) Fit a curve $y = ax^b$ for the data [5]

x	2000	3000	4000	5000	6000
y	15	15.5	16	17	18

c) If regression line of x on y is $9x + y = \lambda$ and the regression line of y on x is $4x + y = \mu$ where means of x and y are 2 and -3 respectively. Find the values of λ and μ and the coefficient of correlation between x and y . [5]

Q4) a) Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both Queens if : [5]

- i) the first card drawn is replaced
- ii) the first card drawn is not replaced

b) A series of five one-day matches is to be played between India and Australia. Assuming that the result of all the five matches is independent and the probability of India's win in each match is 0.6, find the probability that India wins the series. [5]

c) A life time of a certain component has a normal distribution with mean of 400 hours and standard deviation of 50 hours. Assuming a normal sample of 1000 components, find number of components whose life time lies between 340 to 465 hours. [5]

[Given : $A(z = 1.2) = 0.3849$, $A(z = 1.3) = 0.4032$]

OR

Q5) a) The mean and variance of a binomial distribution are 4 and 2 respectively. Find $P(r \leq 2)$. [5]

b) Number of road accidents on a high-way 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) more than 3

- c) A die is tossed 300 times gave the following result. [5]

Score	1	2	3	4	5	6
Frequency	43	49	56	45	66	41

Is the data consistent at 5% level of significance with hypothesis that the die is unbiased?

(Given : $\chi^2_{5,0.05} = 11.07$)

- Q6) a)** Using method of bisection, find the cube root of 69. (five iterations) [5]

- b) Find the root of the equation $x - e^{-x} = 0$ that lies between 0.5 and 1 by Newton Raphson method correct up to four decimal places. [5]

- c) Solve by Gauss - Seidel method, the following system of equations. [5]

$$8x_1 + 3x_2 + 2x_3 = 13$$

$$x_1 + 5x_2 + x_3 = 7$$

$$2x_1 + x_2 + 6x_3 = 9$$

OR

- Q7) a)** Solve the following system by Gauss elimination method. [5]

$$2x_1 + x_2 + x_3 = 10$$

$$3x_1 + 2x_2 + 3x_3 = 18$$

$$x_1 + 4x_2 + 9x_3 = 16$$

- b) Solve the following system of equations by Jacobi's iteration method.[5]

$$20x_1 + x_2 - 2x_3 = 17$$

$$3x_1 + 20x_2 - x_3 = 18$$

$$2x_1 - 3x_2 + 20x_3 = 25$$

- c) Solve the equation $f(x) = x - e^{-x}$ by Regula-Falsi method with the initial approximations 0.5 and 1 correct up to three decimal places. [5]

- Q8) a)** Using Newton's backward difference formula find the value of y at $x = 3.5$ for following data : **[5]**

x	0	1	2	3	4
y	3	2	3	6	11

- b) Use Simpson's $\left(\frac{1}{3}\right)^{\text{rd}}$ rule to find the value of $\int_1^2 \frac{1}{x} dx$. Take $h = 0.25$.
Correct the solution upto fourth decimal place. **[5]**

- c) Use Euler's method to solve the equation $\frac{dy}{dx} = 1 + xy$ with $y(0) = 1$ and tabulate the solution for $x = 0$ to $x = 0.4$. Take $h = 0.1$ and correct the solution upto fourth decimal place. **[5]**

OR

- Q9) a)** Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} = x^2 + y^2, y(1) = 1.5$ in the interval $(1, 1.1)$ with $h = 0.1$ and correct the solution upto fourth decimal place. **[5]**

- b) Given $\frac{dy}{dx} = x^2 + y, y(0) = 1$ determine using modified Euler's method the value of y when $x = 0.05$. Take $h = 0.05$ and correct the solution upto fourth decimal place. Use two iterations only. **[5]**

- c) Find the value of y for $x = 0.5$ using Newton's forward difference formula for following data : **[5]**

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



[6402]-41

S.E. (Computer Engineering)/(Artificial Intelligence & Data Science)/
(Computer 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 Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) Assume the suitable data, if necessary.
- 3) Figures to the right indicate full marks.
- 4) Draw neat labelled diagram wherever necessary.

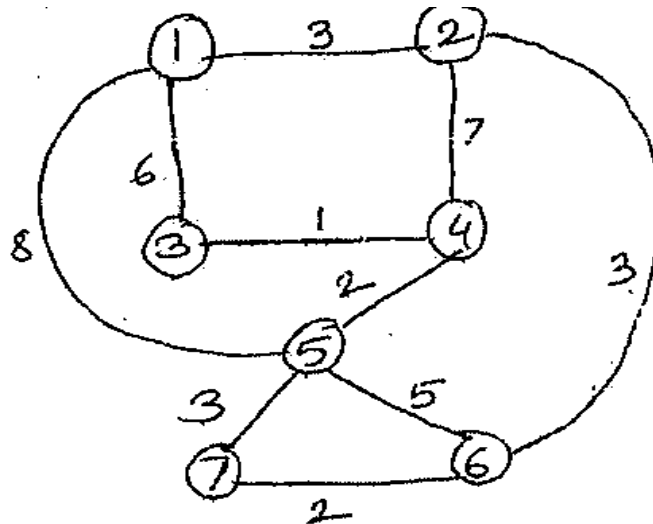
Q1) a) Define the following terms :

[6]

- i) Complete Graph
- ii) Connected Graph
- iii) Subgraph

b) Write a pseudo C/C++ code for depth traversal of graph represented using adjacency matrix. [6]

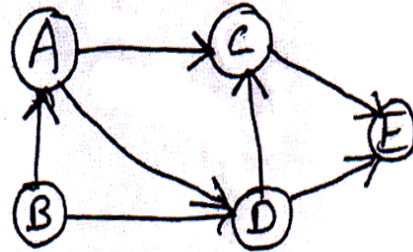
c) Find MST for the following graph using Prim's algorithm. Show various steps. [6]



OR

P.T.O.

- Q2) a)** Write an algorithm for BFS traversal of graph. [6]
- b)** Give difference between Prim's and Kruskal's algorithm. [6]
- c)** What is topological sorting? Find topological sorting of given graph. [6]



- Q3) a)** Build AVL tree for following input: A,Z,B,Y,C,X,D,U,E. Show balance factor of all nodes and name rotation in each step. [6]
- b)** Explain static and dynamic tree tables with suitable example. [6]
- c)** Explain with example Red Black tree. [5]
- Q4) a)** Write functions for LL and LR rotation with respect to AVL tree. [6]
- b)** Explain with example K dimensional tree. [6]
- c)** Construct AVL tree for following data: 15,20,24,10,13,7,30,36,25 [5]
- Q5) a)** Write an algorithm to delete data from B Tree. Create B tree of order 3 of following data 78, 21, 14, 11,97, 85, 74, 63, 45, 42, 57, 20, 16, 19. [10]
- b)** Explain Tric data structure to insert, delete, search operations with example. [8]

OR

- Q6) a)** Create B+tree of orders 5 of following data 5,30,50, 110, 80, 40, 10, 120, 60, 20, 70, 100, 35, 90. Perform deletion of values 90 and then 100 [10]
- b)** Explain following primary index, Secondary index, Sparse index and Dense index with example. [8]

- Q7) a)** Compare Sequential and Direct access file organization. **[8]**
- b)** What is the concept of Multilist Structure in file organization. Explain Coral ring for multilist structure. **[9]**

OR

- Q8) a)** What is linked organization? Explain inverted file and cellular partitions with respect to linked organization. **[9]**
- b)** What is Sequential and index sequential file organization? State its advantages and disadvantages. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD4082

[Total No. of Pages : 2

[6402]-42

**S.E. (Computer Engineering)/(AIDS)/(Computer Science)/
(Computer Science & Design Engg.)
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, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume suitable data, if necessary.

Q1) a) Discuss Estimation Using Use Case Points with the help of an example. **[8]**

b) Design and discuss the project decomposition and work task communication process. **[10]**

OR

Q2) a) Discuss any 2 of the following with suitable example: **[10]**

- i) LOC-Based Estimation
- ii) FP based estimation technique
- iii) Problem-Based Estimation

b) What are the basic principles of software project scheduling. Explain different tasks of project scheduling. **[8]**

Q3) a) Explain refinement and refactoring. Give the importance of Refactoring in improving the quality of software. **[8]**

b) With the help of diagram explain how to translate the requirements model into the design model. **[9]**

OR

Q4) a) What is software Architecture? Why Architecture is important? What is the use of Architecture Decision Description Template? **[9]**

b) Enlist the golden rules of User Interface Design. **[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

OR

P.T.O.

- Q6)** a) What are the advantages of SCM Repository? Explain functions performed by SCM Repository. [8]
- b) Discuss layers of SCM Process. Write a short note on Change control mechanism in SCM. [10]

- Q7)** a) Define testing? Explain graph based functional testing techniques with suitable example. [9]
- b) Discuss any two of the following. [8]
- i) bottom-up testing with its advantages
 - ii) Software Testing Life Cycle
 - iii) Alpha and Beta Testing

OR

- 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. Discuss with suitable top-up and bottom-up integration in integration testing. [9]



Total No. of Questions : 8]

SEAT No. :

PD4083

[Total No. of Pages : 2

[6402]-43

S.E. (Computer Engineering)

MICROPROCESSOR

(2019 Pattern) (Semester - IV) (210254)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Explain following in detail. **[6]**

- i) Global Descriptor Table
- ii) Local Descriptor Table

b) Draw and explain the general descriptor format. **[6]**

c) Explain the process of Segment translation in detail. **[6]**

OR

Q2) a) Explain following in detail **[6]**

- i) GDTR
- ii) LDTR &
- iii) IDTR

b) Draw and explain segment selector format. **[6]**

c) Explain the process of page translation in detail. **[6]**

Q3) a) Explore the need for a protection mechanism in 80386. **[6]**

b) List and explain various Privilege Instructions. **[6]**

c) Explore five aspects of protection applied in segmentation. **[5]**

OR

P.T.O.

- Q4)** a) Explain different levels of protection? State the rules of protection check. [6]
b) Write a short note on CPL, DPL, and RPL. [6]
c) What is call gate? Explain how it is used in calling functions with higher privilege levels. [5]

- Q5)** a) Draw and Explain the Task State Segment of 80386. [6]
b) Explore the role of Task Register in multitasking and the instructions used to modify and read Task Register. [6]
c) List and explain various features of virtual 8086 Mode. [6]

OR

- Q6)** a) Explain the TSS descriptor of 80386 with a neat diagram. [6]
b) Define task switching and explain the step involved in task switching operation. [6]
c) Explore memory management in the virtual 8086 Mode. [6]

- Q7)** a) Explain the process of Enabling and Disabling Interrupts in 80386. [6]
b) Explain different types of exceptions in 80386 with suitable examples. [6]
c) Differentiate between Microprocessor and Microcontroller. [5]

OR

- Q8)** a) How are interrupts identified in 80386? [6]
b) Explain the following exceptions in brief [6]
i) Overflow,
ii) Divide error
iii) invalid opcode
c) With the help of neat diagram explain the architecture of typical microcontroller. [5]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4084

[Total No. of Pages : 2

[6402]-44

S.E. (Computer Engineering)

PRINCIPLES OF PROGRAMMING LANGUAGES

(2019 Pattern) (Semester - IV) (210255)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Explain why Java is secure, portable and Dynamic. Which of the concepts in Java ensures these? [8]

b) What is the String class in Java? List and explain with proper examples any four methods of the String class. [9]

OR

Q2) a) Discuss the importance of garbage collection in Java. Explain how the finalize() method is related to garbage collection. Differentiate garbage collection in Java and C++? [8]

b) What do you mean by method overloading? Demonstrate through a program in Java how method overloading is used to add two integers and two strings respectively. [9]

Q3) a) Describe the constructor call sequence in Java when dealing with inheritance. How does it differ for constructors of the superclass and subclass with proper examples? [9]

b) What are interfaces in Java? Explain how interfaces are defined and implemented. Provide an example of extending interfaces. [9]

OR

Q4) a) Discuss the types of exceptions in Java. Explain the concepts of uncaught exceptions, try-catch blocks, throw, throws, and finally with examples. [9]

b) Define streams in Java. Differentiate between Byte Streams and Character Streams. Explain the purpose of Predefined Streams. [9]

P.T.O.

- Q5) a)** Compare and contrast implementing threads using the Thread class and the Runnable interface in Java. Provide examples for both approaches. [8]
- b) Introduce three popular JavaScript frameworks used in web development: ReactJS, VueJS, and AngularJS. Discuss their features and advantages. [9]

OR

- Q6) a)** Discuss the advantages and disadvantages of using threads in Java programs. Provide examples illustrating scenarios where threads are beneficial and where they may lead to issues. [8]
- b) Explain the role of JavaScript in creating web-based applications using Java. Provide examples of how JavaScript can be integrated with Java applications. [9]
- Q7) a)** Discuss the concepts of definitions, predicates, conditionals, and scoping in Lisp. Provide code examples for each concept. [9]
- b) Write a Lisp program to calculate the factorial of a given number using recursion. [9]

OR

- Q8) a)** Compare and contrast the Functional Programming Paradigm and the Logic Programming Paradigm. Highlight their differences in terms of syntax, semantics, and problem-solving approaches. [9]
- b) Develop a Prolog program on two numbers for basic arithmetic operations (addition, subtraction, multiplication, division). [9]



[6402]-45

S.E. (Artificial Intelligence and Data Science)

OPERATING SYSTEM

(2019 Pattern) (Semester - III) (217521)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve Questions 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) Provide solution to producer- Consumer process problem using semaphore. [6]
- b) What is deadlock? What are the conditions under which a deadlock situation may arise? [6]
- c) What is banker's algorithm? Explain it with suitable example. [6]

OR

- Q2) a) What is Process? Differentiate between Process and Thread? [6]
- b) Write a short note on Pipe, Semaphore, Signal. [6]
- c) With given matrices, determine safe state with the help of banker algorithm. [6]

Claim Matrix C				Allocation Matrix A				Resource Vector R		
	R ₁	R ₂	R ₃		R ₁	R ₂	R ₃	R ₁	R ₂	R ₃
P ₁	3	2	2	P ₁	1	0	0	9	3	6
P ₂	6	1	3	P ₂	6	1	2			
P ₃	3	1	4	P ₃	2	1	1			
P ₄	4	2	2	P ₄	0	0	2			
Available Vector V : R ₁ -0, R ₂ -1, R ₃ -1										

P.T.O.

- Q3) a)** Write a note on (Any two) : **[6]**
- i) Demand Paging
 - ii) Segmentation
 - iii) Memory Partitioning
- b) Consider the page reference string 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2 Calculate page fault for FIFO. If the number of page frames : 3 **[6]**
- c) How operating system utilizes swapping techniques in memory management? Explain in detail. **[5]**

OR

- Q4) a)** Explain following memory allocation strategies with suitable example. **[6]**
- i) Best fit
 - ii) First fit
 - iii) Next fit
- b) What is fragmentation? Explain types of fragmentation with example. **[5]**
- c) Given memory partition of 100K, 500K, 200K, 300K and 600K (in order). How would each of First fit, Best fit and worst fit algorithm place processes of size 212K, 417K, 112K, 426K (in order)? Which also makes the most efficient use of memory. **[6]**
- Q5) a)** List and Explain file types and file access methods. **[6]**
- b) List methods of allocation of disk space. Explain any of these methods. **[6]**
- c) What information is present in directories. Explain the structure of directories in detail. **[6]**

OR

- Q6)** a) Explain the following concepts [6]
i) Disk Access methods
ii) Directory structure
b) Explain the advantages of organizing file directory structure into a tree structure? [6]
c) List and explain various layers of a file system. [6]
- Q7)** a) What is make utility? Explain it with example. Consider your own make file. [6]
b) Explain share memory with system calls. [5]
c) Give overview of Linux operating system. Also explain its goals. [6]

OR

- Q8)** a) Define the components of LINUX system with diagram. What is the responsibility of kernel in LINUX operating system? [6]
b) What are different Process management system calls in Linux. Explain any two with example. [6]
c) What are the primary goals of conflict-resolution mechanisms used by the Linux kernel for loading kernel modules? [5]



[6402]-46**S.E. (Artificial Intelligence and Data Science)****STATISTICS****(2019 Pattern) (Semester - IV) (217528)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates :**

- 1) Answer 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 calculator is allowed.

Q1) a) The number of I-phones sold by the showroom was recorded for 15 days. Find the **[10]**

- i) Range and Coefficient of range
- ii) Quartile deviation and coefficient of Quartile deviation
For the following discrete distribution

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Freq.	29	14	21	100	26	38	108	19	100	74	69	104	62	92	22

b) Obtain the regression lines y on x and x on y for the data : **[8]**

X	5	1	10	3	9
Y	10	11	5	10	6

OR

Q2) a) Find the first four moments about any arbitrary point for the following data. **[10]**

Marks	29	30	31	32	33	34	35	36	37	38	39
No. of Students	2	1	4	5	10	75	50	74	62	15	6

Also find

- i) Four central moments
 - ii) Coefficient of skewness and kurtosis
- b)** Compute the coefficient of correlation for the following data. **[8]**

X	10	14	18	22	26	30
Y	18	12	24	6	30	36

P.T.O.

Q3) a) In a sample of 1000 cases the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal find [6]

i) How many students score between 12 and 15?

ii) How many score below 8?

[Given: $A(z=0.8)=0.2881$, $A(z=0.4)=0.1554$, $A(z=2.4)=0.4918$]

b) An unbiased coin is thrown 10 times. Find the probability that [5]

i) getting exactly 6 heads.

ii) Getting at least 6 heads.

c) If the probability that an individual suffers a bad reaction from a certain injection is 0.001. Determine the probability that out of 2000 individuals [6]

i) Exactly 3 will suffer a bad reaction.

ii) At most 1 will suffer a bad reaction

OR

Q4) a) A random variable X the following probability distribution [6]

X	1	2	3	4	5	6	7
P(X)	k	2k	3k	k^2	$k^2 + k$	$2k^2$	$4k^2$

Find :

i) k

ii) $P(x>5)$

iii) $P(0 \leq x \leq 5)$

b) The number of breakdowns of a computer in a week is a Poisson variable with $m=np=0.3$. What is the probability that the computer will operate [5]

i) With no breakdown

ii) At most one breakdown in a week.

c) Mean and variance of Binomial Distribution are 6 and 2 respectively. [6]

Find

i) $P(r=0)$,

ii) $P(r \leq 1)$

- Q5) a)** A random sample of 16 newcomers gave mean of 1.67m and standard deviation of 0.16m. The mean height of the students of the previous year known to be 1.600m. At 5% significance level is the mean height of the newcomers significantly different from the mean height of the students population of the previous years? **[6]**

[Given $t_{\alpha} = 2.13$]

- b)** From the data given below. Intelligence tests of two groups of boys and girls gave the following results. Examine the difference is significant at 5% level of Significance. **[6]**

	Mean	S.D.	Size
Girls	70	10	70
Boys	75	22	110

[Given $Z_{\alpha} = 1.96$]

- c)** Following table shows number of books issued, on the various days of the week, from a certain library. At 5% level of significance test the null hypothesis that number of books issued independent of the day. **[6]**

Day	Mon	Tue	Wed	Thur	Fri	Sat
No.of books issued	120	130	110	115	135	110

[Given $\chi^2_{\alpha} = 11.071$]

OR

- Q6) a)** Find the F-statistics from the following data **[6]**

Sample	Size(n)	Total Observations	Sum of squares Of observations
1	8	9.6	61.52
2	11	16.5	73.26

- b)** A school does a study about the occurrence of different colored eyes in its pupils. It is hypothesized that 15% of pupils will have green eyes, 25% of pupils will have blue eyes and 60% of pupils will have brown eyes. Of the 1000 pupils, 80 are chosen at random. The results of the sample are as follows. **[6]**

Green	Blue	Brown
18	28	34

[Given $\chi^2_{\alpha} = 5.99$]

- c)** A manufacturer claims that a special type of projector bulb has an average life 160 hours. To check this claim an investigator takes a sample of 20 such bulbs, puts on the test and obtains an average life 167 hours with standard deviation 16 hours. Assuming that the life time of such bulbs follows normal distribution, does the investigator accept the manufacturer's claim at 5% level of significance? **[6]**

[Given $t_{\alpha} = 2.093$]

Q7) a) State & Prove Neyman-Pearson Fundamental Lemma. **[9]**

b) A single observation is drawn from the distribution **[8]**

$$f(x, \theta) = \frac{2x}{2\theta + 1} \quad 0 \leq x \leq \theta + 1$$
$$= 0 \quad \theta \leq \theta + 1$$

It is require to test $H_0 : \theta = 1$ vs $H_1 : \theta = 1.5$, H_1 is rejected iff the observation is >1.7 . Calculate the probability the errors of two kinds.

OR

Q8) a) Write short note on : **[9]**

i) Critical Region

ii) Most powerful test

iii) Advantages and disadvantages of non-parametric tests

b) Explain in detail likelihood ratio test and the properties of it. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD4087

[Total No. of Pages : 2

[6402]-47
S.E.(AIDS)
INTERNET OF THINGS
(2019 Pattern) (Semester - IV) (217529)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Draw neat and Clean diagrams.*
- 3) *Assume suitable data, if necessary.*
- 4) *Figures to the right indicate full marks.*

Q1) a) Explain Request Response model, Publish Subscribe model and Push/Pull Model? **[9]**

b) Justify how Retail Sector impacting on end to end user by integrating IOT technology. **[9]**

OR

Q2) a) Explain in brief Telematics and Telemetry model? **[10]**

b) How is security a big concern in IOT? What kind of development is there in market to make IoT more secure. **[8]**

Q3) a) What are some common networking devices used in the internet of Things (IoT) ecosystem? **[8]**

b) Explain the IOT system working block with the help of control units, Communication Modules and Sensors? **[9]**

OR

Q4) a) Draw IOT protocol structure and explain IPv4, 6LoWPAN in detail? **[9]**

b) How information is exchanged in real time without human intervention?**[8]**

Q5) a) Explain how you will design an energy management system in a commercial building using IoT. **[10]**

b) Elaborate on how you will use IoT for remote healthcare. **[8]**

OR

P.T.O.

Q6) a) Describe the need of semantic web technology and business impacting IoT? **[10]**

b) What is Industrial IoT? How is it different from Conventional IoT? **[8]**

Q7) a) Explain Smart home and Smart city applications in view of IoT. **[10]**

b) How will IoT be used to protect environmental loss? **[7]**

OR

Q8) a) Explain use of IoT in the agriculture field. Explain it with a case study. **[10]**

b) Write a note on Industrial IoT. **[7]**



Total No. of Questions : 8]

SEAT No. :

PD4088

[Total No. of Pages : 2

[6402]-48

**S.E. (Artificial Intelligence & Data Science)
MANAGEMENT INFORMATION SYSTEM
(2019 Pattern) (Semester - IV) (217530)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) What are the problems of managing data resources in a traditional file environment and how are they solved by a database management system?

[8]

b) Why information policy, data administration, and data quality assurance essential for managing the firm's data resources?

[9]

OR

Q2) a) What is IT infrastructure and what are its components? What are the stages and technology drivers of IT infrastructure evolution?

[8]

b) What are the major capabilities of database management systems (DBMS) and why is a relational DBMS so powerful?

[9]

Q3) a) What is CRM? How does study of CRM helps in different business applications.

[8]

b) How do supply chain management systems coordinate planning, production, and logistics with suppliers?

[9]

OR

Q4) a) Discuss importance of project management. How data science help in project management.

[8]

b) What are the unique features of e-commerce, digital markets, and digital goods?

[9]

P.T.O.

- Q5)** a) Identify attributes of Decision Support System. How data mining is useful in decision support. [9]
- b) What is ERP? What are the essential components of EMS? How ERP can contribute in the improvements of an organization? [9]

OR

- Q6)** a) Explain Concept of Customer Relationship Management (CRM) with suitable examples? [9]
- b) Distinguish between MIS and DSS. [9]

- Q7)** a) Explain Artificial Neural Networks with suitable examples? [9]
- b) What is role of MIS in the effective functioning of business organization? [9]

OR

- Q8)** a) Explain concept of data ware housing. Discuss need of data ware housing in modern business. [9]
- b) Explain about Genetic Algorithms. [9]



Total No. of Questions : 8]

SEAT No. :

PD-4089

[Total No. of Pages : 2

[6402]-49

S.E. (Computer Science & Design)

DATA STRUCTURE AND ALGORITHMS

(2019 Pattern) (Semester - III) (218242)

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)** Sort the following numbers step by step using Insertion sort: 55, 85, 45, 11, 34, 5, 89, 99, 67. **[6]**
- b)** Discuss the advantages and disadvantages of the Merge sort algorithm compared to the Quick sort algorithm. **[6]**
- c)** Describe the concept of Linear search. Provide a real-world scenario where Linear search is useful. **[6]**

OR

- Q2) a)** Explain the Bubble sort algorithm step by step. Illustrate with an example and analyze its time complexity. **[6]**
- b)** Explain the Binary search algorithm. Provide an example and analyze its time complexity. **[6]**
- c)** Sort the given list step by step using Quick sort: 15, 08, 20, – 4, 16, 02, 01, 12, 21, – 2. **[6]**

- Q3) a)** Define a singly linked list and explain how it differs from a doubly linked list. Provide examples. **[6]**
- b)** Describe the operations of inserting a node at the beginning and at the end of a singly linked list. Include code if possible. **[6]**
- c)** Explain the concept of a circular linked list. When and why would you use it over a regular linked list? **[5]**

OR

P.T.O.

- Q4)** a) Discuss the advantages and disadvantages of using a linked list over an array for storing data. [6]
b) Describe the process of reversing a singly linked list. Illustrate with examples. [6]
c) Write a C++ program code for polynomial addition using doubly linked list. [5]

- Q5)** a) Define what a stack is and explain its key characteristics. Provide an example scenario where a stack data structure is applicable. [6]
b) Describe the operations associated with a stack (PUSH, POP) and their roles in stack manipulation. Include code examples where applicable. [6]
c) Explain the concept of a postfix expression evaluation using a stack. Provide a step-by-step example of how a postfix expression is evaluated using a stack. [6]

OR

- Q6)** a) Discuss the practical applications of stacks in computer science or real-world scenarios. Provide specific examples. [6]
b) Compare and contrast stacks with other linear data structures, such as queues or linked lists, highlighting their differences. [6]
c) What is recursion? Explain use of stack for recursion. [6]

- Q7)** a) Define what is a queue is and explain its key properties. Provide an example scenario where a queue data structure is useful. [6]
b) Describe the operations associated with Queue data structure (enqueue, dequeue) and their roles in queue manipulation. [6]
c) Explain the concept of a priority queue and provide an example where a priority queue would be beneficial over a regular queue. [5]

OR

- Q8)** a) Discuss the practical applications of queues in computer science or everyday life. Provide specific examples. [6]
b) Compare and contrast queues with other linear data structures, such as stacks or dequeues, highlighting their differences. [6]
c) What is circular queue? Explain advantages of circular queue over linear queue. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4090

[Total No. of Pages : 2

[6402]-50

S.E. (Computer Science & Design Engg.)

LOGIC DESIGN AND COMPUTER ARCHITECTURE

(218245) (2019 Pattern) (Semester - III)

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) Neat sketches must be drawn wherever necessary.

- Q1)** a) Design JK flip flop using SR flip flop. [6]
b) Construct MOD 72 ripple counter using 7490 IC. [6]
c) Draw and explain SIPO Shift register. [5]

OR

- Q2)** a) Design and implement 2 bit Asynchronous up counter using JK flip flop. [6]
b) Write short note on Sequential and combinational circuit. [6]
c) Draw and Explain the internal structure of IC 7490. [5]
- Q3)** a) Draw and Explain instruction cycle state diagram. [6]
b) What is Bus? Draw the single bus structure. [6]
c) What are the five classic components of a computer? [5]

OR

- Q4)** a) Write short note on Register Organization. [6]
b) Explain the pipelining process in VLIW processors. [6]
c) Explain the Difference between Von Neumann & Harvard architecture. [5]

P.T.O.

- Q5)** a) State characteristics of RISC & CISC. [6]
b) Define Interrupt, explain its types [6]
c) Write short note on cluster configuration. [6]

OR

- Q6)** a) State and Explain types of operands Addressing modes [6]
b) Explain Features of multicore Intel core i7 [6]
c) Explain the types of hazards in pipeline architecture? [6]

- Q7)** a) Explain how read and write operations are carried out in cache memory. [6]
b) Explain different mapping functions of Cache memory. [6]
c) What is DMA? Explain with the neat diagram. [6]

OR

- Q8)** a) Draw and explain the structure of memory hierarchy. [6]
b) State and explain Characteristics of Memory Systems. [6]
c) Differentiate SRAM from DRAM. [6]



[6402]-51

S.E. (Computer Science & Design)
DATA STRUCTURES & FILES
(2021 Pattern) (Semester - IV) (218253)

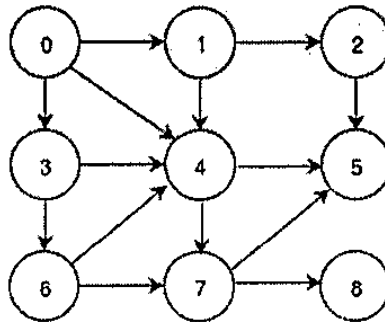
Time : 2½ Hours]

[Max. Marks : 70

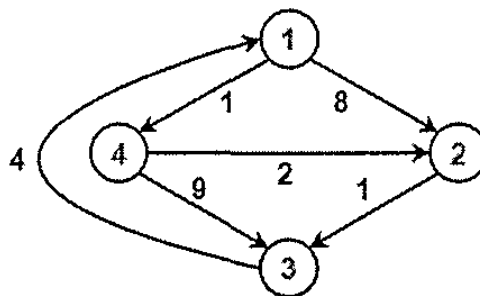
Instructions to the candidates :

- 1) Attempt question Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Draw neat & labelled diagrams if necessary.
- 3) Assume suitable data if necessary.
- 4) Figures to the right side indicate full marks.

Q1) a) For the graph below find out DFS & BFS. Show the intermediate steps using stack and queue in detail. [8]



b) Apply Floyd Warshall's algorithm on following graph. Comment on it's complexity. [6]



c) Discuss the situation in which linked representation of graph will prove more beneficial than array representation. [4]

OR

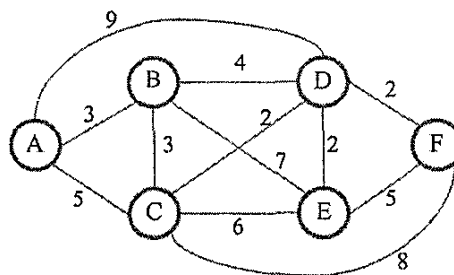
P.T.O.

- Q2) a)** What are different storage representations of graph? Consider the graph represented by the following adjacency matrix : [8]

	1	2	3	4	5	6
1	0	3	1	6	0	0
2	3	0	5	0	3	0
3	1	5	0	5	6	4
4	6	0	5	0	0	2
5	0	3	6	0	0	6
6	0	0	2	2	6	0

Comment on time and space complexity in different storage representations.

- b) Find the shortest graph in the following graph from node A using Dijkstra's Algorithm. [6]



- c) Explain topological sorting with an example. [4]

- Q3) a)** Let $p(1:3) = p(0.5, 0.1, 0.05)$ $q(0:3) = (0.15, 0.1, 0.05, 0.05)$ Compute and construct OBST for above values using Dynamic approach. [7]

- b) Construct an AVL tree for the following data: 20, 11, 5, 32, 40, 2, 4, 27, 23, 28, 50. [6]

- c) Explain two cases of deletion in red black tree with the help of suitable example. [4]

OR

- Q4) a)** Explain following trees with the help of example [7]

- AA tree
- Splay tree
- k dimensional tree

- b) Insert following keys in Red Black Tree. [6]

10, 18, 7, 15, 16, 30, 25, 40, 60.

- c) Differentiate between static and dynamic symbol table. [4]

- Q5) a)** Insert the following keys to a 5 way B tree. [9]
A, G, F, B, K, D, H, M, J, E, S, I, R, X, C, L, N, T, U, P
- b)** Differentiate between primary and secondary indexing. In what situations would primary indexing be more advantageous over secondary indexing, and vice versa? [8]

OR

- Q6) a)** Construct a B+ tree for (1, 4, 7, 10, 17, 21, 31, 25, 19, 20, 28, and 42) with order 4. [9]
- b)** Explain all cases of deletion in B tree with the help of suitable example. [8]

- Q7) a)** What is a File? List different file opening modes in C++. Write a C++ program to create a file. Insert records in the file by opening file in append mode. [6]
- b)** What are the key differences between cellular partitioning and inverted file indexing, and how do these differences impact their effectiveness in organizing and retrieving data? [6]
- c)** Compare & contrast primary, secondary & clustering index. [6]

OR

- Q8) a)** Compare index sequential and direct access files. [6]
- b)** How does the concept of “coral rings” contribute to the efficiency and organization of data in modern data structures? [6]
- c)** Define sequential file. Explain any three primitive operations carried out in sequential file Write pseudo code for any two of them. [6]



Total No. of Questions : 8]

SEAT No. :

PD4092

[Total No. of Pages : 2

[6402]-52

S.E. (Computer Science & Design Engineering)

OPERATING SYSTEMS

(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, and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Describe in detail functions of operating system? [6]
b) What is Readers-Writers problem? Give a solution to Readers-Writers problem using Semaphores. [6]
c) Define mutual exclusion? How mutual exclusion achieve? [5]

OR

- Q2)** a) Explain in detail Batch Operating System and Time Sharing operating system. [6]
b) What is Semaphore? Explain wait and signal operations. [6]
c) What are the methods used to handle Deadlocks. Explain Deadlock prevention and Avoidance in detail. [5]

- Q3)** a) Explain Memory management. Explain two types of memory allocation. [6]
b) Explain paging and translation look aside buffer with its diagram. [6]
c) Write a short note on Buddy System with its advantages and disadvantages. [6]

OR

- Q4)** a) Explain concept of Virtual Memory. Explain Demand paging with example. [6]
b) What is the Difference between Paging and Segmentation. [6]
c) Explain Memory Partitioning in memory management. [6]

- Q5)** a) Explain and compare the SCAN and C-SCAN disk scheduling algorithms. [6]
b) Write short note on File directory. Explain various types of Directories. [6]
c) What are the different buffering ways in I/O buffering? [5]

OR

P.T.O.

- Q6)** a) Compare and explain LIFO FIFO & STTP. [6]
b) Explain Free space management and Directory Structure in File management. [6]
c) Explain Disk Scheduling in detail? [5]

- Q7)** a) Explain with diagram the Kernel Structure in Linux. [6]
b) What is Shell. Explain different types of Shell. [6]
c) Explain Linux processes and Thread management. [6]

OR

- Q8)** a) Describe step by step booting process in Linux. [6]
b) Write difference between Process and Thread Linux. [6]
c) Explain Interfaces in Linux. [6]



Total No. of Questions : 8]

SEAT No. :

PD4093

[Total No. of Pages : 2

[6402]-53

S.E.(Computer Science and Design)

COMPUTER NETWORKS

(2019 Pattern) (Semester - IV) (218255)

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) Assume suitable data, if necessary.

- Q1)** a) Explain the switching techniques used in computer data communication.[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) Give short note on OSPF. [5]
b) How do IP addresses get mapped on to data link layer addresses, such as Ethernet? [6]
c) A host was given the 192.168.2.64/25 IP address, indicate: [6]
i) Net mask of the network.
ii) The network address to which the host belongs.
iii) The network broadcast address to which the host belongs.

- Q3)** a) What is traffic shaping? How is it used in congestion control? [7]
b) What is 3-Way handshake in TCP? Explain in brief why it is required?[7]
c) Explain multiplexing and de-multiplexing in transport layer. [4]

OR

- Q4)** a) Explain in detail RTP with packet header format. [7]
b) Explain TCP state transition diagram. [7]
c) What is socket? Which are various socket primitives used in client server communication? [4]

P.T.O.

- Q5)** a) Explain working of DHCP. [4]
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. [8]

OR

- Q6)** a) Explain FTP in details. [4]
b) What is difference between persistent and non persistent HTTP? Also explain HTTP message format. [6]
c) Write short note on-SMTP and Caching in web browser. [8]

- Q7)** a) Explain key principles of security. [4]
b) Differentiate between Symmetric and Asymmetric Key Cryptography. [6]
c) List and explain various elements of Information Security. [7]

OR

- Q8)** a) Explain different types of attacks. [4]
b) Explain IPsec with modes of operation. [6]
c) Explain firewall with its types. [7]



Total No. of Questions : 8]

SEAT No. :

PD4094

[Total No. of Pages : 2

[6402]-54

S.E. (Computer Science and Design)

DESIGN THINKING

(2019 Pattern) (Semester - IV) (218256)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) What is sketching in design thinking? How can you use sketching as a ideation method? [5]
- b) Briefly explain various techniques of idea generation. [6]
- c) What is brainstorming? What are different variants of brainstorming? [6]

OR

- Q2)** a) When do designers think in preposition and colours? Explain with example. [5]
- b) What is appropriation? Describe Some key forms of appropriation. [6]
- c) How to use story telling in design process? What are the elements of good story telling? How to reach the users through story? [6]

- Q3)** a) What are the principles and benefits of lean startup method? [7]
- b) What is story boarding? Why is story boarding essential? Give an example of story boarding. [7]
- c) Write a short note on quick and dirty prototype. [4]

OR

- Q4)** a) Explain the importance of presentation technique in design thinking process. Explain the different presentation types. [7]
- b) Create a story board for a healthy life style. [7]
- c) What is a mock up in design thinking? Give example. [4]

P.T.O.

- Q5)** a) How to use customer's feedback in product development? [4]
b) What is testing? Why and When to conduct user testing? [6]
c) Compare usability and desirability testing. [8]

OR

- Q6)** a) What is testing? When to conduct user testing? [4]
b) What are the principles of usability testing? [6]
c) Explain Kano model of Testing. [8]

- Q7)** a) How design thinking helps in innovation? [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) How to introduce design thinking into your organization? [7]



Total No. of Questions : 8]

SEAT No. :

PD-4095

[Total No. of Pages : 4

[6402]-55

S.E. (I.T)

DISCRETE MATHEMATICS

(2019 Pattern) (Semester - III) (214441)

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

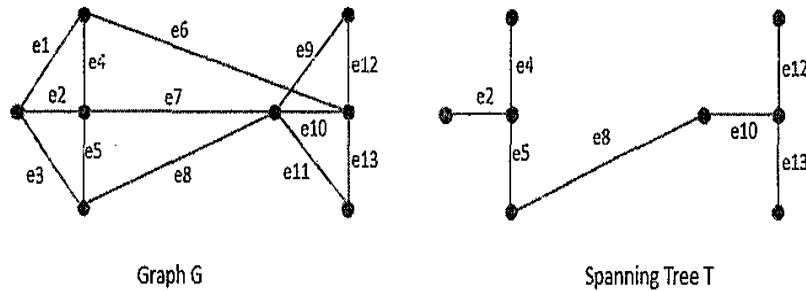
- Q1)** a) Determine the number of edges in a graph with 8 nodes, 3 of degree 2, 4 of degree 3 and 2 of degree 4. Draw one such graphs. [6]
- b) Construct an optimal tree for the weights 8,9,10, 11, 13, 15, and 22. Find the weight of the optimal tree. [6]
- c) Find the chromatic number with the help of graph coloring for: [6]
- i) K_6 (complete graph with 6 vertices)
 - ii) Any complete bipartite graph.
 - iii) C_7 (cyclic graph with 7 vertices).

OR

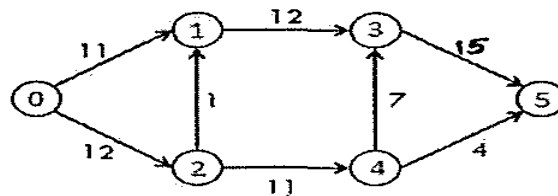
- Q2)** a) Define with graph: [6]
- i) Complete Graph
 - ii) Regular Graph
 - iii) Bipartite Graph

P.T.O.

- b) Determine the Fundamental system of Cutsets for the following Graph G with respect to the given spanning tree T. [6]



- c) Using labelling procedure, find the max flow for the following transport network. [6]



- Q3) a) Consider the following relations on $\{1, 2, 3, 4\}$: [6]

- $R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$,
- $R_2 = \{(1, 1), (1, 2), (2, 1)\}$,
- $R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$,
- $R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$,
- $R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$,
- $R_6 = \{(3, 4), (4, 3)\}$.

Which of these relations are reflexive or irreflexive or neither?

- b) Solve the following recurrence relation [6]

$$ar + 7a_{r-1} + 10a_{r-2} = 2^r \text{ where, } a_1 = 3, a_2 = 6$$

- c) Functions, f, g & h are defined on the set $X = \{1, 2, 3\}$ as

$$f = \{(1, 2), (2, 3), (3, 1)\}$$

$$g = \{(1, 3), (2, 1), (3, 2)\}$$

$$h = \{(1, 2), (2, 1), (3, 3)\}$$

i. Find hog and goh . Are they equals?

ii. Find $hogof$ and $gohof$. [5]

OR

Q4) a) Consider these relations on the set of integers:

$$R1 = \{(a, b) \mid a \leq b\},$$

$$R2 = \{(a, b) \mid a > b\},$$

$$R3 = \{(a, b) \mid a = b \text{ or } a = -b\},$$

$$R4 = \{(a, b) \mid a = b\},$$

$$R5 = \{(a, b) \mid a = b + 1\},$$

$$R6 = \{(a, b) \mid a + b \leq 3\}$$

Which of these relations contain each of the pairs (1, 1), (1, 2), (2, 1), (1, -1), and (2, 2)? [6]

b) Let R be a relation on set A = (0, 1, 2, 3, 4). Which ordered pairs are in the relation R represented by the matrix? M_R is as given below. List the ordered pair to find the reflexive closure and symmetric closure. [6]

0	1	1	0	0
1	0	0	1	1
0	1	1	1	1
0	1	1	0	0
0	0	1	0	1

c) Let A = {2, 3, 4, 5, 6} where R_1 and R_2 be the relation on A such that $R_1 = \{(a, b) \mid a - b = 2\}$ and $R_2 = \{(a, b) \mid a + 1 = b \text{ or } a = 2b\}$. Find $R_1 R_2$, $R_2 R_1$, $R_1 R_2 R_1$ also verify $(R_1 R_2)^c = R_2^c R_1^c$ [5]

Q5) a) Using Euclidean Algorithm find GCD of 189 & 462. [4]

b) Using the Chinese Remainder Theorem find the value of X such that:

$$X = 1 \pmod{3}$$

$$X = 2 \pmod{5}$$

$$X = 9 \pmod{11} \quad [10]$$

c) Determine quotient and remainder for the following:

i. $97/11$

ii. $-97/11$ [4]

OR

- Q6)** a) Find the Euler's Totient function of the following numbers:
 i. 10
 ii. 100
 iii. 1024 [6]
 b) Find the multiplicative inverse of 35 mod 96 using Extended Euclidean Algorithm. [6]
 c) Using Euler's Theorem and Binary expansion method solve the following (Show step-wise answer) $19^{155} \bmod 55$. [6]

- Q7)** a) Find the hamming distance between x and y
 • $x=1101010$ $y=1010000$
 • $x=0111110$ $y=0111011$
 • $x=00101001$ $y=10101011$
 • $x=11000010$ $y=00100101$ [4]
 b) Let P be the set of all matrices of the form $\begin{bmatrix} x & x \\ x & x \end{bmatrix}$ where x is a non-zero rational number. * is the matrix multiplication defined over P. + is an addition operation. Show that (P, +, *) is a Commutative Ring. [10]
 c) Define Abelian Group considering all five properties. [3]

OR

- Q8)** a) Show that the (2,5) encoding function $e:B_2 \rightarrow B_5$ defined by $e(00)=00000$, $e(10)=10101$, $e(01)=01110$, $e(11)=11011$ is a group code. [6]
 b) Let $Z_n = \{0, 1, 2, \dots, n-1\}$. Let $\oplus$ a binary operation on Z_n such that for a and b in Z_n
 $a \oplus b = a+b$ if $a+b < n$ $= a+b-n$ if $a+b \geq n$ [6]
 c) Let, f and g be two permutations on a set $X = \{1, 2, 3, 4, 5, 6\}$. Find the product of f and g and also find the cycles in f and g. [5]

$$f = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 5 & 1 & 4 & 2 \end{bmatrix} \quad g = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 6 & 1 & 5 & 3 & 4 & 2 \end{bmatrix}$$



Total No. of Questions : 8]

SEAT No. :

PD-4096

[Total No. of Pages : 2

[6402]-56

S.E. (IT)

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) *Figures to the right indicate full marks.*
- 3) *Assume Suitable data, if necessary.*

- Q1)** a) Draw and Explain in detail Internal diagram of Decade counter IC 7490. [6]
- b) Differentiate between Synchronous Counter and Asynchronous Counter. [6]
- c) Draw & Explain 3-bit Asynchronous Up-Counter using MS J-K flip flop (IC7476). [5]

OR

- Q2)** a) Draw Circuit diagram of 3-bit SIPO shift Register using D flip flop. Explain its working. [6]
- b) List the various applications of Counter. [6]
- c) Draw Pin Configuration of IC 7476.Explain the function of Preset and Clear. [5]
- Q3)** a) Design and explain Hardwired Control Unit. [6]
- b) Explain in brief different functional units of computer system. [6]
- c) What are the typical registers in a CPU? State the purpose of each type of registers. [6]

OR

P.T.O.

- Q4)** a) Explain and draw basic structure of Harvard architecture. Write the difference between Harvard and Von Neumann architecture. [6]
- b) Write micro-operations for any ONE: fetch, indirect, execute, interrupt [6]
- c) Draw & explain typical organization of microprogrammed control unit.[6]
- Q5)** a) What is mean by Instruction format? Explain 0-1-2-3 address formats with suitable example? [6]
- b) What is meant by Machine Instruction? Explain various Operand types used in Machine Instruction. [6]
- c) Draw and explain Symmetric Multiprocessors Architectures. [5]

OR

- Q6)** a) Differentiate between RISC and CISC Architecture. [6]
- b) What is mean by interrupt? Explain step by step interrupt handling procedure of microprocessors. [6]
- c) List the advantages & applications of multiprocessor systems. [5]
- Q7)** a) Draw Memory Hierarchy. What is the objective of organizing different memories at the different hierarchy? [6]
- b) Consider a cache consisting of 16 words. Each block consists of 4 words. Size of main memory is 256 bytes. Find number of bits in each of the TAG & WORD fields for fully associative mapped cache. [6]
- c) Write a note on any ONE: Programmed I/O, Interrupt Driven I/O. [6]

OR

- Q8)** a) Along with suitable diagram explain set associative cache mapping technique. [6]
- b) Along with suitable diagram explain following cache Write Strategies:
 i) Write Through ii) Write Back [6]
- c) Describe the typical signals used to connect memory to processor. [6]



[6402]-57

S.E. (I.T.)

DATA STRUCTURE AND ALGORITHM (DSA)
(2019 Pattern) (Semester-III) (214443)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, 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) Convert following Infix Expression to Postfix and evaluate using stack
 $(A/(B-C+D))*(E-F)$

A = 100 B =20 C= 1 D=6 E= 6 F=2 [6]

- b) Explain stack PUSH and POP operations with example. [6]
- c) Explain Priority Queue with example. [6]

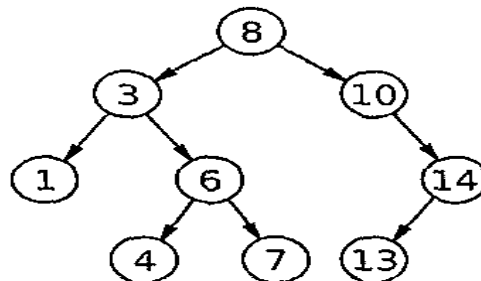
OR

Q2) a) Convert following Infix Expression to Prefix and evaluate using stack
 $((A + B) - C * (D / E))$

A=10 B=10 C=6 D=15 E=5 [6]

- b) Explain stack using Linked List with example. [6]
- c) Explain Implicit stack and explicit stack with example. [6]

Q3) a) [6]



In a given BST state the output of Inorder, preorder, postorder, level wise traversals. Also draw mirror image.

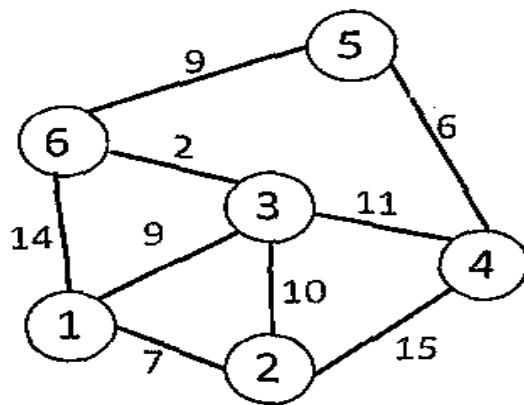
P.T.O.

- b) Explain recursive algorithm to display height of Binary Tree. [6]
 c) Construct BST from below data
 Inorder-7, 9, 4, 2, 5, 1, 3, 6, 8
 Preorder-1, 2, 4, 7, 9, 5, 3, 6, 8 [5]

OR

- Q4)** a) Construct the expression tree from the following postfix expression using stack. $AD * BC + -$ [6]
 b) State and Explain the algorithm to search data in BST. Give example. [6]
 c) Explain advantages and disadvantages of TBT. [5]

Q5) a)

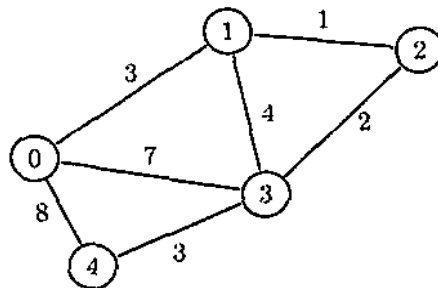


If '1' is the resource, explain step by step minimum spanning tree by 'Prims' algorithm. [6]

- b) Explain with example by which methods Graph is represented? [6]
 c) Explain the heap sort technique with the help of example. [6]

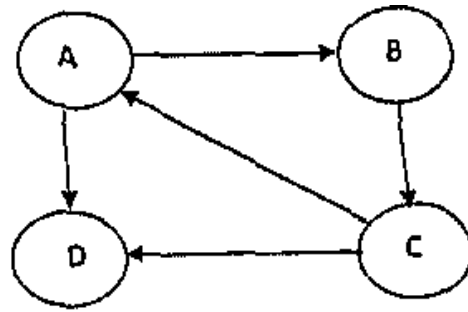
OR

Q6) a)



If '1' is the source, find the shortest path from source to all vertices, using Dijkstra's algorithm. Show answer step by step. [6]

b)



Show the output of DFT using stack. Use 'A' as a starting node. [6]

c) Explain with example OBST. [6]

Q7) a) Create the hash table using Linear Probing

Table size : 12

Data : 3, 2, 46, 6, 11, 13, 53, 12, 70, 90

Hash function: $\text{data} \% \text{table size}$ [6]

b) Explain in brief any 3 Collision resolution techniques. [6]

c) Compare sequential file and direct access file with example. [5]

OR

Q8) a) Explain chaining without replacement with example. [6]

b) Explain with example different types of Hash functions. [6]

c) Differentiate 'ifstream' and 'ofstream' with example. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4098

[Total No. of Pages : 2

[6402]-58

S.E. (Information Technology)

OBJECT ORIENTED PROGRAMMING

(2019 Pattern) (Semester - III) (214444)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 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) Write a program to create a class student with data members roll no, name & address. Initialize the values for data members using the constructor and display them. [9]

b) Explain the parameterized constructor with an example. [9]

OR

Q2) a) Explain constructor overloading with an example. [9]

b) What is the garbage collection and finalize ()method? [9]

Q3) a) Implement the following Inheritance

Class Employee is Super Class and Programmer is subclass. Employee class has data member salary of float data type. The programmer class has a data member bonus of integer data type. Access the salary of the Employee class from the Programmer class. [9]

b) Differentiate between compile time polymorphism and run time polymorphism. [8]

OR

P.T.O.

- Q4)** a) Define Interface. Explain how multiple inheritance is achieved in Java. **[9]**
 b) Illustrate Multilevel inheritance with an example. **[8]**
- Q5)** a) Write a Program to accept and display the month number. Throw a number format exception if an improper month number is entered. **[9]**
 b) Explain the exception handling mechanism with an example. **[9]**

OR

- Q6)**
- a) Write a Program to write a generic function & demonstrate swapping of multiple types of data using the same. [9]
 - b) Define exception and Explain: [9]
 - i) throws
 - ii) finally
 - iii) try
 - iv) catch
- Q7)**
- a) Write a short note on: [9]
 - i) Adaptor.
 - ii) Singleton.
 - b) What is a stream? Explain various stream classes in Java. [8]

OR

- Q8)** a) Explain the following File operations using File class: **[9]**
- i) Create a File
 - ii) Read from a File
 - iii) Write to a File
 - iv) Close a File
- b) Implement a program for maintaining a database of student records using Files. Student has Student_id, name, Roll_no, Class, marks, and address. Display the data for a few students. **[8]**
- Create Database
 - Display Database
 - Delete Records
 - Update Record
 - Search Record.



Total No. of Questions : 8]

SEAT No. :

PD-4099

[Total No. of Pages : 2

[6402]-59

S.E. (I.T.)

BASICS OF COMPUTER NETWORKS (BCN)

(214445) (2019 Pattern) (Semester - III)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Draw & Explain the frame format for IEEE 802.3. [6]
b) Explain the various controlled access methods. [6]
c) Discuss CSMA/CD random access technique. How is collision detection achieved in this technique. [6]

OR

- Q2)** a) Explain the following physical layer implementation in standard Ethernet: [6]
i) 10Base5
ii) 10BaseT
iii) 10BaseF
b) Write short note on: [6]
i) IEEE 802.4 (Token Bus)
ii) IEEE 802.5 (Token Ring)
c) Explain FDMA, TDMA and CDMA in detail. [6]

- Q3)** a) Explain different classes of IP addresses and show by calculations how many networks and hosts are possible in each class. [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) Computer between IPv4 and IPv6. [5]

OR

P.T.O.

- Q4)** a) For a given class-C network, design 4 equal subnets having minimum 50 nodes in each sub network. [6]
b) Explain NAT & CIDR with neat Diagram. [6]
c) Draw and Explain Header diagram of IPv4. [5]

- Q5)** a) What is routing? State different types of routing. Explain two interior gateway routing protocols. [6]
b) Compare and contrast the advertisement used by RIP and OSPF Routing protocols. [6]
c) Explain Distance Vector Routing with Count to Infinity Problem. [6]

OR

- Q6)** a) What is Autonomous System? What are the Inter Domain Routing Protocols? Explain One Inter Domain Routing protocols in details. [6]
b) Differentiate between Distance Vector Routing and Link State Routing. [6]
c) What is BGP? Explain the operation of BGP with suitable example. [6]

- Q7)** a) Explain duties of transport layer and differentiate between connection oriented and Connection less services. [6]
b) Draw & Explain Leaky Bucket and Token Bucket algorithm. [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) What is Silly Window Syndrome? Explain at-least two methods to overcome it. [5]



Total No. of Questions : 8]

SEAT No. :

PD4100

[Total No. of Pages : 2

[6402]-60

S.E. (Information Technology)
PROCESSOR ARCHITECTURE
(2019 Pattern) (Semester - IV) (214451)

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 right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) Explain transceiver function of serial communication interrupt in detail. [7]
- b) Explain external hardware interrupts in detail. [7]
- c) Explain the interface of LED with PIC 18FXXX. [4]

OR

- Q2)** a) Draw and explain the interfacing relay and buzzer with PIC 18FXXX microcontroller. [7]
- b) Differentiate between interrupt and polling. List different sources of interrupts in PIC18. [6]
- c) Explain the INTCON register PIC 18 microcontroller. [5]

- Q3)** a) List the steps involved in programming PIC microcontroller in capture mode. [6]
- b) Explain the DC motor interfacing with PIC 18F microcontroller with suitable diagram. [6]
- c) Write short note on SPI bus. [5]

OR

- Q4)** a) Explain operation of PWM mode of PIC 18FXXX microcontroller with diagram. [6]
- b) Write short note on 12C bus. [6]
- c) Distinguish between synchronous and asynchronous serial communication. [5]

P.T.O.

- Q5)** a) Draw and explain the interfacing of LM34/LM35 with PIC18FXXX 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 PIC 18F microcontroller. [6]

OR

- Q6)** a) State the features of on-board ADC of PIC18F microcontroller. [8]
Explain the signals:
i) SOC
ii) EOC
b) Draw and explain the interfacing diagram of DAC0808 with PIC18FXXX microcontroller. [6]
c) List out the steps necessary for reading from EEPROM of PIC18 [4]
- Q7)** a) Compare PIC microcontroller and ARM core processor. [6]
b) What are privileged and non-privileged modes? Write down the processor modes in ARM. [5]
c) What are the main features of ARM7 architecture? How it is different from pure RISC processor? [6]

OR

- Q8)** a) Why ARM processors are suitable in embedded system applications?[6]
b) Illustrate the Banked Registers with their modes. [5]
c) What is TDMI? Draw and explain data flow model of ARM7 in detail.[6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4101

[Total No. of Pages : 2

[6402]-61

S.E. (Information Technology)
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) 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 view in SQL and how it is define? Discuss the problem that may arise when one attempt to update views. How views are typically updated? **[8]**
- b) Write a note on Database modification using SQL. **[6]**
- c) Differentiate between: WHERE and HAVING clauses in SQL. **[4]**

OR

- Q2) a)** Describe the circumstances in which you would choose to use embedded SQL rather than using SQL alone or using only a general purpose programming language. Compare dynamic and embedded SQL with suitable example. **[8]**
- b) With suitable example explain SQL aggregate functions. **[6]**
- c) Explain the concept of trigger with suitable example. **[4]**

- Q3) a)** Define BCNF? How does it differ from 3NF? Why is it consider a stronger form of 3NF? **[7]**
- b) Relation R (A,B,C,D,E) having following set of FD. Convert it to 3NF and also check whether it is in BCNF or not. **[6]**
 $A \rightarrow BD, B \rightarrow C, D \rightarrow E$
- c) Write a note on Measures of Query cost. **[4]**

OR

- Q4) a)** Given a relation schema $R = (A,B,C,D,E)$ and function dependency as $A \rightarrow C, C \rightarrow D, CE \rightarrow A, B \rightarrow C, DE \rightarrow C$. Relation R is decomposed into $r_1 = AD, r_2 = AB, r_3 = BE, r_4 = CDE, r_5 = AE$. Decide this decomposition is lossy or lossless ? Justify. **[6]**
- b) Show that with suitable example: if a relation schema is in BCNF, then it is also in 3NF. **[6]**
- c) Write a note on evaluation of expression. **[5]**

P.T.O.

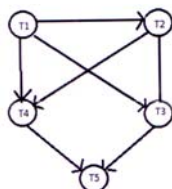
- Q5) a)** Give test for conflict serializability. Check whether following schedule is conflict serializable. [6]

T1	T2
Read(A)	
Write(A)	
	Read(A)
	Write(A)
Read(B)	
Write(B)	
	Read(B)
	Write(B)

- b) Explain the concept of transaction. Describe ACID properties for transaction. [6]
 c) Discuss the problem with concurrency. Describe any two method based on locks to control concurrency. [6]

OR

- Q6) a)** Differentiate between conflict and view serializability. Given precedence graph, is the corresponding schedule conflict serializable. [6]



- b) When do deadlock happen, how to prevent them and how to recover if deadlock takes place? [6]
 c) Explain deferred database modification and immediate database modification and their differences in the context of recovery. [6]

- Q7) a)** State which database system architecture you will prefer for following application. [6]

- Railway reservation system
- Search Engine
- College admission system

- b) Draw and explain architecture of parallel Databases. [6]
 c) What are the characteristics of NoSQL cloud databases. [5]

OR

- Q8) a)** What is fragment of a relation? What are the main type of fragmentation? Why is fragmentation a useful context in distributed database design. [6]

- b) Explain centralize and client server database architecture. [6]
 c) What are the requirement of mobile databases? List existing mobile databases. [5]



Total No. of Questions : 8]

SEAT No. :

PD4102

[Total No. of Pages : 2

[6402]-62

S.E.(Information Technology)

COMPUTER GRAPHICS

(2019 Pattern) (Semester - IV) (214453)

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 with diagram Cohen Sutherland line clipping algorithm. [6]
b) What is the concept of vanishing point in perspective projection? Explain with diagram. [6]
c) Explain rotation about arbitrary axis in 3D transformation. [6]

OR

- Q2)** a) Explain the following term with example [6]
i) Windowing
ii) Clipping
iii) Viewport
b) Find the normalization transformation window to viewport, with window, lower left corner at (1, 1) and upper right corner at (3, 5) onto a viewport, for entire normalized device screen. [6]
c) Explain with diagram, Perspective vanishing points as 1 point, 2 point and 3 point. [6]

- Q3)** a) Explain with diagram Gouraud shading algorithm in detail. [6]
b) What is a segment? How do we create it? Why do we need segments? [6]
c) Explain CMY and HSV color models. [5]

OR

P.T.O.

- Q4)** a) What is Shading? What steps are required to shade an object using Phong shading algorithm? [6]
b) What are various color models? Explain with diagram RGB and HLS color model. [6]
c) Define color gamut. Explain with diagram CIE Chromaticity Diagram.[5]

- Q5)** a) Explain Bezier curve. List its properties. [6]
b) Write short notes on:
i) Koch curve
ii) Frame-by-frame Animation techniques [6]
c) What is fractal? Explain Hilbert curve in detail. [6]

OR

- Q6)** a) Write short notes on: [6]
i) B-spline curve
ii) Blending function of Bezier curve
b) What are the methods of controlling animation? [6]
c) Explain various types of animation languages. [6]

- Q7)** a) Explain the physical modeling in Virtual Reality. [6]
b) Explain haptic feedback in Virtual Reality system. [6]
c) Differentiate HMD and CAVE in Virtual Reality. [5]

OR

- Q8)** a) Explain the behavior modeling in Virtual Reality. [6]
b) What is geometric modeling in Virtual Reality? [6]
c) Explain gesture interfaces in Virtual Reality. [5]



Total No. of Questions : 8]

SEAT No. :

PD4103

[Total No. of Pages : 2

[6402]-63

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 diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Explain the golden rules for user interface design. [9]
b) Explain the software quality guidelines and attributes of a software design. [9]

OR

- Q2)** a) What is a design? Explain architectural design pattern in detail. [9]
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 9 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]

OR

P.T.O.

- Q4) a)** Construct PERT Network for the above mentioned activities. Calculate critical path for the same. [9]

ACT	Predecessor	Optimistic	Most Likely	Pessimistic
A	-	1	2	3
B	-	2	3	4
C	A	1	2	3
D	B	2	4	6
E	C	1	4	7
F	C	1	2	9
G	D, E	3	4	11
H	F, G	1	2	3

- b) What do you understand by scope of a project? What are the parameters considered in project scope statement? Explain scope statement for any software of your choice [8]

- Q5) a)** Explain McCall's Quality Factors. [9]

- b) Write a short note on : [9]

- i) Black Box testing
- ii) Regression Testing
- iii) Beta Testing

OR

- Q6) a)** Explain defect life cycle along with diagram also state the importance of defect reporting. [9]

- b) What is software testing? Design a testing strategy for a given software project, considering various testing types and their applicability. [9]

- Q7) a)** Explain Test Driven Development along with a diagram. [9]

- b) What is risk in a software project? Explain risk management and risk responses. [8]

OR

- 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



Time : 2½ Hours]

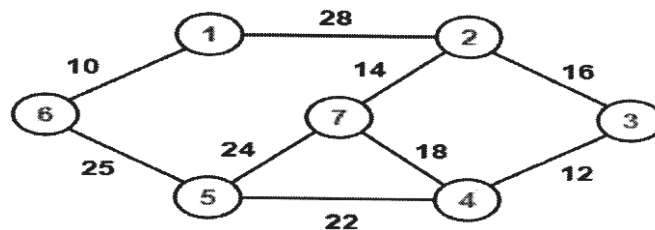
[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) What is a planar graph? Suppose that a connected planar graph has six vertices, each of degree four. Into how many regions is the plane divided by a planar representation of this graph? [6]

b) Build a minimum spanning tree for the following graph using Kruskal's algorithm. [6]

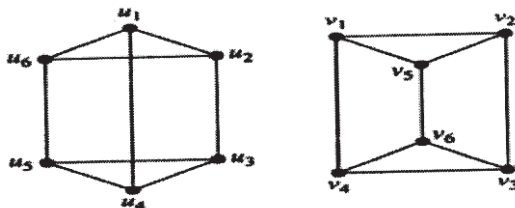


c) Define Prefix Code. Which of the following codes are prefix codes? Justify your answer. [6]

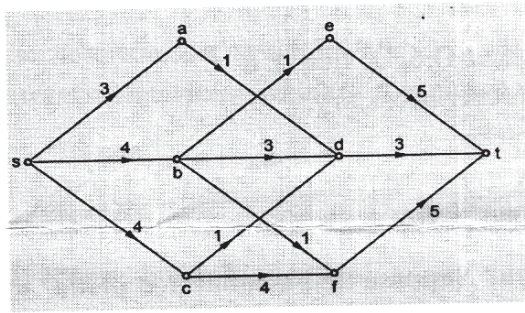
- i) a: 101, e: 11, t: 001, s: 011, n: 010
- ii) a: 010, e: 11, t: 011, s: 1011, n: 1001, i: 10101

OR

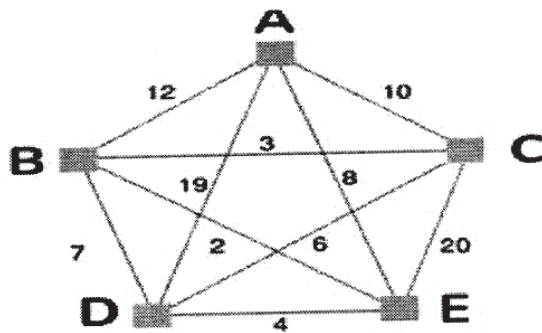
Q2) a) Determine whether the following graphs are isomorphic to each other. Justify your answer. [6]



- b) Using the labeling procedure, find the maximum flow in the following transport network. [6]



- c) Use the nearest Neighborhood method to solve the Traveling Salesperson problem starting with vertex A. Find the cost of the tour. [6]



- Q3) a) Consider these relations on the set of integers: [6]

$$R_1 = \{(a, b) \mid a \leq b\}$$

$$R_2 = \{(a, b) \mid a > b\},$$

$$R_3 = \{(a, b) \mid a = b\}$$

$$R_4 = \{(a, b) \mid a = 1 + b\}$$

$$R_5 = \{(a, b) \mid a = b \text{ or } a = -b\},$$

$$R_6 = \{(a, b) \mid a + b \leq 3\}$$

Which of these relations contain each of the pairs (1, 1), (1, 2), (2, 1), (1, -1), and (2, 2)?

- b) Solve the following recurrence relation. [6]

$$a_n = a_{n-1} + 2a_{n-2} \text{ where } a_0 = 2 \text{ and } a_1 = 7$$

- c) What is the minimum number of students required in a discrete mathematics class to be sure that at least five will receive the same grade, if there are five possible grades, A, B, C, D, and F? [5]

OR

Q4) a) Explain the injective function with an example? Determine whether each of these functions is an injection from $\mathbb{R}$ to $\mathbb{R}$. [6]

i) $f(x) = 2x + 1$

ii) $f(x) = x^2 + 1$

iii) $f(x) = x^3$

iv) $f(x) = (x^2 + 1)/(x^2 + 2)$

b) What is POSET? Let A is set of factors of positive integer m and relation is divisibility on A . i.e. $R = \{ (x,y) \mid x,y \in A, x \text{ divides } y \}$ For $m = 50$. Draw Hasse Diagram. [6]

c) Find the transitive closure by using Warshall's algorithm for the given relation as: [5]

$$R = \{(2,1), (2,3), (3,1), (3,4), (4,1), (4,3)\}$$

Q5) a) Using Binary expansion method solve the following (Show step-wise answer) $7^{71} \bmod 15$ [6]

b) Which of the following is true? Justify your answer. [6]

i) $8347 \equiv 597 \pmod{25}$

ii) $1960 \equiv 971 \pmod{23}$

iii) $1253 \equiv 1045 \pmod{10}$

c) Using Chinese Remainder Theorem, find the value of P using following data [6]

$$P \equiv 4 \pmod{11}$$

$$P \equiv 5 \pmod{7}$$

OR

Q6) a) What is a Mersenne prime number? Which of the following is the Mersenne Prime number? 7, 31, 255, 63, 8191 [6]

b) Find the Euler's totient function of the following numbers. [6]

i) 37

ii) 50

iii) 96

c) Find a multiplicative inverse of 52 mod 127 using Extended Euclidean Algorithm. [6]

Q7) a) Consider the set $A = \{1, 3, 5, 7, 9, \dots\}$ i.e. a set of odd positive integers. Determine whether A is closed under: **[6]**

- i) $a * b = a + 3b$
- ii) $a * b = a/b$
- iii) $a * b = a \cdot b$ (Multiplication)
- iv) $a * b = \text{power}(a, b) - b$
- v) $a * b = 2a + 2b$
- vi) $a * b = \min(1, a, b) - a$

b) Show that $(\mathbb{Z}_7, +)$ is an Abelian Group **[6]**

c) Prove that Hamming Distance $d(x, y) = d(y, x)$. **[5]**

OR

Q8) a) Show that with operation $*$ defined on the set $P = \{1, -1\}$ by $(a * b = a \cdot b)$ is an Abelian group **[6]**

*	1	-1
1	1	-1
-1	-1	1

b) Explain Integral Domain with an example. **[6]**

c) Consider the (2,6) encoding function e . $e(00) = 110000$, $e(10) = 101000$
 $e(01) = 011110$, $e(11) = 111001$ **[5]**

Find the minimum distance of e .



Total No. of Questions : 8]

SEAT No. :

PD4105

[Total No. of Pages : 2

[6402]-65

S.E. (AI&ML)

DATASTRUCTURES & ALGORITHMS

(2019 Pattern) (Semester - III) (218542)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Write sudo code to read a valid postfix expression and evaluate the same. **[6]**
- b) Enlist the applications of double ended queue & priority queue. **[6]**
- c) Establish queue over flow and under flow conditions for linear, when sequential organization is used with max elements N. **[6]**

OR

- Q2)** a) Clearly indicate the content of stack during conversion of infix expression to prefix expression. **[9]**
- i) $(A + B) \$ (D - E) / (F + G / I * 2)$
- ii) $5 / \times \$ y - z * (P + Q)$
- b) Write sudo code for insert & delete operations for circular using when sequential organization is used for implementation. **[9]**

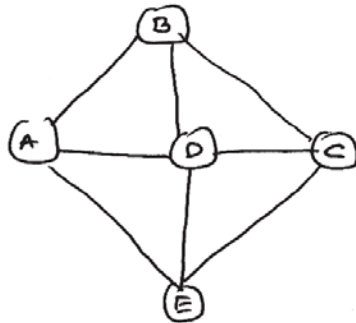
- Q3)** a) Write sudo code for creating an expression tree and Discuss its time complexity. **[8]**
- b) Discuss with the help of example how threaded binary search trees, make the BST operations faster? **[6]**
- c) Discuss the procedure of adding a node in a BST using example. **[4]**

OR

- Q4)** a) Write sudo code for inorder traversal technique for inorder - threaded binary tree. **[6]**
- b) Construct an expression tree for the given postfix expression. Demonstrate the steps property. $AB + CD - *$ **[6]**
- c) Discuss the time complexity of finding height and depth of a tree. **[6]**

P.T.O.

- Q5) a)** What is a minimum spanning tree. Discuss the various methods available for finding it. [6]
- b)** Enlist applications of graphs. Explain now the Dijkstra algorithm is contributing to computer networks. [5]
- c)** Discuss briefly the graph traversals & perform those traversals for the following graph. [6]



OR

- Q6) a)** Discuss how AVL is different from BST with suitable examples & illustrations? [8]
- b)** Enlist the characteristics of Heap data-structure. Give examples for max-heap & min-heap. [6]
- c)** Discuss the time complexities of BFS & DFS graph traversals. [3]
- Q7) a)** Discuss the significance of the following. Illustrate your explanation with the help of examples. [9]
- Primary indexes
 - Clustering indexes
 - Secondary indexes
- b)** Explain the concept of hashing. How hashing impacts the search time. Justify your answer with time complexity. [8]

OR

- Q8) a)** Discuss the types of collision resolution techniques for hash - tables. [8]
- b)** Enlist the file - opening modes in C++ and discuss any three briefly. [9]



Total No. of Questions : 8]

SEAT No. :

PD-4106

[Total No. of Pages : 2

[6402]-66

S.E. (Artificial Intelligence and Machine Learning)

COMPUTER NETWORKS

(2019 Pattern) (Semester-III) (218543)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

- Q1)** a) What is CRC polynomial? Describe in detail with example. [9]
b) What is frames in data link layer? Describe in detail the fixed size framing and variable size framing? [9]

OR

- Q2)** a) What is noisy protocols? Describe the two protocols for noisy channels? [9]
b) Explain CSMA/CA random access technique in detail with suitable diagram/ flowchart, Explain how collision is avoided in CSMA/CA. [9]
- Q3)** a) What is default routing? Describe in detail RIP and EIGRP. [9]
b) Explain following terms [8]
i) NAT
ii) DHCP

P.T.O.

OR

- Q4)** a) Explain following terms: [9]
i) Distance Vector Routing
ii) Link State Routing
iii) Path Vector Routing
b) Explain ARP protocol with diagram. [8]
- Q5)** a) What is socket? Enlist all socket primitives & explain any three. [9]
b) Explain the three-way handshake algorithm for TCP connection establishment. Compare and contrast between TCP and UDP. [9]

OR

- Q6)** a) Explain TCP with its header format. [9]
b) What do you mean by flow control in transport layer? List the different methods of achieve it. Explain any one method in detail. [9]
- Q7)** a) What is the purpose of DNS? How does recursive resolution differ from iterative resolution? Explain with suitable diagram. [9]
b) What is MIME? What is the purpose of MIME? Explain MIME header in detail. [8]

OR

- Q8)** a) Describe the functions of the two FTP connections. List difference between FTP & TFTP. [8]
b) Write short note on [9]
i) IMAP
ii) SMTP
iii) SNMP



Total No. of Questions : 8]

SEAT No. :

PD-4107

[Total No. of Pages : 2

[6402]-67

S.E. (Artificial Intelligence & Machine Learning)

OBJECT ORIENTED PROGRAMMING

(218544) (2019 Pattern) (Semester - III)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 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 Destructor? Explain the use of destructor in object oriented programming. [6]
- b) Discuss the advantages and disadvantages of constructor overloading.[6]
- c) Explain different types of Constructors in Object Oriented Programming. [6]

OR

- Q2)** a) Differentiate constructors from regular methods in object-oriented programming, considering their purpose, invocation, return type and inheritance properties. [9]
- b) Compare and contrast different types of constructors, such as default constructors, parameterized constructors and copy constructors. [9]
- Q3)** a) Differentiate between abstract classes and interfaces in object-oriented programming. [5]
- b) Differentiate between compile-time polymorphism and runtime polymorphism. [6]
- c) Explain how inheritance can be used to model real-world relationships between entities. [6]

OR

P.T.O.

- Q4)** a) Identify and explain the different types of inheritance, such as single inheritance, multiple inheritance and multilevel inheritance. **[8]**
- b) Analyze the impact of polymorphism on the efficiency of a software system, considering both compile-time and run-time aspects. **[9]**
- Q5)** a) Explain the concept of an exception in object-oriented programming. **[6]**
- b) Provide examples of each type of error and how they manifest in programming code. **[6]**
- c) Discuss the ArrayList class and how it implements the List interface. **[6]**

OR

- Q6)** a) Develop a simple generic class that can work with different data types. Provide an example of how this class can be used in a program. **[9]**
- b) Discuss the consequences of uncaught exceptions and their impact on program execution also discuss purpose and use of multiple catch clauses in a try-catch block. **[9]**
- Q7)** a) What are the different stream classes and what is the purpose of each stream class? **[8]**
- b) Define design patterns and discuss three main categories of design patterns? **[9]**

OR

- Q8)** a) Analyze the strengths and weaknesses of different design patterns. **[8]**
- b) Explain the concept of random access files and provide examples of applications that use random access files. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4108

[Total No. of Pages : 2

[6402]-68

S.E. (AIML)

SOFTWARE ENGINEERING

(2019 Pattern) (Semester - III) (218545)

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) Describe the deployment level design elements? [3]
b) What are the software design quality attributes and quality guidelines?[7]
c) Discuss various pattern develop for system architecture in detail? [7]

OR

- Q2)** a) What is refactoring? Give the importance of refactoring in improving quality of software. [3]
b) Write golden rule used in user interface design. [7]
c) What do you mean by term cohesion and coupling in context of software design? [7]

- Q3)** a) Prepare work break down structure for website building? [3]
b) Explain the term adding of Milestone in GANTT CHART? [7]
c) Explain W5HHH principle. [7]

OR

- Q4)** a) Write short Notes on : [3]
i) PERT
ii) Critical Path Method
b) How to calculate FP and how it is used in estimation of software project?[7]
c) List the four P's of software project management spectrum. [7]

P.T.O.

- Q5)** a) Write a quality attribute for Quality factors of software quality. [4]
 b) Draw a network diagram for a given activities and find CPM and TF? [7]

Activity	Dependence	Duration (Days)	Activity	Dependence	Duration (Days)
A	-	6	F	C	3
B	-	3	G	D	5
C	A	5	H	B, E	5
D	A	4	I	D, H	2
E	A	3	J	F, G, I	3

- c) Explain following testing types : [7]
 i) Regression Testing
 ii) Unit Testing
 iii) Integration Testing

OR

- Q6)** a) Differentiate between testing and debugging? [4]
 b) Compare between White box testing and Black Box Testing. [7]
 c) Write test cases for admission form for college admission. [7]

- Q7)** a) What is Software configuration management repository? [4]
 b) Write short note on workbenches in CASE? [7]
 c) Write short notes on [7]
 i) Test driven development
 ii) Collaborative development

OR

- Q8)** a) What is ERP? State limitation and advantages of ERP? [4]
 b) What is SCM? Explain the change control mechanism in SCM? [7]
 c) Write short notes on CASE tool. [7]



[6402]-69

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) 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 right side indicate full marks.
- 4) Assume suitable data if necessary.

Q1) a) Define with example Mutual exclusion, race condition, Semaphore, and Deadlock. [8]

b) How is the TestandSet instruction used to solve the critical section problem? Write and explain the pseudocode for TestandSet instruction implementation. [9]

OR

Q2) a) Explain the wait-for graph method for deadlock detection along with an example. [8]

b) For the given snapshot of the system: [9]

	Allocation				Max				Available			
P1	0	1	1	0	5	4	4	4	1	2	4	3
P2	2	0	0	1	2	1	3	3				
P3	1	1	3	2	8	5	4	4				
P4	2	1	2	2	6	5	4	5				
P5	3	1	0	1	6	2	2	3				

Determine:

- i) Need Matrix
- ii) Current snapshot is safe or unsafe.
- iii) Whether following requests can be granted or not for Process P3 : 1 1 0 1

P.T.O.

- Q3) a)** Consider a logical address space of 128 pages of 512 Bytes each mapped onto a physical memory of 32 frames of 512 Bytes. [9]
- i) How many bits are in the physical address?
 - ii) How many bits are in the logical address?
 - iii) How many bits are required to determine the frame number in the physical address?
 - iv) How many bits are required to determine the page number in logical address?
- b) With the help of neat diagrams (Bar diagram and Tree), Write a short note on the Buddy system. [9]

OR

- Q4) a)** Consider the page reference string with 3 frames. [9]
1, 2, 3, 4, 5, 4, 5, 3, 6, 7, 8, 9, 5, 4, 7, 8, 9, 5, 4, 2.
Calculate the number of page faults for the following page replacement algorithm.
- i) FIFO
 - ii) OPTIMAL
 - iii) LRU
- b) For the system where memory cycle time is 200 nanoseconds, Translation Look-aside Buffer access time is 20 nanoseconds, [9]
Determine the Effective Access Time when
- i) Hit ratio is 99%
 - ii) Hit ratio is 95%
- Also justify if the value of hit ratio should be smaller or larger.

- Q5) a)** A disk drive has 200 tracks, numbered 0-199. The drive is currently serving the request at track no 53. The queue of pending requests in FIFO order is 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position what is the total distance that disk arm moves to satisfy all the pending requests for the following disk scheduling algorithms. Assume that the head is moving in the increasing order of track number for C-SCAN and LOOK. [12]
- i) FCFS
 - ii) C-SCAN
 - iii) LOOK
 - iv) SSTF
- b) Explain with diagrams different Record Blocking techniques. [6]

OR

- Q6)** a) Explain with the help of neat diagrams different secondary storage management methods. [9]
b) List and explain (any 3) directory structure organization. [9]

- Q7)** a) Explain ORIGIN, EQU, and LTROG with an example. [6]
b) Explain the data structures required for TWO PASS Assembler in detail. [6]
c) Differentiate between literal and immediate operand. [5]

OR

- Q8)** a) What are the types of loaders? Discuss 4 different functions of the loader. [6]
b) Using a suitable diagram, explain the 'Compile and Go' Loader scheme with its advantages and disadvantages. [6]
c) Explain any two phases of the compiler with a suitable diagram. [5]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4110

[Total No. of Pages : 2

[6402]-70

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

Q1) a) What is knowledge-based agent (KBA) in AI? Explain architecture of KBA with neat diagram? [7]

b) Specify the syntax of First-order logic in BNF form with suitable example. [6]

c) Compare between Forward Chaining and Backward Chaining. [5]

OR

Q2) a) What is the relationship between knowledge and intelligence? Explain various levels of describing knowledge based agent. [7]

b) What is Proposition in AI? Explain types of Propositions with example. [6]

c) Discuss various approaches of designing a knowledge-based agent. [5]

Q3) a) Differentiate between positive class and negative class. Explain the training versus testing phase in machine learning. [4]

b) Explain different cross validation techniques. [8]

c) Discuss different applications of machine learning. [5]

OR

Q4) a) Elaborate various cross validation techniques with advantages and limitations. [9]

b) Explain the Machine Learning pipeline in detail with suitable diagram. [8]

Q5) a) Compare Supervised, Unsupervised, and Semi-Supervised learning with examples. [6]

b) What is the need for Dimensionality Reduction Explain the concept of the Curse of Dimensionality. [6]

c) State and justify Real life applications of supervised and unsupervised learning. [6]

OR

P.T.O.

- Q6)** a) Explain Principal Component analysis in brief. [6]
b) Explain Unsupervised learning with real time examples. [6]
c) Write a short note on subset selection. [6]

- Q7)** a) Define following terms: [8]
i) Accuracy
ii) Precision
iii) Recall
iv) Error rate
b) What is difference between simple linear and multiple linear regressions? Explain how to assessing performance of Regression. [9]

OR

- Q8)** a) Calculate the regression coefficient of X on Y and obtain the lines of regression for the following data [9]

X	1	2	3	4	5	6	7
Y	9	8	10	12	11	13	14

- b) What is an error w.r.t. Regression? Explain at least 4 performance measures for regression. [8]



Total No. of Questions : 8]

SEAT No. :

PD4111

[Total No. of Pages : 3

[6402]-71

S.E.(AIML)

**DATABASE MANAGEMENT SYSTEM
(2019 Pattern) (Semester - IV) (218554)**

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) Consider the following schema for a company database 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)[8]

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

P.T.O.

- Q2)** a) Use the schema and answer the queries in SQL. SAILORS (Sid, Sname, rating, age) BOATS (bid, bname, color) RESERVES (sid, bid, day) [8]
- i) Find names of sailors who reserved green boatem CS/IS 06CS54-10
 - 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 form of 3NF? Explain with appropriate example. [8]
- b) What do you mean by equivalent minimal set of functional dependencies? Explain with exmple. [5]
- c) What do you mean by [4]
- i) Insertion Anomaly
 - ii) Delection 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 database. [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]



Total No. of Questions : 8]

SEAT No. :

PD4112

[Total No. of Pages : 2

[6402]-72

S.E. (Artificial Intelligence and Machine Learning)

COMPUTER GRAPHICS

(2019 Pattern) (Semester - IV) (218555)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) 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) 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) 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]**

- b) What is projection? Explain with diagram, oblique - Cavalier, Cabinet, Orthographic - isometric, diametric, trimetric Parallel projections. **[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.

OR

P.T.O.

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 design in animation sequence? Describe about each step briefly. [9]

OR

Q6) a) Write short note on : [9]

i) Design of animation sequence

ii) Frame-by-frame Animation techniques

b) What is curve interpolation? As far as splines are concerned what do Bezier and B-splines curves indicate? [9]

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) Explain 3D position trackers. [5]

OR

Q8) a) What is graphics rendering pipeline in a Virtual Reality system. [6]

b) Explain gesture interfaces in Virtual Reality. [6]

c) What is kinematic modeling in a Virtual Reality? [5]



[6402]-73

S.E. (Chemical/Printing/Biotech)
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) Choose correct option of the following.

- a) The fourier sine transform $F_s(\lambda)$ of $f(x) = \begin{cases} 1 & 0 \leq x \leq 1 \\ 0 & , x > 1 \end{cases}$ is [2]

i) $\frac{\cos \lambda \pi - 1}{\lambda}$

ii) $\frac{1 - \cos \lambda}{\lambda}$

iii) $\frac{1 - \sin \lambda}{\lambda}$

iv) $\frac{\cos \lambda \pi}{\lambda}$

- b) The first and second moments of the distribution about the value 2 are 1 and 16. Variance of the distribution is. [2]

i) 12

ii) 3

iii) 15

iv) 17

- c) A Curve is given by $\vec{r} = (t^3 + 2) \mathbf{i} + (4t - 5) \mathbf{j} + (2t^2 - 6t) \mathbf{k}$. Tangents vectors to the curve of $t = 0$ and $t = 2$ are [2]

i) $3\mathbf{i} + 4\mathbf{j} - 6\mathbf{k}, 6\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$

ii) $3\mathbf{i} - 6\mathbf{j}, 12\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$

iii) $4\mathbf{j} - 6\mathbf{k}, 12\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$

iv) $4\mathbf{j} - 6\mathbf{k}, 12\mathbf{i} + 2\mathbf{k}$

P.T.O.

d) The general solution of PDE $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for $y \rightarrow \infty$ is [2]

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

e) The mean of poisson distribution is [1]

- i) np
- ii) npq
- iii) 2npq
- iv) 3np

f) Inverse fourier cosine transform of $F_c(\lambda)$ is [1]

- i) $f(x) = \int_0^\infty F_c(\lambda) \cos \lambda x d\lambda$
- ii) $f(x) = \frac{2}{\pi} \int_0^\infty F_c(\lambda) \cos \lambda x d\lambda$
- iii) $f(x) = \frac{2}{\pi} \int_0^\infty F_c(\lambda) e^{-i\lambda x} d\lambda$
- iv) $f(x) = \frac{2}{\pi} \int_0^\infty F_c(\lambda) \sin \lambda x d\lambda$

Q2) a) Using fourier integral representation. Show that [5]

$$\int_0^\infty \frac{\cos \frac{\pi \lambda}{2} \cdot \cos \lambda x}{1 - \lambda^2} d\lambda = \begin{cases} \frac{\pi}{2} \cos x, & |x| \leq \frac{\pi}{2} \\ 0, & |x| > \frac{\pi}{2} \end{cases}$$

b) Show that the fourier transform of $f(x) = e^{-|x|}$ is $\frac{2}{1 + \lambda^2}$. [5]

c) Solve the following integral equation $\int_0^\infty f(x) \sin \lambda x dx = \frac{1}{\lambda} e^{-a\lambda}$. [5]

OR

Q3) a) Find the fourier cosine transform of the function,[5]

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

b) Using fourier integral representation, show that [5]

$$\int_0^{\infty} \frac{1 - \cos \pi \lambda}{\lambda} \cdot \sin \lambda x d\lambda = \begin{cases} \frac{\pi}{2}, & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

c) Solve the following integral equation $\int_0^{\infty} f(x) \cos \lambda x dx = e^{-\lambda}, \lambda > 0$. [5]

Q4) a) The first four moments of a distribution about value 4 are 0, 2, 0 and 11. Find moments about mean, β_1 and β_2 . [5]

b) Find coefficient of correlation from given data. $n = 10, \Sigma x = -51, \Sigma y = -100, \Sigma x^2 = 1169, \Sigma y^2 = 1694, \Sigma xy = 1242$. [5]

c) An average 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 detective. [5]

OR

Q5) a) Obtain regression lines for following data. [5]

x	6	2	10	4	8
y	9	11	5	8	7

b) If the probability that an individual suffer a bad reaction from a certain injection is 0.001, determine the probability that out of 2000 individuals [5]

i) Exactly 3

ii) More than 2 will suffer a bad reaction

c) The mean weight of 500 students is 63 kg and standard deviation is 8 kgs. Assuming that weights are normally distributed find how many student weight lies between 51.5 kgs and 52.5 kgs. [5]

(Given $A(1.4315) = 0.4326, A(1.3125) = 0.4049$)

Q6) a) Find the Directional Derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ along a line equally inclined with co-ordinate axis. [5]

b) Find the values of a, b, c so that

$\vec{F} = (x + y + az)i + (bx + 3y - z)j + (3x + cy + z)k$ is irrotational. and determine ϕ such that $\vec{F} = \nabla \phi$. [5]

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

OR

Q7) a) A curve is given by the equation $x = t^2 + 1, y = 4t - 3, z = 2t^2 - 6t$. Find angle between tangent at $t = 2$ and $t = 3$. [5]

b) Solve any one [5]

i) Show that $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$

ii) Prove that $\frac{\vec{a} \times \vec{r}}{r^n}$ is solenoidal

c) Use stoke's theorem, to evaluate $\oint_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = xy^2\vec{i} + y\vec{j} + xz^2\vec{k}$ for the surface of rectangular lamina bounded by $x = 0, y = 0, x = 1, y = 1, z = 0$. [5]

Q8) a) Solve the equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ representing the vibration of a string of length l fixed at both ends, given boundary conditions: [8]

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

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

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

iv) $y(x, 0) = x, 0 < x < l$

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

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

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

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

iv) $u(x, 0) = u_0$

OR

Q9) a) If a string of length l is initially at rest in it's equilibrium position and each of it's point is given a velocity $V(x)$ such that $V(x) = cx; 0 < x < \frac{l}{2}$,

$$= c(l - x); \frac{l}{2} \leq x < l$$

obtain the displacement $y(x, t)$ at any time t [7]

b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ which satisfies the condition: [8]

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

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

iii) $u(x, 0) = 0$

iv) $u(x, a) = \sin \frac{\pi x n}{l}$



Total No. of Questions : 8]

SEAT No. :

PD4114

[Total No. of Pages : 2

[6402]-74

S.Y. (Biotechnology Engineering)

BIOCHEMISTRY - I

(2019 Pattern) (Semester - III) (215461)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) Answer the following. [18]

- a) Give the three letter abbreviations and one-letter symbols for Glutamate, Glycine, Tyrosine and Tryptophan.
- b) Enlist the amino acids with positively charged R groups and draw the structure for the same.

OR

Q2) Answer the following. [18]

- a) Which amino acid absorbs ultraviolet light? Depict the structure for same.
- b) Write a short note on ion exchange chromatography and affinity chromatography.

Q3) Answer the following. [17]

- a) Write a Short notes on Purines and Pyrimidines.
- b) Explain the role of nucleic acids in living organisms.

OR

Q4) Answer the following. [17]

- a) Differentiate between DNA and RNA.
- b) Draw the structures of any three bases.

Q5) Answer the following. [18]

- a) What causes kink in lipids? Explain the consequence of the same.
- b) Explain the separation of lipids using adsorption chromatography.

OR

P.T.O.

Q6) Answer the following. **[18]**

- a) Depict the diagram showing classification of Some common types of storage and membrane lipids.
- b) What are the properties of lipid bilayer?

Q7) Answer the following. **[17]**

- a) Explain the clinical significance of sodium and potassium.
- b) State the function and deficiency of vitamin K.

OR

Q8) Answer the following. **[17]**

- a) Write short note on factors effecting absorption of calcium.
- b) What are Fat Soluble Vitamins? Describe the source, functions, and deficiency of any one.



Total No. of Questions : 8]

SEAT No. :

PD-4115

[Total No. of Pages : 2

[6402]-75
S.E.
BIOTECHNOLOGY
Fluid Flow & Unit Operations
(2019 course) (Semester - III) (215462)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data jf necessary.*

Q1) a) A semi tubular cylinder of 50 m radius with concave side upstream is submerged in flowing water of velocity 0.6 m/s. If the cylinder is 7m long, calculate drag force when $CD=2$. **[6]**

b) Explain Stoke's law and derive expression for drag force on sphere. **[6]**

c) Explain the concept of gravity sedimentation process & Write about sorting classifiers that uses sink and float method and differential settling method. **[6]**

OR

Q2) a) Write note on Lift and drag forces, drag coefficients. **[6]**

b) Describe Newton's Laws of motion with neat labeled diagram. **[6]**

c) Describe in detail about batch sedimentation process. **[6]**

Q3) a) Describe in detail about packed bed reactor/system applicable for Flow of fluid through solids with neat labeled diagram. **[9]**

b) Derive Ergun equation that expresses the friction factor in packed bed column in detail. **[8]**

OR

P.T.O.

- Q4)** a) Describe Burke Plummer equation for turbulent flow. [9]
b) Explain the term Computational Fluid Dynamics (CFD). [8]
- Q5)** a) What is the necessity of Mixing and Agitation in bioprocesses? Justify it in detail with any case study or example. [8]
b) What is pumping system? Describe the types of pumps with neat sketch. [10]

OR

- Q6)** a) What is Valve? Describe the various types of valves with neat labeled diagram. [10]
b) What is the role of impellers in mixed systems? Describe the various types of impellers with neat labeled diagram. [8]
- Q7)** a) What is screen effectiveness? Derive an expression for calculating screen effectiveness. [8]
b) Write note on particle technology which includes size and shape and derive the expression for irregular shape particle. [9]

OR

- Q8)** a) Justify about energy for size reduction and explain Rittinger's law, Bonds law, Kicks's law [8]
b) Describe the working, construction, specifications involved and uses of Jaw crusher and Gyratory crusher with neat sketch. [9]



Total No. of Questions : 8]

SEAT No. :

PD4116

[Total No. of Pages : 2

[6402]-76
S.E. (Biotechnology)
HEAT TRANSFER
(2019 Pattern) (Semester - III) (215463)

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 right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Explain with the help of diagram pool boiling curve. **[10]**
b) Write significance of following Nos. **[8]**
i) Nusselt No.
ii) Grashof No.
iii) Stanton No.
iv) Rayleigh No.

OR

- Q2)** a) By using Rayleigh's method of dimensional analysis derive an expression for forced convection. **[9]**
b) What are different applications of dimensional analysis? **[9]**
- Q3)** a) What is velocity boundary layer and thermal boundary layer? How is it applied? State its significance. **[9]**
b) Write detailed applications of heat transfer in Biotechnology. **[8]**

OR

- Q4)** a) Write short notes on: **[8]**
i) Kirchoff's law
ii) Wein's Displacement law
b) What is Radiation give one example? Define Emissivity, Absorptivity, Transmittivity. **[9]**

P.T.O.

- Q5) a)** Give classification of types of heat exchangers. [9]
- b) Draw a neat sketch and write a short note on stationary and rotating matrix heat exchangers. [9]

OR

- Q6) a)** Draw and explain Shell and tube type of heat exchangers. Which type of flow is considered to be effective? Why? [9]
- b) What is LMTD? Give expression? Draw and explain why logarithmic mean is considered in case of heat exchangers? [9]

- Q7) a)** Discuss the terms: [8]
- i) Evaporator Capacity
- ii) Evaporator Economy
- b) What is heat of bariation? Derive an expression neglecting heat of bariation. [9]

OR

- Q8) a)** Draw and explain Calendria evaporator? State their applications. [9]
- b) Write mass balance equations along an evaporator. [8]

* * *

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PD4117

[6402]-77

S.E. (Biotechnology)

MICROBIOLOGY

(2019 Pattern) (Semester - III) (215464)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q. 5 or Q.6, Q. 7 or Q.8.*
- 2) *Figures to right indicate full marks.*
- 3) *Assume suitable data if necessary.*

Q1) a) Draw bacterial growth curve and explain the phases. **[9]**

b) Definition, principle, process and applications of continuous culture.**[9]**

OR

Q2) a) What methods are used to measure microbial population. **[9]**

b) Define : **[9]**

i) Generation time

ii) Specific growth rate

iii) Binary fission

Q3) a) What is filtration sterilization? Explain its types and applications. **[9]**

b) What is a Minimum Inhibitory Concentration (MIC) of antibiotics? How it is determined? **[8]**

OR

P.T.O.

- Q4)** a) Classify different methods of control of microorganisms with examples. [9]
b) Define : [8]
i) Sterilization
ii) Disinfection
iii) Antibiotics and
iv) MIC

- Q5)** a) Illustrate different types of microbial interactions in environment with examples. [10]
b) Justify the significance of microbes in food. [8]

OR

- Q6)** a) What is the ecological significance of soil microorganisms? [10]
b) Describe the concept of Potability of water. [8]

- Q7)** a) Describe Influenza with its etiological agent, symptoms, treatments and preventive measures. [8]
b) Write symptoms for : [9]
i) Cholera
ii) HIV and
iii) Candidiasis

OR

- Q8)** a) Describe Tuberculosis with its etiological agent, symptoms, treatments and preventive measures. [8]
b) Define : [9]
i) Pandemic and
ii) Epidemic
iii) Endemic



Total No. of Questions : 8]

SEAT No. :

PD4118

[Total No. of Pages : 2

[6402]-78

S.E. (Biotechnology Engineering)

BIOCHEMISTRY - II

(2019 Pattern) (Semester - IV) (215470)

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 right indicate full marks.

Q1) Answer the following.

[18]

- a) Describe the steps involved in conversion of pyruvate to phosphoenolpyruvate.
- b) Differentiate between glycolysis and gluconeogenesis.

OR

Q2) Answer the following.

[18]

- a) What is the significance of pentose phosphate pathway?
- b) What is substrate level phosphorylation? Give one example.

Q3) Write in detail about.

[17]

- a) Explain the role of transferase and α -(1,6)-glucosidase in the glycogen breakdown.
- b) Explain with the labeled diagram how ETC cycle occurs in mitochondria.

OR

Q4) Answer the following.

[17]

- a) Explain in details the reactions involved in the breakdown of glycogen to Glucose-6-phosphate.
- b) What is UDP-glucose? Draw its structure and explain what its role in glycogen synthesis is?

P.T.O.

Q5) Answer the following. [18]

- a) Write a note on ammonia toxicity and dialysis.
- b) Draw urea cycle and show steps involved in it.

OR

Q6) Answer the following. [18]

- a) Explain various separation techniques involved in protein purification.
- b) Alanine transports ammonia from skeletal muscles to the liver-Explain it.

Q7) Answer the following. [17]

- a) Explain the process of oxidation of PUFA.
- b) Write in detail about ketone bodies.

OR

Q8) Answer the following. [17]

- a) Describe the role of fatty acid synthase in synthesis of fatty acids.
- b) What are the sources of NADPH for fatty acid synthesis?

* * *

Total No. of Questions : 8]

SEAT No. :

PD-5275

[Total No. of Pages : 2

[6402]-79

S.E. (Biotechnology)

CELL BIOLOGY & TISSUE CULTURE

(2019 Pattern) (Semester-IV) (215471)

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 jf necessary.

Q1) a) What is cell cycle? Describe Cell cycle control system with neat sketch. [6]

b) Write detail note on Karyokinesis, Cytokinesis. [6]

c) Explain in detail about mechanism involves in Mitosis, Meiosis. [6]

OR

Q2) a) Discuss the detail mechanism of Programmed cell death - Apoptosis.[6]

b) Explain about Pathways of intracellular signal transduction. [6]

c) Write about Types of receptors GPCR. [6]

Q3) a) Explain in Detail about Epithelial tissue, connective tissue. [9]

b) Discuss I detail about muscle tissue, nervous. tissue. [8]

OR

Q4) a) What are stem cells? Explain about Hematopoietic stem cells & embryonic stem cells. [9]

b) What is cancer? Discuss types of cancer with its properties. [8]

Q5) a) What is Animal tissue culture? Discuss animal tissue culture media ad its types. [8]

b) Write in detail about Passaging and Cell separation. [10]

OR

P.T.O.

Q6) a) Discuss in detail about cryopreservation of animal cells. **[10]**

b) Write note on contamination and cytotoxicity. **[8]**

Q7) a) What is Plant tissue culture?define totipotency and discuss the basic requirements for carrying out plant tissue culturing. **[8]**

b) Explain in detail about Plant growth hormones and their types with functions. **[9]**

OR

Q8) a) Explain in detail about Callus culture and Pollen culture with neat sketch. **[8]**

b) Describe detail concept of transgenic plants with neat sketch. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4119

[Total No. of Pages : 2

[6402]-80

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 the right indicate full marks.
- 3) Assume suitable data if necessary.

- Q1)** a) Explain the working of refrigeration system with neat sketch. [6]
b) What is irreversible process? Explain its criteria involved. [6]
c) Define heat engine and describe its working and types of heat engines.[6]

OR

- Q2)** a) Write detail note on Carnot cycle/engine. [6]
b) Discuss about heat pump along with its applications and neat sketch.[6]
c) Refrigerator working on reversed carnot cycle requires 0.7 KW per KW of cooling to maintain a temperature of -20°C , determine the following:[6]
i) COP of refrigerator
ii) Temperature at which heat is rejected
iii) Amount of heat rejected to the surroundings per KW of cooling (Q_1).

Given: $W = 0.7 \text{ KW}$

$$Q_2 = 1\text{KW}$$

$$T_2 = -20^{\circ}\text{C}$$

- Q3)** a) Define chemical potential? Derive the expression for fundamental relationship for changes in the free energy of a solution. [9]
b) What is ideal solution? Describe the equation for Raoult's law and discuss the properties and characteristics of ideal solution. [8]

OR

P.T.O.

- Q4)** a) Explain about phase equilibrium in detail. [9]
b) Explain about chemical potential and derive an expression for effect of temperature and pressure on chemical potential. [8]

- Q5)** a) Define equilibrium constant? Derive the formula for equilibrium constant. [8]
b) Write detail note on Gibbs free energy and Discuss its relationship with equilibrium constant and reaction quotient. [10]

OR

- Q6)** a) Discuss in detail about Duhem's theorem for reacting systems. [10]
b) Define chemical reaction equilibrium? Discuss the factors affecting chemical equilibrium. [8]

- Q7)** a) Write in detail about Thermodynamics of biochemical-changes - Energy Yielding and Energy Requiring Reactions. [8]
b) Discuss the various applications of thermodynamics in biological systems with example. [9]

OR

- Q8)** a) Explain the laws of thermodynamics in biosystems with examples and applications. [8]
b) Write in detail about Energy transformations in biological systems. [9]



Total No. of Questions : 8]

SEAT No. :

PD4120

[Total No. of Pages : 2

[6402]-81

S.E. (Biotechnology)

GENETICS AND MOLECULAR BIOLOGY

(2019 Pattern) (Semester - IV) (215473)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) What is semi-conservative replication? Write a short note on its experimental evidence about semi-conservative mode of DNA replication. **[9]**

b) Describe the types and functional role of DNA polymerase enzyme. **[9]**

OR

Q2) a) Explain the phases in DNA replication process. **[9]**

b) With neat labelled diagram explain the features of Replication Fork. **[9]**

Q3) a) What is RNA splicing? Explain group I splicing pathway. **[9]**

b) Give structure and functions of tRNA. **[8]**

OR

Q4) a) Give structure and functions of mRNA in eukaryotes. **[9]**

b) Write a short note on Ribozymes. **[8]**

Q5) a) Give in details initiation, elongation and termination process of transcription in prokaryotes. **[10]**

b) Write role of RNA polymerase in transcription process. **[8]**

OR

P.T.O.

- Q6)** a) Describe Transcription cycle in bacteria. [10]
b) Write a short note on Reverse Transcriptase enzymes. [8]

- Q7)** a) Give an overview on the stages of polypeptide synthesis in prokaryotes. [9]
b) Write a short note on Molecular Chaperons. [8]

OR

- Q8)** a) Define genetic code. Write general properties of genetic code. [9]
b) Write a note on components of ribosomes with their role in translation process. [8]

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Total No. of Questions : 8]

SEAT No. :

PD4121

[Total No. of Pages : 2

[6402]-82

S.E. (Chemical)

INDUSTRIAL CHEMISTRY - I

(2019 Pattern) (Semester - III) (209341)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) What is R_f Value? What is its importance and explain factors affecting on it. [6]
- b) Give Instrumentation and applications of HPLC. [6]
- c) Explain Principle and Applications of Column chromatography. [6]

OR

- Q2)** a) Explain the Principle and Instrumentation of Flame photometer. [6]
- b) Explain the principle and instrumentation of IR Spectroscopy. [6]
- c) Explain the principle and Applications of TLC? [6]

- Q3)** a) Derive thermodynamic equation relating T_b and H_{vap}. [6]
- b) Define Van't Hoff factor. How is it Calculated. [6]
- c) An aqueous solution of glucose has an osmotic pressure of 5.20 atm at a temperature of 298 K. How many moles of glucose were dissolved per liter of solution? Given: R=0.0821 Lit. atm.degree⁻¹Mol⁻¹. [5]

OR

- Q4)** a) Derive Equation relating molar mass of solute with lowering of Vapour Pressure of its solution. [6]
- b) Define Osmotic Pressure. Explain Pfeffers Method for determination of it. [6]
- c) K_f for Benzene is 5.1 K/Mol and it's freezing point is 278.66 K, its freezing point lowers by 2.3 °C when 0.40 gm of solute is dissolved in 9.3 gm of Benzene calculate molar mass of solute. [5]

P.T.O.

- Q5)** a) Give mechanism of Nitration of Benzene. [6]
b) Describe Friedel Crafts Alkylation Explain its Limitations. [6]
c) Write a note on Favorskii Rearrangement. [6]

OR

- Q6)** a) Explain why phenols undergoes Nitration faster than Nitrobenzene. [6]
b) Discuss mechanism for E^1 and E^2 reactions of alkyl halides. [6]
c) Give Mechanism of Acylation of Benzene. [6]

- Q7)** a) How will you Prepare Quinoline from aniline. [6]
b) Define the term Dye, What are the chromophores and auxochromes? [6]
c) Give steps involved in the synthesis of Crystal Violet. [5]

OR

- Q8)** a) Draw the Orbital Picture of Pyrrole, Furan and pyridine. [6]
b) Define the term dye and Explain the term Bathochromic Shift and Hypsochromic Shift. [6]
c) Give steps involved in the synthesis of Methyl Orange. [5]



Total No. of Questions : 8]

SEAT No. :

PD4122

[Total No. of Pages : 2

[6402]-83

S.E. (Chemical)

FLUID MECHANICS

(2019 Pattern) (Semester-III) (209342)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Define Bernoulli's equation with assumptions. [6]
b) Derive Euler's equation of motion. [6]
c) An orifice meter with orifice diameter 15cm is inserted in a pipe of 30cm diameter the pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp.gr 0.9 when the coefficient of discharge of the meter = 0.64. [6]

OR

- Q2)** a) Draw a neat sketch and explain the working principle of orifice meter derives equation. [6]
b) Derive expression for Pitot tube and explain the working principle. [6]
c) A 200mm×100mm venturimeter is provide in a vertical pipe carrying water flowing in the upwards direction a differential mercury manometer connected to the inlet and throat gives a reading of 220 mm find the rate of flow assume $C_d=0.98$ [6]

- Q3)** a) Prove that expression for laminar flow of fluid. [6]
b) Derive Hagen-Poiseuille Equation, highlighting the assumptions made. [6]
c) Water at 15°C flow between two large parallel plate at a distance of 1.6mm apart. Determine: [6]
i) Maximum velocity = 0.3m/s
ii) The pressure per unit length
iii) The shear stress at the wall of the plate

OR

P.T.O.

- 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 of, 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 term dimensional homogeneous equation? With suitable example. [6]
b) Explain the concept of boundary layer? [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]

OR

- Q6)** a) With suitable example, describe in detail the Rayleigh’s Method of dimensional analysis? [6]
b) Explain Buckingham’s π -theorem in detail. [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]

- Q7)** a) What is fluidization ? Write its importance in chemical process industries. [6]
b) Differentiate between particulate fluidization and aggregative fluidization [5]
c) Explain value and its type with application? [5]

OR

- Q8)** a) Explain operating characteristic of centrifugal pump? [6]
b) Explain fluidization with its type and application? [5]
c) Explain phenomenon of cavitation’s in centrifugal pumps. How it can be prevented? [5]



Total No. of Questions : 8]

SEAT No. :

PD4123

[Total No. of Pages : 2

[6402]-84
S.E. (Chemical)
ENGINEERING MATERIALS
(2019 Pattern) (Semester - III) (209343)

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) *Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Draw Iron-Iron carbide equilibrium diagram and explain different reaction involved. **[10]**
b) Explain various phases observed in Iron-Iron carbide equilibrium diagram. **[6]**

OR

- Q2)** a) Define polymers. Write down the classification of polymers with example. **[10]**
b) Write note on Addition and Condensation polymerization. **[6]**

- 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 Nanotechnology and write down its classification in detail. **[9]**
b) Explain Sol-Gel method for synthesis of nanomaterials. **[9]**

OR

P.T.O.

Q6) a) Explain Chemical 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 Electron Microscope (SEM). **[18]**

OR

Q8) Explain principle and working of Scanning Tunneling Microscopy (STM). **[18]**

* * *

Total No. of Questions : 8]

SEAT No. :

PD4124

[6402]-85

[Total No. of Pages : 4

S.E. (Chemical)

PROCESS CALCULATIONS

(2019 Pattern) (Semester - III) (209344)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Pure sulphur is burnt in a sulphur burner using dry air. Oxygen is used 20% excess above that required for complete combustion of sulphur to SO_3 . The burner efficiency is such that only 30% of the sulphur burns to SO_3 and the remainder burns to SO_2 . Calculate (i) the analysis of the resulting mixture in mole % (ii) the weight of the gas produced per kg of sulphur burnt. [8]

b) 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% excess air is supplied, calculate the analysis of gases at the end of combustion. [8]

OR

Q2) a) A combustion chamber is fed with butane and excess air. Combustion of Butane is complete. The composition of the combustion gases on volume basis is given below: [8]

$\text{CO}_2 = 9.39\%$, $\text{H}_2\text{O} = 11.73\%$, $\text{O}_2 = 4.70\%$ and $\text{N}_2 = 74.18\%$

Find percentage excess air used and mole ratio of air to butane 'used.

b) A gas containing 25% CO , 5% CO_2 , 2% O_2 and rest N_2 is burnt with 20% excess air. If the combustion is 80% complete, calculate the composition by volume of the flue gases considering the given compositions of gas to be on mole basis. [8]

P.T.O.

- Q3) a)** The gas having the following composition is at temperature of 775 K:[10]
 $\text{SO}_2 = 7.09\%$, $\text{O}_2 = 10.55\%$, $\text{SO}_3 = 0.45\%$ and $\text{N}_2 = 81.91\%$
 Calculate the heat content of 1 kmol gas mixture over 298 K using the heat capacity data given below: $C_p^0 = a + bT + cT^2 + dT^3$, kJ/kmol.K

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
SO_2	24.7706	62.9481	-44.2582	11.122
O_2	26.0257	11.7551	-2.3426	-0.5623
SO_3	22.0376	121.624	-91.8673	24.3691
N_2	29.5909	-5.141	13.1829	-4.968

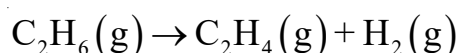
- b) A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K to 383 K. Calculate the heat that must be transferred using C_p data : [8]

$$C_p^0 = a + bT + cT^2 + dT^3, \text{ kJ/ kmol.K}$$

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
CO_2	21.3655	64.2841	-41.0506	9.7999

OR

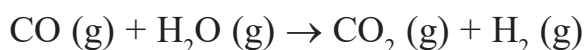
- Q4) a)** Calculate the heat of reaction at 298.15 K of the following reaction : [8]



Data

Component	ΔH_c^0 kJ/ mol
$\text{C}_2\text{H}_6(\text{g})$	-1560.69
$\text{C}_2\text{H}_4(\text{g})$	-1411.2
$\text{H}_2(\text{g})$	-285.83

- b) Obtain an empirical equation for calculating the heat of reaction at any temperature T (in K) for the following reaction : [10]



$$\text{Data : } \Delta H_R^0 = \Delta H_{T=298\text{K}}^0 = -41.16 \text{ kJ/mol}$$

Component	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
$\text{CO}(\text{g})$	29.0277	-2.8165	11.6437	-4.7063
$\text{H}_2\text{O}(\text{g})$	32.4921	0.0796	13.2107	-4.5474
$\text{CO}_2(\text{g})$	21.3655	64.2841	-41.0506	9.7999
$\text{H}_2(\text{g})$	28.6105	1.0194	-0.1476	0.769

Q5) a) Define wet bulb temperature, dry bulb temperature, humid volume and humid heat. [8]

b) A gas mixture containing benzene vapour is saturated at 101.325 kPa and 323 K. Calculate the absolute humidity if the other component of the mixture is [10]

i) nitrogen

ii) carbon dioxide

Data: Vapour pressure of benzene at 323 K = 36.664 kPa.

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 m³/h at 318 K and 101.3 kPa a. The CO₂ content of the gas is 10.4 mole%, while the outgoing gas mixture contains 4.5 mole % CO₂. A 3.2 M monoethanol amine solution is introduced at the top of the tower at the rate of 0.625 L/s. Dissolved CO₂ concentration of the entering solution is 0.166 kmol/kmol of MEA. Find the concentration of dissolved CO₂ in the solution leaving the tower.

Data: Specific volume of the gas at 318 K and 101.3 kPa a, V=26.107 m³/kmol. [18]

Q7) a) Explain the following : [9]

i) Classification of fuels

ii) Calorific values of fuels

iii) Adiabatic Flame Temperature

b) The burning of a fuel oil which does not have nitrogen gives the following composition of the flue gas by volume: CO₂ = 11.6%, O₂=5% and N₂ = 83.4% on dry basis. Compute the percentage excess air used and the carbon to hydrogen weight ratio in the fuel. [9]

OR

Q8) Calculate the gross and net heating values of the natural gas at 298.15 K which has the following molar composition : **[18]**

$\text{CH}_4 = 74.4\%$, $\text{C}_2\text{H}_6 = 8.4\%$, $\text{C}_3\text{H}_8 = 7.4\%$, $\text{iso-C}_4\text{H}_{10} = 1.7\%$, $\text{n-C}_4\text{H}_{10} = 2.0\%$, $\text{iso-C}_5\text{H}_{12} = 0.5\%$, $\text{n-C}_5\text{H}_{12} = 0.4\%$, $\text{CO}_2 = 0.9\%$ and $\text{N}_2 = 4.3\%$.

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
$\text{iso-C}_4\text{H}_{10}$	2868.20	2648.12
$\text{n-C}_4\text{H}_{10}$	2877.40	2657.32
$\text{iso-C}_5\text{H}_{12}$	3528.83	3264.73
$\text{n-C}_5\text{H}_{12}$	3535.77	3271.67

Specific volume of the natural gas at 298.15 K and 101.3 kPa = 24.465 m³/kmol.



Total No. of Questions : 8]

SEAT No. :

PD4125

[Total No. of Pages : 2

[6402]-86

S.E. (Chemical Engineering)

INDUSTRIAL CHEMISTRY - II

(2019 Pattern) (Semester - IV) (209347)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.

- Q1)** a) Demonstrate different types of volumetric analysis with examples. [6]
- b) Explain theory of indicators and also explain a difference of 2 PH is required for colour change. [6]
- c) 50 ml of 0.50M, barium hydroxide are required to fully titrate a 100ml solution of sulfuric acid. What is the initial concentration of the acid? [6]

OR

- Q2)** a) What is precipitation titration? Explain it using Fajans method. [6]
- b) Explain the strong acid strong base titration with the help of titration curve and indicators. [6]
- c) 50 ml of 0.05N Fe^{2+} is titrated against 0.1N Ce^{4+} from burette. Calculate potential of indicator electrode which is immersed in reaction mixture, when 24.5ml of Ce^{4+} is added from burette. [6]

- Q3)** a) What is adsorption isotherm? Deduce the Langmuir adsorption isotherm. [6]
- b) Explain mechanism of catalysis reaction involving adsorption phenomenon. [6]
- c) The volume of nitrogen gas at 1 atm and 273K required to cover 1g of the silica gel is 0.129dm^3 . Calculate the surface area of the gel if each nitrogen molecule occupies an area of $16.2 \times 10^{-20}\text{m}^2$. [5]

OR

P.T.O.

- Q4)** a) What are the factors affecting the rate and extent of adsorption. [6]
 b) Give mechanism of metal coordination compound catalysed reaction in Methanol carbonylation. [6]
 c) Explain photolysis of water molecules using coordination catalysis. [5]
- Q5)** a) Give various conformation of propane with P.E. diagram. [6]
 b) Give optical activity of compound containing two chiral centres. [6]
 c) Write the structural formula and the geometrical isomerism of the following compounds. [6]
 i) 2-butene
 ii) $\text{CHCl}=\text{CHCl}$
 iii) 2, 3, dichloro 2 - butene

OR

- Q6)** a) Explain various types of conformation in cyclohexane with their order of stability. [6]
 b) Explain geometrical isomerism in compound with one double bond. [6]
 c) Explain the terms enantiomers and diastereomers giving examples. [6]
- Q7)** a) What is the equation of first law of thermodynamics under various process. [6]
 b) Explain the spontaneity by 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. The values of w for the process will be. [5]

OR

- Q8)** a) State and explain Kirchhoff's law and its applications. [6]
 b) Derive the relation between heat of reaction at constant pressure and at constant volume mentioned the three case of it. [6]
 c) 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 800J of thermal energy from its surroundings. Find the ΔU for process in joule. [5]

* * *

[6402]-87
S.E. (Chemical)
HEAT TRANSFER
(2019 Pattern) (Semester - IV) (209348)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.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 short notes on **[8]**

- i) Black body
- ii) Gray body
- iii) Radiation Shield
- iv) Opaque Body

b) Calculate the net radiant heat exchange per square meter for very large planes at temperatures of 703 K and 513 K, respectively. Assume that the emissivities of the hot and cold planes are 0.85 and 0.75 respectively. **[10]**

OR

Q2) a) What are the different laws of Radiation? Explain Stefan Boltzmann's law. **[10]**

b) Two large parallel plates with emissivities 0.2 & 0.6 are maintained at 1000K & 500K respectively. A third plate with emissivity 0.08 is introduced as a radiation shield in between two plates. Calculate reduction in heat loss rate per unit area & temperature of the shield? **[8]**

Q3) a) Explain Condensation and its Modes and features? **[7]**

b) Saturated water at 35° C flows across 20mm diameter cylinder at a velocity of 5m/sec. The surface of the cylinder is maintained at 170° C. Calculate the heat loss rate per unit length of the cylinder? **[10]**

The properties of saturated water at mean film temperature are

Density = 956 Kg/m³; Specific heat = 4.223 KJ/Kg K;

Thermal conductivity = 0.683 W/m K; Pr = 1.71;

Dynamic viscosity = 276.7×10⁻⁶ kg/m sec

C = 0.0239; n = 0.805.

OR

P.T.O.

- Q4) a)** How does the process of condensation differ between vertical and horizontal plates? [7]
b) Explain Condensation Number? [10]
- Q5) a)** Derive Log mean Temperature Difference (LMTD) for countercurrent double pipe heat exchanger. [10]
b) In a double pipe counter current flow heat exchanger, 10000 kg/h of an oil having a specific heat of 2095 J/(kg.K) is cooled from 353 K to 323 K by 8,000 kg/h of water entering at 298 K. Calculate the heat exchanger area for an overall heat transfer coefficient of 300 W/(m².K). Take C_p for water as 4180 J/(kg.K). [8]

OR

- Q6) a)** Explain Shell and Tube heat exchanger in detail with neat sketch? [10]
b) Water enters a counter flow double pipe heat exchanger at 288K flowing at a rate of 1300kg/hr. It is heated by oil flowing at rate of 550kg/hr from an inlet temperature of 367K. Determine the total heat transfer and outlet temperature of oil and water for 1m² area of heat transfer.
 Data : Specific heats of oil and water are 2,000J/kg.K and 4187J/kg.K
 Overall Heat transfer coefficient is 1075W/m²K. [8]
- Q7) a)** What is evaporation? Explain Calendria type evaporator with neat sketch? [7]
b) A single effect evaporator is used to concentrate 20,000kg/hr of a solution at 298 K from 5% to 20% by weight of salt concentration. Steam is fed to the evaporator at pressure corresponding to the saturation temperature of 399 K. The evaporator is operating at atmospheric pressure and boiling point rise is 7 K. Calculate the Heat load, the steam consumption and steam economy. [10]
 Data : Specific heat of feed: 4.0kJ/(kg.K)
 Latent heat of condensation of steam at 399 K = 2185kJ/kg
 Latent heat of vaporization of water at 373K = 2257kJ/kg

OR

- Q8) a)** Explain the parallel feed multiple effect evaporators in detail? [10]
b) A triple-effect evaporator is concentrating a solution that has no appreciable boiling point elevation. The temperature of steam to the first effect is 381.3K and the boiling point of the solution in the last effect is 324.7K. The overall heat transfer coefficients in the first, second and third-effect are 2800, 2200 and 1100 W/(m². K), respectively. At what temperatures will the solution boil in the first and second effects? [7]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4127

[Total No. of Pages : 3

[6402]-88

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) Derive the equation to determine the diameter of shaft for the following two conditions: **[8]**

- i) Shaft subject to twisting moment only.
- ii) Shaft subject to bending moment only.

b) Find the diameter of a solid steel shaft to transmit 20KW at 200 RPM. The ultimate shear stress may be taken as 360MPa and FOS as 08. If the hollow shaft is to be used in place of solid shaft, find the ID & OD, when the ratio of ID to OD is 0.5. **[10]**

OR

Q2) a) Prove that the length of key, by considering the crushing strength of key,

$$L = \frac{\pi}{4} * \frac{f_{ss}}{f_{ck}} * \frac{d_s^2}{t} \quad \text{[6]}$$

Where,

L – Length of key,

f_{ss} - Permissible shear stress for shaft material,

f_{ck} - Permissible crushing stress for key material,

d_s – Diameter of shaft.

t – Thickness of key.

b) Design the rectangular key for a shaft of 5 mm diameter. The shearing and crushing stresses for the key material are 42 MPa and 70 MPa. **[12]**

P.T.O.

- Q3) a)** A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm & 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing. Find the minimum force per pitch which will rupture the joint. [10]

If the above joint is subjected to a load such that FOS is 4, find out the actual stresses developed in the plates and the rivets.

- b)** Define welding. Classify welding joints. What are advantages of welded joints over riveted joints & how will you define strength of butt weld joint subjected to tensile force. [7]

OR

- Q4) a)** Prove that the ratio of driving tensions for flat belt drive along with proper sketch. [7]

$$\frac{T_2}{T_1} = e^{\mu \cdot \theta}$$

Where,

T_2 : is tension in tight side.

T_1 : is tension in slack side.

θ : is angle of contact between belt and pulley.

μ : is the coefficient of friction between belt and pulley.

- b)** Two pulleys, one 450 mm diameter and other 200 mm diameter, on parallel shaft 1.95 m apart are connected by a crossed belt. Find the length of belt required and angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 RPM, if maximum permissible tension in the belt is 1 kN, and the coefficient of friction between belt and pulley is 0.25? Also draw the sketch. [10]

- Q5) a)** Write the short note on optimum proportions of a vessel. [6]

- b)** A pressure vessel having outer diameter 1.3 m and height 3.8 m is subjected to an internal pressure of 12 Kg/cm². 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/cm². Corrosion allowance is 1 mm.

OR

- Q6) a)** Calculate the thickness of a torispherical heads (100-6) and (80-10) elliptical head (2:1) for a pressure vessel having 1.0 m diameter and having design pressure of 3.5 kg/cm². Welded joint is fully tested so welded joint can be considered as 100%. The permissible stress for the material of construction is 1250 kg/cm². **[12]**
- b)** Enlist the various types of heads used for pressure vessel along with proper sketch. Also write the equation to determine the thickness of each head with meaning of each notation. **[6]**

- Q7) a)** Prove that, for cylindrical pressure vessel with flat head at the top and at the bottom, **[7]**

$$L = D \left[1 + \frac{3DP}{4CfJ} \right]$$

$$V = \frac{\pi}{4} D^2 L = \frac{\pi}{4} D^3 \left[1 + \frac{3DP}{4CfJ} \right]$$

Where,

L - Optimum length of pressure vessel.

V- Optimum volume of pressure vessel.

C- Corrosion allowance.

P - Pressure in the pressure vessel.

f - Allowable stress of material

J- Welded joint efficiency.

D- Diameter of pressure vessel.

- b)** A pressure vessel is required to have a capacity of 20 m³. The vessel has an operating pressure of 6 kg/cm². The material used for fabrication have an allowable stress of 1090 kg/cm². Welded joint efficiency is 85%. The corrosion allowance is 2mm. Estimate the optimum diameter and optimum length of pressure vessel. **[10]**

OR

- Q8) a)** A Pressure vessel is required to process 19 m³ non-hazardous slurry at 17.7 kg/cm², 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/cm². The welded joint efficiency is 85%. No corrosion allowance is necessary. **[12]**

Maximum diameter of the vessel can be 2.4 m.

Calculate

- i) The height of the vessel.
- ii) Minimum thickness of shell and elliptical head.
- b)** Define Pressure vessel and give some industrial examples where these are used commonly. **[5]**



Total No. of Questions : 8]

SEAT No. :

PD4128

[Total No. of Pages : 2

[6402]-89
S.E. (Chemical)
CHEMICAL TECHNOLOGY-I
(2019 Pattern) (Semester - IV) (209350)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Describe major engineering problems in the manufacturing of synthetic ammonia based on the pressure catalytic reaction. **[7]**

b) State uses of Ammonium Nitrate. **[2]**

c) Explain stamicarbon Urea stripping process with a simplified flow Sheet.**[8]**

OR

Q2) a) Draw a neat process flow Diagram (PFD) for manufacture of Nitric Acid by ammonia oxidation process & explain it. **[10]**

b) Explain in brief stengel process for production of Ammonium Nitrate.**[7]**

Q3) a) Describe in brief market and sales of soaps & detergents in India. **[5]**

b) Explain in brief continuous hydrolysis and saponification process with a neat process flow Diagram (PFD) for manufacturing of soaps. **[10]**

c) How cleansing compounds canbe classified? **[3]**

OR

Q4) a) Describe in brief manufacturing of Alkyl-Aryl sulfonates. **[7]**

b) Explain in brief reactions involved in manufacturing process for detergent by sodium reduction of coconut oil. **[5]**

c) Explain in brief the difference between batch saponification process & continuous saponification process. **[6]**

P.T.O.

- Q5)** a) Explain in brief major role of plastics in agriculture & water management. [6]
b) Explain in brief thermosetting & thermoplastic resins. [8]
c) State uses of LDPE & HDPE. [3]

OR

- Q6)** a) Draw and explain a flow chart for manufacture of polyvinyl resin. [7]
b) Explain in brief about polyurethanes. [6]
c) Explain in brief functionality structure of polymers. [4]

- Q7)** a) State methods for production of crude petroleum. [4]
b) State reactions take place in Catalytic reforming process. [4]
c) Draw and explain with a neat Process Flow Diagram (PFD) of manufacturing process for Butadiene - Styrene rubber. [10]

OR

- Q8)** a) Describe in brief unit operations & unit processes involved in refining of crude oil. [7]
b) Explain in brief about manufacture of silicone rubbers. [6]
c) Describe in brief about Isomerization Process. [5]

* * *

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

PD4129

[6402]-90

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 indicate full marks.*
- 4) Assume suitable data, if necessary.*

Q1) a) Write an explanatory note on **[12]**

- i) Magnetic Separator
- ii) Fabric Filter

b) Explain Froth Floatation with a neat sketch. **[6]**

OR

Q2) Draw a neat sketch of pressure drop and bed height vs. superficial velocity for a bed of solids and explain in detail conditions of fluidization. **[18]**

Q3) Explain and derive the necessary equations for **[17]**

- a) Mixing Index
- b) Power number

OR

Q4) a) What are turbines? Explain with a neat sketch different types of turbines. **[8]**

- b)** Write notes on **[9]**
- i) Flow pattern with off centre propeller
 - ii) Ribbon Blender
 - iii) Sigma Mixer

P.T.O.

Q5) a) Derive the necessary relation for optimum time cycle for plate and frame filter press. [12]

b) Derive the following for filtration at constant pressure difference. [6]

$$\frac{t - t_1}{V - V_1} = \frac{r\mu v}{2A^2(-\Delta P)}(V - V_1) + \frac{r\mu v V_1}{A^2(-\Delta P)}$$

OR

Q6) a) What is filter medium? State the various requirements of filter medium. [9]

b) What are centrifuges? Explain with a neat sketch. [9]

Q7) a) Write an explanatory note on pneumatic conveyors. [9]

b) Write an explanatory note on Bucket Elevators. [8]

OR

Q8) a) What are chain and flight conveyors? Explain any two types of chain conveyors. [9]

b) Write an explanatory note on Belt Conveyors. [8]



Total No. of Questions : 9]

SEAT No. :

PD4130

[Total No. of Pages : 4

[6402]-91

S.E. (Production and Industrial Engineering/(Production S.W/
Robotics & Automation)

ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207007)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.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) Assume suitable data, if necessary.
- 4) Use of electronic pocket calculator is allowed.

Q1) a) The first and second moments of the distribution about the value 3 are 2 and 20. second moment about the mean is [2]

- i) 12
- ii) 14
- iii) 16
- iv) 20

b) The mean and variance of binomial probability distribution are $\frac{5}{4}$ and $\frac{15}{16}$ respectively. Probability of failure q in a single trial is equal to [2]

- i) $\frac{1}{2}$
- ii) $\frac{15}{16}$
- iii) $\frac{1}{4}$
- iv) $\frac{3}{4}$

c) $\nabla(\bar{a} \cdot \bar{r})$ where $\bar{a} = a_1\bar{i} + a_2\bar{j} + a_3\bar{k}$, $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ is equal to [2]

- i) 0
- ii) $\bar{a}$
- iii) $\bar{r}$
- iv) 1

P.T.O.

- d) $\nabla \times \vec{r}$ where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ is equal to [1]
- 0
 - $\frac{1}{r}\vec{r}$
 - $\vec{r}$
 - 3
- e) For the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with general solution $u(x, t) = (C_4 \cos mx + C_5 \sin mx) e^{-m^2 t}$ if $u(0, t) = 0, \forall t$ then [2]
- $C_5 = 0$
 - $C_4 = 0$
 - $m = 0$
 - None of these
- f) Mean of binomial probability distribution is [1]
- nq
 - $n^2 p$
 - npq
 - np

Q2) a) Fit a straight line of the form $y = ax + b$ to the following data [5]

x	6	2	10	4	8
y	9	11	5	8	7

b) Calculate the first four moments about the mean of the following distribution. [5]

x	2	2.5	3	3.5	4	4.5	5
y	4	36	60	90	70	40	10

c) Find the coefficient of correlation for the following table [5]

x	35	34	40	43	56	20	38
y	32	30	31	32	53	20	33

OR

Q3) a) Fit a straight line to the following data. [5]

x	0	5	10	15	20	25
y	12	15	17	22	24	30

b) First four moments of distribution about the value 5 are 2, 20, 40 and 50. Find first four central moment also comment on skewness and kurtosis. [5]

c) Obtain the regression lines for the following table [5]

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

- Q4)** a) On an average a box containing 10 articles is likely to have 2 defective. If we consider a consignment of 100 boxes. How many of them are expected to have three or less defectives. [5]
- b) A can hit the target 1 out of 4 times. B can hit the target 2 out of 3 times, C can hit the target 3 out of 4 times. Find the probability of at least two hit the target. [5]
- c) The mean weight of 500 students is 63 kgs and the standard deviation is 8 kgs. Assuming that the weights are normally distributed. Find how many students weight 52 kgs? The weights are recorded to the nearest kg [5]

(Given: Area corresponding to 1.44 is 0.4251

Area corresponding to 1.31 is 0.4049)

OR

- Q5)** a) Two cards are drawn from a well shuffled pack of 52 cards. Find the probability that they are both king if the first card drawn is not replaced.[5]
- b) In a poisson distribution if $p(r=1) = 2$ $p(r=2)$ find $p(r=3)$ [5]
- c) A nationalized bank utilizes 4 teller windows to render fast service to customers on a particular day 800 customers were observed they were given service at the different windows as follows: [5]

No. of windows	1	2	3	4
Expected no.of customer	150	250	170	230

Test whether customers are uniformly distributed

(Given: $\chi^2_3; 0.05 = 7.815$)

- Q6)** a) Find the directional derivative of $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ towards the point $(2, 1, -1)$ [5]
- b) Show that $\vec{F} = (6xy + z^3)\vec{i} + (3x^2 - z)\vec{j} + (3xz^2 - y)\vec{k}$ is irrotational. Find scalar ϕ such that $\vec{F} = \nabla \phi$. [5]
- c) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = (2xy + 3z^2)\vec{i} + (x^2 + 4yz)\vec{j} + (2y^2 + 6xz)\vec{k}$ and C is the straight line joining $(0, 0, 0)$ and $(1, 1, 1)$ [5]

OR

- Q7) a)** Find the directional derivative of $\phi = x^2 - y^2 + 2z^2$ at the point $(1, 2, 3)$ in the direction of $4\bar{i} - 2\bar{j} + \bar{k}$. [5]
- b)** Show that (any one) [5]
- i) $\nabla \left(\frac{\bar{a} \cdot \bar{r}}{r^2} \right) = \frac{\bar{a}}{r^2} - 2 \frac{(\bar{a} \cdot \bar{r})\bar{r}}{r^4}$
- ii) $\nabla \cdot \left[r \nabla \frac{1}{r} \right] = \frac{-1}{r^2}$
- c)** Evaluate $\int_C \bar{F} \cdot d\bar{r}$ for $\bar{F} = (2x + y)\bar{i} + (3y - x)\bar{j}$ and C is parabolic curve $y^2 = x$ joining points $(0, 0)$ and $(1, 1)$ [5]

- Q8) a)** If $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ represents the vibration of the string of length l , fixed at both ends, find solution with conditions: [8]
- i) $y(0, t) = 0$
- ii) $y(l, t) = 0$
- iii) $\frac{\partial y}{\partial t} = 0$ at $t = 0$
- iv) $y(x, 0) = k(lx - x^2)$, $0 < x < l$
- b)** Solve $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$ if [7]
- i) $u(0, t) = 0$
- ii) $u_x(l, t) = 0$
- iii) $u(x, t)$ is bounded
- iv) $u(x, 0) = \frac{u_0 x}{l}$

OR

- Q9) a)** An infinitely long uniform metal plate is enclosed between lines $y = 0$ and $y = 2$ meters for $x > 0$. The temperature is zero along the edges $y = 0$, $y = 2$ meters and at infinity. If the edge $x = 0$ is kept at a constant temperature u_0 , find the temperature distribution $f(x, y)$. [8]
- b)** Using Fourier transform. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < \infty$, $t > 0$ [7]
- Subject to conditions
- i) $u(0, t) = 0$, $t > 0$
- ii) $u(x, 0) = \begin{cases} 1 & 0 < x < 1 \\ 0 & x > 1 \end{cases}$
- iii) $u(x, t)$ is bounded



Total No. of Questions : 8]

SEAT No. :

PD4131

[Total No. of Pages : 2

[6402]-92

S.E. (Production & Production Sandwich)

HEAT & 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 side indicate full marks.
- 4) Assume suitable data if necessary.

- Q1) a)** Explain Darcy Weisbach equation. **[9]**
b) A crude oil of kinematic viscosity 0.4 stroke is flowing through a pipe of diameter 300mm at the rate of 300 liters per second. Find the head loss due to friction for a length of 50m of the pipe. **[9]**

OR

- Q2) a)** What is Buckingham's pie theorem? **[9]**
b) Explain working of any one turbine. **[9]**

- Q3) a)** How boiler are classify? And sketch 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 0.95dry. Determine the equivalent of evaporation from & at 100°c **[8]**

OR

- Q4) a)** What is 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 31000KJ/kg. Determine **[8]**
i) The efficiency of the boiler.
ii) The equivalent of evaporator from &at 100° c.

- Q5) a)** Discuss necessity of air conditioning for micro and nano manufacturing. **[9]**
b) What are various types of refrigeration systems? **[9]**

OR

P.T.O.

- Q6)** a) What is units of refrigeration and coefficient of performance of refrigerator? [9]
b) Define 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) Explain clearance volume of compressor? Write significance of it. [9]
b) Discuss classification of Internal Combustion engine in detail. [8]



[6402]-93

S.E. (Production/Production S.W/Robotics & Automation)

STRENGTH OF MATERIALS**(2019 Pattern) (Semester-III) (211082)***Time : 2½ Hours]**[Max. Marks : 70**Instructions to the candidates:*

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

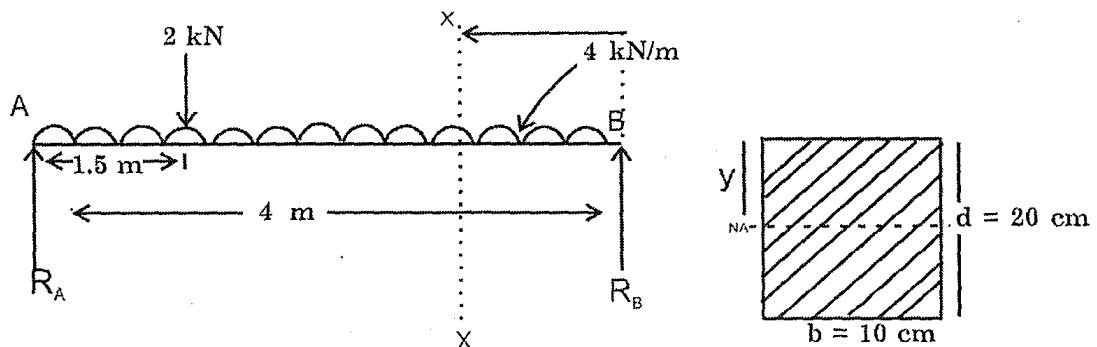
Q1) a) Derive relation between Maximum shear stress and average shear stress for circular cross-sectional Beam [8]

b) Write assumption made in Pure bending theory. [9]

OR

Q2) a) Derive relation between Maximum shear stress and average shear stress for Square cross-sectional Beam. [8]

- b) A Simply supported beam AB of span length 4 m supports a uniformly distributed load of intensity $q = 4 \text{ kN/m}$ spread over the entire span and a concentrated load $P = 2 \text{ kN}$ placed at a distance of 1.5 m from left end A. The beam is constructed of a rectangular cross-section with width $b = 10 \text{ cm}$ and depth $d = 20 \text{ cm}$. Determine the maximum tensile and compressive stresses developed in the beam to bending. [9]

*P.T.O.*

- Q3)** a) A steel rod of 40 mm diameter, is 2.5 M long. Find maximum instantaneous stress induced when a pull of 80 kN is applied- [6]
- gradually
 - Suddenly
- b) Discuss Analytical methods for determining the stresses in a member subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress. [6]
- c) An element in a strained body is subjected to a tensile stress of 150 Mpa and Shear stress 50 Mpa tending to rotate an element in anticlockwise direction. Find magnitude of shear and normal stresses on a section inclined at 45 degree with the tensile stress. [6]

OR

- Q4)** a) Define- [6]
- Strain energy
 - Proof Resilience
 - Modulus of Resilience
- b) Direct stress of 120 Mpa (Tensile) and 90 Mpa (compressive) exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greater principal stress at a point due to these is 150 Mpa. Find the shear stress on these planes. Find also the maximum stress at the point [6]
- c) Derive strain energy stored in a body when the load is suddenly applied. [6]

- Q5)** a) Design the diameter of circular shaft to transmit 50 KW power rotating at 100 rpm. Maximum torque is likely to exceed mean torque by 25%. Maximum permissible shear stress is 60 Mpa. Also calculate angle of twist for a length of 2M. Take $G = 80 \text{ GPa}$. [6]
- b) Derive an equation for circular shaft subjected to torsion. [6]

$$\frac{\tau}{R} = \frac{T}{J} = \frac{G\theta}{L}$$

Where J = Polar moment of inertia τ = Shear stress induced due to torsion T , G = Modulus of rigidity θ = Angular deflection of shaft R , L = Shaft radius & length respectively.

- c) Discuss the stresses in a thin cylinder vessel subjected to internal pressure. [6]

OR

- Q6)** a) A hollow shaft 1M in length is required to transmit a torque of 10kN-M. The total angle of twist in this length is not to exceed 1° and the allowable shearing stress is 100 Mpa. Determine the inside and outside diameter of the shaft if $G=100\text{GPa}$. [6]
- b) Discuss the stresses in a thin spherical shell subjected to internal pressure. [6]
- c) Define-Hoop or Circumferential Stress, Longitudinal Stress, Radial pressure. [6]
- Q7)** a) Derive a relation for slope and deflection for a simply supported beam with central point load. [10]
- b) A hollow mild steel tube 6 M long and 4 cm in internal diameter and 6mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. $E=2 \times 10^5 \text{ N/mm}^2$. [7]

OR

- Q8)** a) Derive relation for buckling load for column when both end are hinged. [7]
- b) A cast iron beam 40 mm wide and 80 mm deep is simply supported on a span 1, 2 M. The beam carries a point load of 15kN at the centre. Find the deflection at the centre, $E=108000 \text{ N/mm}^2$. [5]
- c) Explain procedure for finding deflection in cantilever beam by Macaulay's method. [5]



Total No. of Questions : 8]

SEAT No. :

PD4133

[Total No. of Pages : 2

[6402]-94

**S.E. (Production/Production Sandwich)
MANUFACTURING PROCESSES - I
(2019 Pattern) (Semester - III) (211083)**

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 following lathe operations by neat sketches: **[8]**

- i) Facing
 - ii) Plane turning
 - iii) Chamfering
 - iv) Drilling
- b) With the help of neat sketch, explain horizontal column and knee type milling machine. **[10]**

OR

Q2) a) With the help of neat sketch, explain thread cutting operation on lathe machine by using half nut and lead screw. **[9]**

- b) With the help of neat sketch, explain vertical column and knee type milling machine. **[9]**

Q3) a) With the help of sketch. Explain the construction and working of radial drilling machine. **[9]**

- b) With the help of sketch, explain the construction and working of surface grinding machine. **[8]**

OR

P.T.O.

- Q4) a)** With the help of sketch, explain different operations performed on drilling machine. **[8]**
- b) With the help of sketch, explain the construction and working of cylindrical grinding machine. **[9]**

- Q5) a)** Explain Buffing, Honing and Burnishing processes in short. **[9]**
- b) Explain Polishing, Tumbling and Electroplating processes in short. **[9]**

OR

- Q6) a)** Compare between the Electroplating, Galvanizing and Metal spraying processes. **[9]**
- b) Explain Lapping process with neat sketch in detail. **[9]**

- Q7) a)** Describe various advantages and limitations of additive manufacturing. **[8]**
- b) Describe VAT Polymerization process in short. State its merits, demerits and applications. **[9]**

OR

- Q8) a)** Describe various applications of additive manufacturing. **[8]**
- b) Explain material jetting additive manufacturing process in detail. **[9]**

* * *

Total No. of Questions : 8]

SEAT No. :

PD4134

[6402]-95

[Total No. of Pages : 2

S.E. (Production Engineering/Production Sandwich)

MATERIALS SCIENCE AND METALLURGY

(2019 Pattern) (Semester - III) (211084)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Assume Suitable data, if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat figures whenever necessary.*
- 5) *Use of scientific calculators is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

Q1) What is the science of powder metallurgy? Write in detail about this non conventional manufacturing process. **[18]**

OR

Q2) a) Write note on : **[9]**

- i) Diamond impregnated Cutting Tools
 - ii) Cemented carbide tipped tools
- b) Describe any two component which can be manufactured by only powder metallurgy technique. **[9]**

Q3) What is the heat treatment? Name a few treatments given to steels in order to change its properties. **[17]**

OR

Q4) a) What is steel? What do you understand by eutectoid, hypereutectoid and hypereutectoid steel? **[10]**

- b) Explain the following with neat diagram : **[7]**
- i) Peritectic transformation
 - ii) Eutectic transformation

P.T.O.

Q5) a) Draw and Explain the method of plotting TTT diagram and what information is obtained from this diagram? **[10]**

b) Explain terms: **[8]**

i) Quenching

ii) Annealing

iii) Normalizing

iv) Carburizing

OR

Q6) a) Define hardenability. How it is measured? **[8]**

b) What is retained austenite? Why it is not desirable? **[10]**

Q7) a) Write note on High temperature alloy. **[8]**

b) Write Note on Copper and its Alloy. **[9]**

OR

Q8) a) Write Note on Aluminum and its Alloy. **[8]**

b) Write Note on Composite Material and Nano Materials. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4135

[Total No. of Pages : 2

[6402]-96

S.E. (Production Engineering and Industrial Engineering/Production Engineering /Sandwich)

**ELECTRICAL AND ELECTRONICS ENGINEERING
(2019 Pattern) (Semester - IV) (203050)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Draw and explain V-I Characteristics of SCR. [5]
b) State the applications of IGBT. [6]
c) Explain construction of TRIAC with a neat diagram. [6]

OR

- Q2)** a) Draw and explain V-I Characteristics of DIAC. [5]
b) Explain concept of commutation of SCR. [6]
c) State any applications of SCR. [6]

- Q3)** a) With suitable diagram explain OPAMP as a inverting amplifier. [5]
b) What is OPAMP? Draw its symbol and mark respective terminals. [6]
c) Explain Mono-stable mode of operation of IC 555. [6]

OR

- Q4)** a) Explain Astable mode of operation of IC 555. [5]
b) State the characteristics of OPAMP. [6]
c) With suitable diagram explain OPAMP as a differential amplifier. [6]

P.T.O.

- Q5)** a) What do you understand by PLC. State any 4 applications of PLC. [8]
b) Explain I/O modules of PLC. [6]
c) State the advantages of PLC. [4]

OR

- Q6)** a) What is Ladder diagram? State its properties. [8]
b) With suitable block diagram explain arrangement of PLC. [6]
c) State the disadvantages of PLC. [4]

- Q7)** a) Compare Microprocessor with Microcontroller. [8]
b) Explain the role of embedded system in automation. [6]
c) Write a note on sensors. [4]

OR

- Q8)** a) Explain the port structure of Arduino IDE. [8]
b) State the features of Atmega 328P. [6]
c) Write a note on actuators. [4]

* * *

[6402]-97

S.E. (Production Engineering)/(Sandwich)

THEORY OF MACHINES

(2019 Pattern) (Semester - IV) (211091)

Time : 2½ Hours]

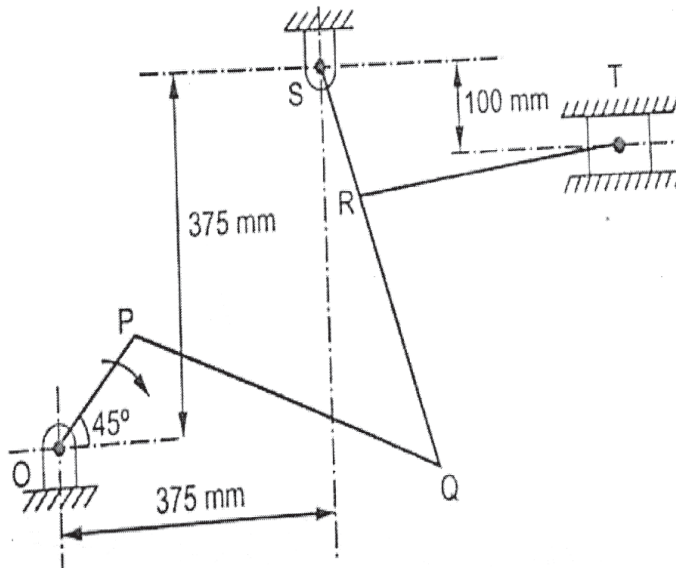
[Max. Marks : 70

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 right side indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of logarithmic tables, slide rules, mollier charts, electronic pocket calculator and steam table is allowed.

Q1) a) Explain relative velocity and absolute velocity with example. [6]

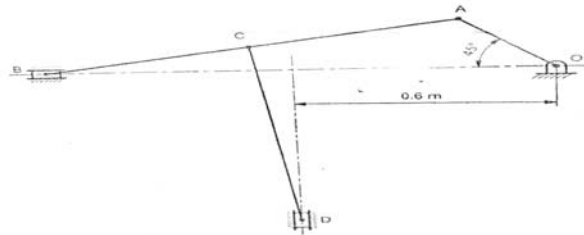
- b) Figure shows a mechanism in which dimensions of various links are as follows: $OP = RS = 150\text{mm}$, $PQ = QS = 450\text{ mm}$ and $RT = 375\text{mm}$. Crank OP rotating at uniform speed of 180rpm . Determine velocity of slider T and Angular velocity of QS . Use relative velocity method. [12]



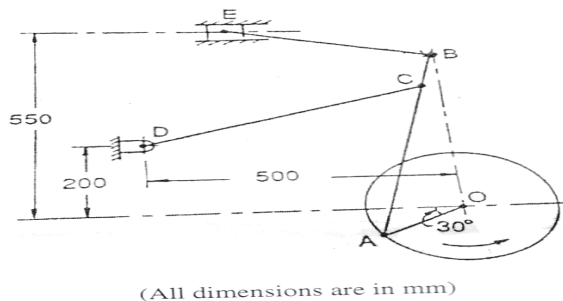
OR

P.T.O.

- Q2) a)** Explain the properties of instantaneous centre of rotation. [8]
- b)** Crank OA of a compound slider crank mechanism as shown in figure rotate at 60 rpm clockwise and gives motion to sliding blocks B and D. The dimensions of various links are OA = 300 mm, AB = 1000 mm, AC = BC and CD = 800 mm. Determine [10]
- Angular velocity of link AB and CD
 - Velocity of block B and D.
- Use Instantaneous centre of rotation method.



- Q3)** Figure shows the mechanism of a radial valve gear. The crank OA rotates at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are: OA = 150mm, AB = 550mm, AC = 450 mm, DC = 500 mm, BE = 350mm. Determine velocity and acceleration of ram E for given position of mechanism. [17]



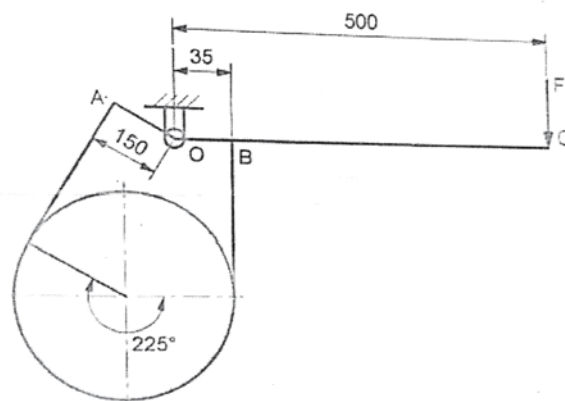
OR

- Q4) a)** The lengths of crank and connecting rod of a vertical reciprocating engine are 300mm and 1.5 m respectively. The crank is rotating at 200 rpm clockwise. Find analytically
- Velocity and acceleration of piston
 - angular acceleration of connecting rod when crank has turn through 40° from top dead centre and piston is moving downwards. [8]
- b)** In a reciprocating engine, crank length is 100 cm and connecting rod is 350 mm. Angular velocity of crank is 60 rad/sec. Crank is at 30° from IDC. Using Klein's construction method determine: [9]
- Velocity and acceleration of piston.
 - Angular velocity and angular acceleration of connecting rod.

- Q5) a)** What is meant by initial tension in belts? Explain the influence of initial tension and co-efficient of friction on power transmitted by belt drive. **[8]**
- b)** An impregnated belt $0.6\text{cm} \times 10\text{cm}$ of open belt drive has 140 N/cm^2 maximum stresses in the belt. The angle of contact on pulley is 120° . Belt density is 970 kg/m^3 . The coefficient of friction between belt and pulley is 0.3. Determine maximum power transmitted by the belt. **[10]**

OR

- Q6) a)** What is slip in a belt drive, and how does it impact the efficiency of power transmission? Discuss the factors that contribute to slip. **[8]**
- b)** Discuss the key properties required in materials used for making belts. How do these properties contribute to the effectiveness of the belt drive system? **[10]**
- Q7) a)** Explain different types of shoe brake systems with suitable diagrams. **[8]**
- b)** A differential band brake as shown in fig has an angle of contact 225° . The band has compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and coefficient of friction between band and drum is 0.30. Find necessary force for clockwise rotation of drum. **[9]**



(All dimensions are in mm)

OR

- Q8) a)** Explain in detail the self energize and self-locking brake? **[8]**
- b)** Explain construction and working of Epicyclic - Train Dynamometer with the help of neat sketch. **[9]**

* * *

Total No. of Questions : 8]

SEAT No. :

PD4137

[Total No. of Pages : 3

[6402]-98

**S.E. (Production /Production S.W)
DESIGN OF MACHINE ELEMENTS
(2019 Pattern) (Semester - IV) (211092)**

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, and Q.7 or Q.8.*
- 2) *Assume suitable data, if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of non-programmable electronic pocket calculator is allowed.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Student will solve/write the Answers to any four questions in single answer book only.*

- Q1) a)** Derive the torque equation for the square threaded screw to 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 6 mm 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 concept of overhauling and self-locking screws. **[4]**

OR

- Q2) a)** Draw a neat labeled sketch of recirculating ball screw mechanism and explain its operation with advantages, disadvantages and applications. **[6]**
- b) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20. **[6]**
- c) Define power screw and explain with figures the types of power screw threads. **[6]**

P.T.O.

- Q3) a)** Explain the terms used in compression springs; Spring Rate, and Spring Index. [4]
- 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 6.1. 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 81370 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: [8]
- Wire diameter,
 - Mean coil diameter,
 - Number of active coils,
 - Total number of coils,
 - Free length of the spring, and
 - Pitch of the coil
- Draw a neat sketch of the spring showing various dimensions.
- c) Define helical spring and explain types of springs with applications. [5]

OR

- Q4) a)** 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 (W) and the deflection per active turn (δ/n). [6]
- 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 sketch a leaf spring assembly. Mention the different utility components/parts in the assembly. [5]

- Q5) a)** Explain the terms used in gears: i) Pitch Circle Diameter, and ii) Addendum. [4]
- b) The following particulars of a single reduction spur gear are given: Gear ratio = 10:1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 rpm Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find: i) The nearest standard module if no interference is to occur; ii) The number of teeth on each wheel; iii) The necessary width of the pinion; and iv) The load on the bearings of the wheels due to power transmitted. [8]
- c) Explain different causes of gear tooth failure. [6]

OR

- Q6)** a) Derive beam strength equation of gear teeth. [7]
b) Explain the design procedure of spur gear. [8]
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 30 kN. The desired life for 90 % of the bearings is 9000 h and the speed is 250 rpm. Calculate the equivalent radial load that the bearing can carry. [6]
c) Explain purpose of lubrication and guidelines for selecting lubrication for rolling contact bearings. [6]

OR

- Q8)** a) Write down selection procedure of bearing from manufacturer's catalogue. [8]
b) Classify rolling contact bearings. [3]
c) A single – row deep groove ball bearing is subjected to radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life L_{10h} of the bearing is 20000 h. The minimum acceptable diameter of the shaft is 75 mm. Calculate dynamic load capacity. [6]



Total No. of Questions : 8]

SEAT No. :

PD4138

[Total No. of Pages : 2

[6402]-99

S.E. (Production Engineering) (Sandwich)

ADVANCED MATERIALS

(2019 Pattern) (Semester - IV) (211093)

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) 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) Which are the key properties of nanomaterials? [6]
b) What are the limitations of nanomaterials? [6]
c) Which are the important properties desired from electrical materials? [6]

OR

- Q2)** a) What is vulcanization? [6]
b) Which are the common magnetic materials? [6]
c) How are polymers classified on the basis of their structure? [6]

- Q3)** a) How are magnetic materials classified based on relative permeability? [6]
b) What do you mean by carbon nanotubes? [6]
c) What is a biodegradable polymer? Give examples. [5]

OR

- Q4)** a) Where are semiconductors used? [6]
b) Give one example each of zero-, one -and two-dimensional nanomaterials? [6]
c) What do you mean by Engineering plastics? Give examples [5]

P.T.O.

- Q5) a)** What do you mean by calendering of elastomers? [9]
- b) Write note on : Mixing mechanism of rubber/elastomers. [8]

OR

- Q6) a)** Which are the manufacturing techniques used for processing of rubbers? [9]
- b) Write note on: Extrusion of Rubber or elastomers. [8]

- Q7) a)** What do you understand by “Ceramics”? Distinguish between “Traditional” and “Advanced” ceramics. [9]
- b) Explain with sketch slip casting for Ceramic processing. [9]

OR

- Q8) a)** What is mean by composites? Which are the attractive features of composites make them suitable for special areas of applications? [9]
- b) Explain with sketch any one technique of metal matrix composite processing. [9]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4139

[Total No. of Pages : 2

[6402]-100

S.E. (Production/ ProductionSandwich)

INDUSTRIAL ENGINEERING AND MANAGEMENT

(2019 Pattern) (Semester - IV) (211094)

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 various factors to select any business location. [6]
- b) Differentiate between fixed cost and variable cost in break even analysis. [6]
- c) State stages for business growth. [5]

OR

- Q2)** a) Discuss qualities needed for becoming a good entrepreneur. [6]
- b) Classify types of costs in detail. [6]
- c) Describe process IPR. Why it is essential. [5]

- Q3)** a) Elaborate on various merit evaluation techniques. [6]
- b) Explain concept of wages in detail. [6]
- c) What is productivity? Why its study is important? [6]

OR

- Q4)** a) Discuss role of industrial engineer in manufacturing industry. [6]
- b) State procedure for work measurement in manufacturing industry. [6]
- c) How to calculate productivity? State its process. [6]

P.T.O.

- Q5)** a) Why study of motion economy is essential? [6]
b) How to use Multiple Activity Chart? Explain it with suitable example. [6]
c) Write a short note on MOST. [6]

OR

- Q6)** a) Why Chronocyclegraph is required? How to use it? [6]
b) Brief on “5W and 1 H”. [6]
c) Elaborate Use of the human body in motion economy. [6]

- Q7)** a) Elaborate two handed chart in detail. [6]
b) How to analyze performance rating? [6]
c) Compare PMTS and MTM. [6]

OR

- Q8)** a) What are the different types of work sampling? [6]
b) What are the 4 types of allowances used in work study? [6]
c) Write a short note on WFS. [6]



Total No. of Questions : 8]

SEAT No. :

PD4140

[Total No. of Pages : 2

[6402]-101

**S.E. (Production Sandwich)
MANUFACTURING PROCESS - II
(2019 Pattern) (Semester - IV) (211121)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) For Machining Centre, Explain the following. [12]

- i) Principles, Working & Advantages
- ii) Applications & Parts Programming

b) Explain the following codes: [5]

- i) G 03
- ii) G 63
- iii) M 06
- iv) M 09
- v) M 30

OR

Q2) a) What are CNC (Computer Numerical Control) machines and what advantages do they offer over conventional machines? [10]

b) Explain the concept of FMS (Flexible Manufacturing System) and its significance in modern manufacturing? [7]

Q3) a) Describe the process of extruding plastic film, including the equipment involved? [8]

b) Explain with neat sketch Injection Moulding Process with its Advantages & Applications. [10]

OR

P.T.O.

Q4) a) Explain in details of Blow Moulding Process with its Advantages & Applications? [10]

b) What is Pressure Forming in Thermoforming, and how does it affect the final product? [8]

Q5) a) Explain with neat sketch EBM. State the Advantages, Limitations and Applications. [9]

b) Explain with neat sketch USM. State the Advantages, Limitations and Applications? [8]

OR

Q6) a) What is the function of electrolyte in ECM? List the common electrolyte used in ECM. [5]

b) Explain the Principle with neat sketch of following. (Any Two) [12]

i) EDM

ii) AJM

iii) IBM

Q7) a) Describe the various types of jigs and fixtures used in manufacturing processes? [12]

b) Describe factors considered for designing jig & fixture? [6]

OR

Q8) a) What are some general guidelines and procedures followed in the design of jigs and fixtures? [13]

b) Explain fool-proofing for jig & fixture? [5]

* * *

[6402]-102

S.E. (Printing Engineering)

THEORY OF PRINTING MACHINE & MACHINE COMPONENTS

(2019 Pattern) (Semester - III) (202060)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a) Write short note on pivoted block brake. [5]
- b) Define brake and gives general requirement of good brake lining material. [5]
- c) A single block brake has a brake drum diameter of 1.5 m and angle of contact is 30° . It takes 350 Nm torque at 400 rpm. [Take $\mu = 0.30$] [7]
- Determine required force P when drum rotating clockwise.

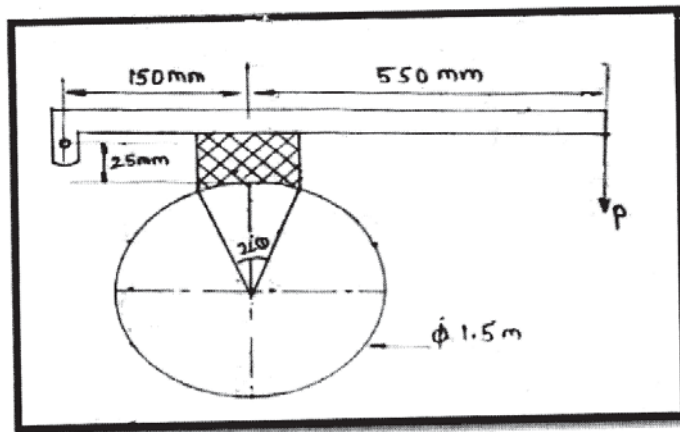


Fig. 1(c)

OR

- Q2) a) What are band brakes? Explain simple band brake with sketch. [5]
- b) Explain double block brake with neat sketch. [5]
- c) A bicycle and rider of mass 125 kg are travelling at a speed of 10 km/hr on a level road. The rider applies brake to the rear wheel which is 1 m diameter. How Far bicycle will travel before it comes to rest? Pressure applied 120 N and $\mu = 0.05$. Also find number of revolutions. [7]

P.T.O.

- Q3)** a) Derive an equation for maximum power transmitted by belt. [5]
 b) Differentiate between Belt drive and chain drive. [5]
 c) A prime mover running at 300 rpm drives DC generator at 500 rpm by belt drive. Diameter of pulley on output shaft is 600mm assume slip of 3%. Determine diameter of generator pulley if the belt running over 6mm thick. [7]

OR

- Q4)** a) Define rope drive and its types. [5]
 b) Differentiate between Flat belt and V- Belt. [5]
 c) A belt embraces the shorter pulley 165° and runs at a speed of 1700 m/min. Dimension of belt are 20 cm, thickness 8mm. Its weights 1 gm/cm^3 , $\mu = 0.25$. find maximum power transmitted if stress is $25 \times 10^5 \text{ N/m}^2$. [7]

- Q5)** The dimension of four bar chain mechanism are shown I figure,. In which link AD is fixed and the crank AB rotates at a uniform speed of 240 rpm in clockwise direction. When the crank is at 60° with horizontal. [18]

Find-

- Angular velocity of link BC and CD.
- Absolute velocity of point E of structure BEC.

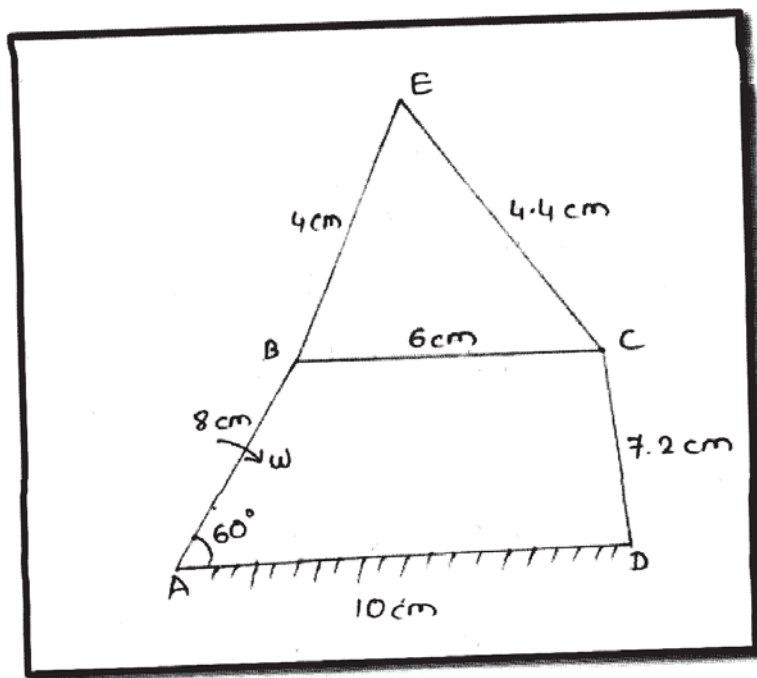


Fig. 5

OR

- Q6) For the mechanism shown in figure find the acceleration of the slider B. angular velocity of OA is 18 rad/s. [18]

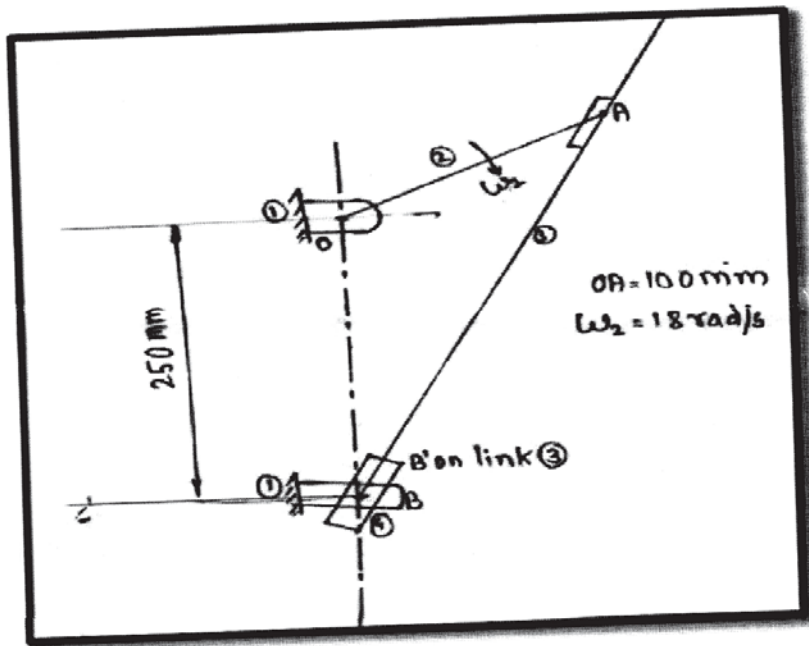


Fig. 6

- Q7) In a four-bar chain mechanism. The angular velocity of MO is 4 rad/s clockwise, angular acceleration of OM is 12 rad/s^2 anticlockwise for a given position of crank OM. [18]

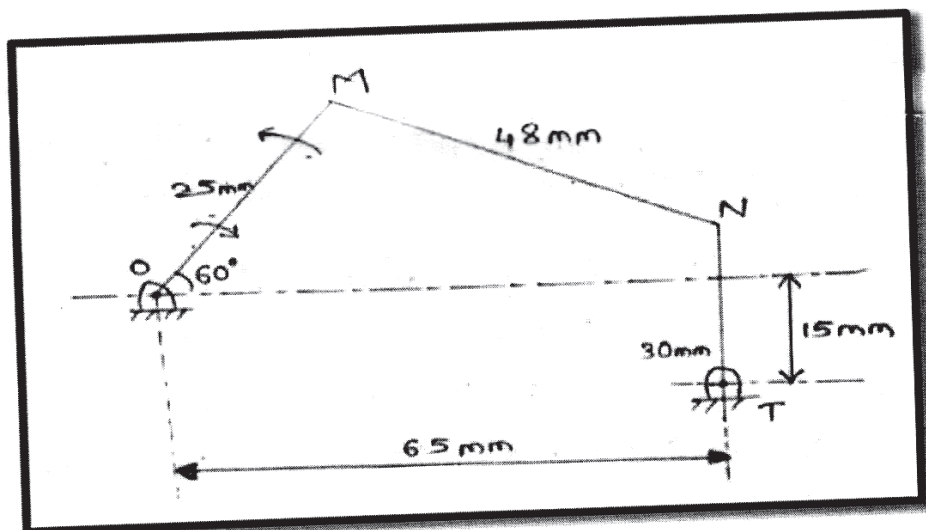


Fig. 7

OR

- Q8)** Figure shows a mechanism in which crank OA is rotating clockwise at 20 rad/s. Determine the angular velocity and angular acceleration of link BC and DE at the instant shown. [18]

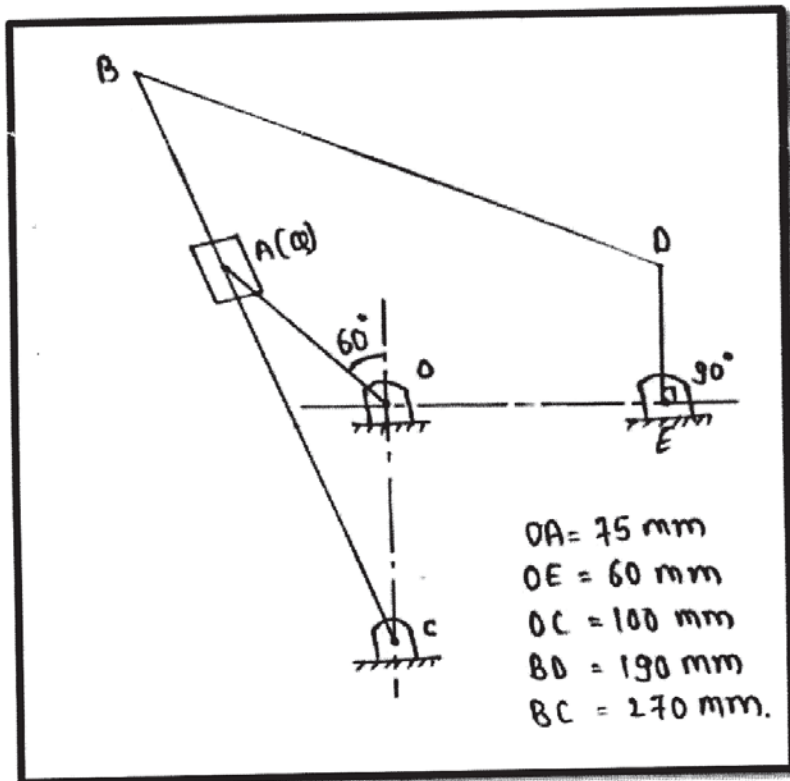


Fig. 8



Total No. of Questions : 8]

SEAT No. :

PD4142

[Total No. of Pages : 2

[6402]-103

S.E. (Printing Engineering)

INTRODUCTION TO PRINTING PROCESSES

(2019 Pattern) (Semester-III) (208281)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Describe the principle of screen printing with a neat sketch. [6]
b) What are the advantages and disadvantages of screen printing? [6]
c) Explain in brief about the aluminium screen-printing frames. [6]

OR

- Q2)** a) What are the advantages and disadvantages of wood screen printing frame. [6]
b) What is the unit for hardness of a squeegee? How is it measured? [6]
c) Write down the different types of squeegees available in the market and its suitable applications. [6]

- Q3)** a) How does mesh count affect the quality of screen printing? [6]
b) With a neat sketch explain mesh thickness and mesh opening. [6]
c) Describe polypropylene screen-printing mesh and its applications. [5]

OR

- Q4)** a) Briefly explain nylon screen printing mesh and its applications. [6]
b) What is the role of thread diameter in screen printing? [6]
c) What are the factors which affect ink film thickness in screen printing? [5]

P.T.O.

- Q5)** a) How to prepare materials for stretching in screen printing? [6]
b) What are two-part adhesives? Where it is used? [6]
c) What is grinding in screen printing? What are the steps involved in grinding? [6]

OR

- Q6)** a) What is degreasing in screen printing? What will happen if degreasing is not done properly? [6]
b) What is the purpose of base coat in screen printing? Generally what color is used for base coat in screen printing. [6]
c) Describe the various screen stretching methods. [6]
- Q7)** a) With a neat sketch explain the indirect screen-printing method. [6]
b) Write any six applications for screen printing in advertisement. [6]
c) Calculate the time in seconds for exposing emulsion in screen printing. The step scale value is 8 and the exposure unit light intensity is 4 mW/cm^2 . [5]

OR

- Q8)** a) How will you calculate the correct time for a screen-printing light sensitive emulsion using a step wedge? [6]
b) Write short notes on screen printing of textiles. [6]
c) What type of inks are used in the screen printing of printed circuit boards? [5]



Total No. of Questions : 8]

SEAT No. :

PD4143

[Total No. of Pages : 2

[6402]-104

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

Q1) Explain the following processes with advantages, applications and limitations.

- a) Mechanical Pulping process. **[18]**
- b) Chemical Pulping process.

OR

Q2) Explain following Properties of paper. **[18]**

- a) pH
- b) Curl
- c) Brightness
- d) Gloss
- e) Humidity
- f) Printability

Q3) Describe following polymers with properties and applications: **[17]**

- a) PE and its types
- b) OPP and its types

OR

P.T.O.

Q4) Explain following types of polymers with properties, types and applications[17]

- a) Polyethylene
- b) Polypropylene
- c) Polyvinyl chloride
- d) Polystyrene

Q5) What are varieties of corrugated ply? Explain each with details and state applications. [18]

OR

Q6) Explain glass as a packaging material with respect to its properties, advantages, limitations and applications in detail. [18]

Q7) a) What is FBB? Explain its properties and applications. [17]

b) What is SBS? Explain its properties and applications.

OR

Q8) With neat diagram, explain the method of testing. [17]

- a) Tensile strength of paper.
- b) Contact angle of a liquid on a substrate.

* * *

Total No. of Questions : 8]

SEAT No. :

PD4144

[6402]-105

[Total No. of Pages : 2

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) 1's complement of 101100 =
- b) 2's complement of 11010111 =
- c) $1011 \times 101 =$
- d) $1110 \div 10$
- e) Solve $(8 - 5)$ using 2's complement method
- f) Add 10011 and 10010
- g) Add 984 and 599 using BCD addition.
- h) $110101 - 100010$
- i) $1010010 + 0101101$

OR

Q2) a) Design half adder and half subtractor with the help of K-Map. [9]

b) Describe the design of one bit magnitude comparator using k-Map. [9]

P.T.O.

Q3) Draw the clocked T flip flop circuit explain its function table and timing diagram. [17]

OR

Q4) a) Draw and explain 3 bit synchronous up counters. [6]

b) Draw the circuits of any two combinational circuits. [6]

c) Depict Parallel in parallel out of shift register in detail. [5]

Q5) a) Describe the successive approximation ADC. [9]

b) Explain R-2R ladder type DAC. [9]

OR

Q6) Explain any 2 types of RAM memories and ROM memory in detail. [18]

Q7) a) Explain block diagram of digital computer. [8]

b) Describe any types of output devices of computer. [9]

OR

Q8) Elucidate any 2 uses of sequential and combinational circuits in the field of printing. [17]



Total No. of Questions : 8]

SEAT No. :

PD4145

[Total No. of Pages : 2

[6402]-106

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

Q1) a) Explain stator resistance starter details. **[9]**

- b) An 18.65 kW, 4 pole, 3 phase, 50Hz Induction motor has friction and windage losses are 2.5% of output. The full load slip is 4%. Calculate rotor copper loss, rotor input and shaft torque of the motor. **[9]**

OR

Q2) a) Explain star-delta starter in details. **[9]**

- b) The power input to a 3 phase induction motor is 60 kW. The stator losses are 1 kW. Find the mechanical power developed and rotor copper loss per phase. **[9]**

Q3) a) Explain types of lighting scheme. **[9]**

- b) Find total saving in electrical load and percentage increase in illumination if instead of using twelve 150W tungsten lamps, we use twelve 80 W florescent tubes. Assume, **[8]**

- i) Choke loss of 25% of rated lamp wattage.
- ii) Average luminous efficiency throughout life for each lamp is 15 lm/W and for each tube 40 lm/W.
- iii) Coefficient of utilization remains the same in both cases.

OR

P.T.O.

- Q4)** a) Write short note on flood lighting design. [9]
b) Explain requirement of good lighting scheme. [8]

- Q5)** a) Explain Vertical core type induction furnace. [9]
b) Explain high frequency eddy-current heating. [9]

OR

- Q6)** a) A slab of insulating material 150cm^2 in area and 1 cm thick is to be heated by direct heating. The power required is 400 W at 30 MHz. Material has relative permittivity of 5 and power factor 0.05. Determine the necessary voltage needed. Assume absolute permittivity is $8.854 \times 10^{-12} \text{ F/m}$. [9]
b) Write short note on Indirect Arc furnace. [9]

- Q7)** a) Explain various types of relays. [9]
b) Explain advantages of electric drive. [8]

OR

- Q8)** a) Explain selection of motors depending on load characteristics. [9]
b) Write short note on Solenoids. [8]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4146

[Total No. of Pages : 2

[6402]-107
S.E. (Printing)
FINISHING TECHNIQUES
(2019 Pattern) (Semester - IV) (208286)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Distinguish between gathering and in setting process. [6]
b) Write short note on combination folding machine. [6]
c) Explain in brief folding to paper style. [5]

OR

- Q2)** a) Distinguish between buckle and knife folding mechanism with suitable diagram. [6]
b) Write short note on folding to print style. [5]
c) Explain in brief what is folding? What are its merits? [6]

- Q3)** a) Explain in brief factors to be considered while selecting a adhesives [6]
b) Why rexine is best covering material. [6]
c) Explain in brief the effect of wet adhesives on paper and board. [6]

OR

- Q4)** a) Write short note on glue pot. [6]
b) Distinguish between hot melt adhesives and water based adhesives. [6]
c) Explain in brief the factors governing the choice of adhesives. [6]

- Q5)** a) Distinguish between embossing and debossing process. [6]
b) Write short note on lamination methods. [6]
c) Write short note on index cutting process. [5]

OR

P.T.O.

- Q6)** a) Distinguish between hot and cold foil stamping. [6]
b) Explain in detail Ruling process. [5]
c) Explain in brief wet and dry lamination methods. [6]

- Q7)** a) Calculate papers for endpapers in Quad royal size for 10,000 books in royal 8vo size with 1% wastage allowances. [9]
b) How many boards of 25"×30" size will be required for making of covers of 2,000 hard bound books in demy octavo size? Allow wastage @ 2%. [9]

OR

- Q8)** a) Calculate papers for endpapers in double crown size for 5000 books in crown 8vo size with 1 %. [6]
b) Estimate boards of 90Dkg in RA1 size for 10,000 books in A5 size. [6]
c) Calculate cost of papers for endpapers in 2RA0 size with 70 gsm @ Rs. 70 per kg for 5,000 books in A5 size. [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4147

[Total No. of Pages : 2

[6402]-108

S.E. (Printing Technology)

INTRODUCTION TO PACKAGING CONCEPTS

(2019 Pattern) (Semester - IV) (208287)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) How packaging is promoting the product in market explain in detail. **[9]**

b) What is the importance of demography. **[9]**

OR

Q2) a) How packaging is providing additional value and differentiation to the products. **[9]**

b) Explain retail market of packaging industry. **[9]**

Q3) a) Explain biological effect on product and package. **[9]**

b) What is the effect of moisture, oxygen and other gases on product inside the package. **[8]**

OR

Q4) a) Write down wood characteristics. **[8]**

b) Write down paper characteristics. **[9]**

Q5) a) Write down specific ISO standards used in packaging industry. **[9]**

b) What is the importance of quality control in packaging. **[9]**

OR

Q6) a) What is the significance of specifications in quality standards. **[9]**

b) What are the general benefits of holding ISO accreditation. **[9]**

P.T.O.

- Q7)** a) Explain the growth of pharmaceutical packaging industry in India. **[8]**
b) Explain the growth of food and beverage packaging industry in India. **[9]**

OR

- Q8)** a) What should be the specific segments can be identified for opportunities in the packaging equipment market in India. **[8]**
b) How India has become the world's fifth largest packaging industry. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD-4148

[Total No. of Pages : 2

[6402]-109

S.E. (Printing Engineering)

**MICROPROCESSOR AND MICROCONTROLLER TECHNIQUES
IN PRINTING**

(208288) (2019 Pattern) (Semester - IV)

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) Explain the different registers available in 8051 microcontroller. **[18]**

OR

Q2) Explain RAM and ROM Organization of 8051. **[18]**

Q3) Explain the addressing modes used in 8051 microcontroller. **[17]**

OR

Q4) a) Write assembly language program using 8051 instructions. **[10]**

- i) Addition of two 8 bit numbers
- ii) Movement of data from one register bank to another register bank.

b) Explain following instructions in microcontroller 8051 **[7]**

- i) **CPL C**
- ii) **MOVC A, @A+DPTR**
- iii) **ADDC A,@Ri**
- iv) **MUL AB**
- v) **MOV A, #56H**
- vi) **DEC A**
- vii) **CLR C**

P.T.O.

Q5) Describe in detail about CWR for different modes of IC 8255. **[18]**

OR

Q6) a) Describe programmable IC 8253 **[9]**

b) Explain programmable interrupt control IC 8259. **[9]**

Q7) Describe the programmable logic controller and its applications in printing industry. **[17]**

OR

Q8) Explain the use of microprocessor and microcontroller in the printing industry. **[17]**



Total No. of Questions : 8]

SEAT No. :

PD4149

[Total No. of Pages : 2

[6402]-110

S.E. (Printing Engineering)

PRINT PRODUCTION TECHNIQUES

(2019 Pattern) (Semester - IV) (208289)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q. 6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

Q1) a) State the differences between analog original and the bitmap original. What will happen if you try to print a continuous tone image directly? How will you convert a continuous tone image into a halftone image? [9]

b) Explain with a neat sketch the penumbral and the diffraction theory of light. [9]

OR

Q2) a) Explain in brief the amplitude modulated screening and the frequency modulated screening. [9]

b) Describe the under colour removal (UCR) and the grey component replacement (GCR) with appropriate sketches. [9]

Q3) a) Explain with a neat sketch the screening frequency and the screen angles for different colours in a four-colour job. [9]

b) Among the five possible ink sequences CMYK, MYCK, YMCK, KCMY and KYMC, which sequence is suitable for four colour printing. Justify your answer. [9]

OR

Q4) a) Explain in detail the verification process for offset plate before actual printing. [9]

b) Explain in detail the viewing and the illumination conditions for printed material as per ISO. [9]

P.T.O.

- Q5) a)** What is dot gain? What is optical dot gain? What is the science behind the formation of optical dot gain? [9]
- b) What is mechanical dot gain? What are the factors which affect mechanical dot gain? [8]

OR

- Q6) a)** Calculate the percentage dot area from the density of halftone area and full tone area and then factor. (i) $D_h = 1$, $D_f = 0.5$, $n = 1$ and (ii) $D_h = 1$, $D_f = 0.5$, $n = 1.6$ using Yule Nielsen equation. [9]
- b) Explain hue error and grayness with a neat sketch. [8]

- Q7) a)** Describe the demerits of offset printing and digital printing? [9]
- b) Describe the importance of relationship between designer, customer and printer in print production. [8]

OR

- Q8) a)** What is production planning and production control in print production? Describe the roles and responsibilities of printing planning and production control team. [9]
- b) Describe in brief the limitations in gravure and flexography printing. [8]



Total No. of Questions : 8]

SEAT No. :

PD4150

[Total No. of Pages : 2

[6402]-111

S.E. (Robotics & Automation Engineering)
INDUSTRIAL ELECTRONICS & ELECTRICAL TECHNOLOGY
(2019 Pattern) (Semester - III) (211501)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable additional data if necessary.
- 5) Use of non-programmable calculator is allowed.

- Q1) a)** Explain following functions used in ADC **[6]**
i) analogRead() function;
ii) analogWrite() function;
iii) analogReference() function
b) What is ADC? Write features of ADC in AtMega 328P microcontroller. **[4]**
c) Draw and explain interfacing of strain gauge with Arduino Atmega 328P. Write its algorithm. **[8]**

OR

- Q2) a)** Draw and explain interfacing of LVDT with Arduino Atmega 328P. Write its algorithm. **[8]**
b) Draw interfacing diagram of temperature sensor (LM35) with Arduino Atmega 328P. Output of LM35 is connected to Arduino analog input pin number A2. **[4]**
c) Explain the concept of PWM with waveform. **[6]**

- Q3) a)** Explain the following types of DC motors with the neat diagram. **[6]**
i) DC Series Motor;
ii) DC Shunt motor.
b) Explain construction of DC generator along with its neat diagram. **[7]**
c) Draw and explain Torque – Armature current characteristics for DC series motor. **[4]**

OR

- Q4) a)** Explain the armature resistance control method used for controlling the speed of the DC motor. Explain with neat diagram. What are the drawbacks of that method? **[7]**
b) Derive the torque equation of DC motor. **[6]**
c) Draw and explain Speed – Armature current characteristics for DC series motor. **[4]**

P.T.O.

- Q5) a)** The power input to the 550 V, 50 Hz, 6 pole, 3 phase induction motor running at 970 rpm is 45 kW. The stator losses are 1 kW and windage loss are 2 kW. Calculate [6]
- i) Slip;
 - ii) Rotor copper loss;
 - iii) Efficiency of motor.
- b) Explain power stages in three phase induction motor. [4]
- c) Explain working, principle of three-phase induction motor along with the neat diagram. [8]

OR

- Q6) a)** What is the need of the starter? Explain the star-delta starter used to start three phase induction motor, with the neat sketch. [8]
- b) Draw and explain Torque – slip characteristics for three phase induction motor. [4]
- c) A 6 pole, 50 Hz, 3-phase induction motor running at full load with 5% slip develops a torque of 155 N-m at the shaft. The friction and windage losses are 250 W, and stator iron losses amounts to 1600W. Calculate [6]
- i) Output Power;
 - ii) Rotor Copper loss;
 - iii) Efficiency at full load.
- Q7) a)** Write down two applications of the following motors. [4]
- i) Stepper motor;
 - ii) BLDC motor.
- b) Draw neat sketch of Universal motor and explain its working. [6]
- c) Explain construction and working of Linear Induction Motor with neat sketch. [7]

OR

- Q8) a)** Compare AC series and DC series motor in detail. [4]
- b) Draw the sketch of shaded pole induction motor and explain its working. [6]
- c) Explain the construction and working of the permanent magnet stepper motor with neat diagram. [7]



Total No. of Questions : 8]

SEAT No. :

PD4151

[Total No. of Pages : 2

[6402]-112

**S.E. (Robotics and Automation)
MANUFACTURING TECHNOLOGY
(2019 Pattern) (Semester - III) (211502)**

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 right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) How to do analysis of wire drawing operation. **[9]**
b) What materials are commonly used in extrusion processes, and what factors influence material selection. **[8]**

OR

- Q2)** a) Explain strip drawing operation in detail. **[9]**
b) How does die design impact the extrusion process? Provide examples of different die designs and their applications. **[8]**

- Q3)** a) List and explain fundamental principles involved in spot welding process. Also state its advantages and limitations. **[9]**
b) Explain ultrasonic welding process in detail. **[8]**

OR

- Q4)** a) Elaborate equipment/accessories needed to carry MIG operation. **[9]**
b) How does the thickness and types of base material influence the welding process and joint design? **[8]**
- Q5)** a) Explain with a neat sketch process of plasma arc machining. **[9]**
b) Compare conventional machining process to non-conventional machining process. Also write advantages and limitations of both processes. **[9]**

OR

P.T.O.

- Q6)** a) Discuss laser electrochemical machining in detail. [9]
b) Explain working principle of EDM. [9]

Q7) Write a short note on:

- a) Emerging trends or future directions in the field of robotics and their potential impact on various industries. [6]
b) Assembly of parts using robot. [6]
c) Application of robot for painting work. [6]

OR

Q8) Write a short note on:

- a) Application of robotics in press working operation. [6]
b) Utilization of robotics in manufacturing process. [6]
c) Advantages of robotics in pharmaceutical industry. [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4152

[6402]-113

[Total No. of Pages : 2

S.E. (Robotics & Automation Engineering)
MATERIALS SCIENCE AND ENGINEERING METALLURGY
(2019 Pattern) (Semester - III) (211503)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Attempt Q.1 or Q.2, Q.3 or Q. 4, Q.5 or Q. 6, Q.7 or Q.8.*
- 2) *Assume Suitable data if necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat figures whenever necessary.*
- 5) *Use of scientific calculators is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

- Q1)** a) What is conditioning of metal powders? Why is it done? [8]
- b) Explain Term : [8]
- i) Electrical Contact Materials.
 - ii) Cermets.

OR

- Q2)** a) Write down the process of powder metallurgy in brief. [8]
- b) Write note on : [8]
- i) Diamond impregnated Cutting Tools.
 - ii) Cemented carbide tipped tools.

- Q3)** a) What is steel? What is meant by eutectoid, hypereutectoid and hypoeutectoid steel also draw its microstructure? [10]
- b) Classify Cast Iron? And give its application. [8]

OR

P.T.O.

- Q4) a)** Define following. [10]
- i) Ferrite
 - ii) Austenite
 - iii) Pearlite
 - iv) Cementite
 - v) Bainite
- b) Explain the following with neat diagram : [8]
- i) Sensitization of steel.
 - ii) Eutectic transformation.

- Q5) a)** Write note on Transformation products of austenite. [9]
- b) What is purpose of Tempering? Give its classification and explain types of tempering heat treatment process. [9]

OR

- Q6) a)** What is temper embrittlement? How it is avoided? [9]
- b) Write note on : [9]
- i) Carburizing.
 - ii) Nitriding.
 - iii) Carbonitriding.

- Q7) a)** Give composition and properties of any three bearing materials. [9]
- b) Write Note on Composite Material and Sports Materials. [9]

OR

- Q8) a)** Write note on Super alloy. [9]
- b) Write Note on Aluminum and its Alloy. [9]



Total No. of Questions : 8]

SEAT No. :

PD4153

[Total No. of Pages : 2

[6402]-114

S.E. (Robotic and Automation)

**INDUSTRIAL ENGINEERING AND MANAGEMENT
(2019 Pattern) (Semester - IV) (211508)**

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 right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

Q1) a) Describe the entrepreneur's role and task. [5]

b) Following data is available for ABC company; [12]

Selling Price per unit = Rs. 110

Variable cost per Unit = Rs. 70

Fixed cost = Rs. 1,00,000

Total units sold = 20,000

Calculate:

- i) PV ratio
- ii) BEP in units
- iii) BEP in sales
- iv) Total Profit
- v) Margin of Safety

OR

Q2) a) Describe the characteristics of an entrepreneurship. [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

P.T.O.

- Q3) a)** Define Industrial Engineering. What are the functions carried out by an Industrial Engineer? Describe any four tools and techniques of Industrial Engineering. **[9]**
- b)** Describe Taylor Piece Wage System and Merrick Piece Wage System with suitable illustration. State the advantages and limitations of these systems. **[8]**

OR

- Q4) a)** Define Basic work content. Describe the factors which affects the basic work content (i.e. excess work content) **[9]**
- b)** Describe Halsey plan and Rowan plan of wage and incentive system with their characteristics, advantages and limitations. **[8]**
- Q5) a)** Describe principles of motion economy related to **[10]**
- i) Work place
- ii) Design of equipment and tools.
- b)** Describe SIMO chart with suitable illustration and appropriate symbols. **[8]**

OR

- Q6) a)** Describe Micro motion study. Describe various therbligs used in Micro motion study. **[9]**
- b)** Describe Man-Machine chart with appropriate symbols **[9]**
- Q7) 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)	1500
Total number of units produced during study	9000
Total number of observations	750
Number of observations of productive work	600
Number of observations of machine controlled work	400
Average performance rating	100
Total allowances (%)	15

OR

- Q8) a)** Describe various types of allowances used in time study. **[8]**
- b)** Describe MTM and MOST with suitable illustration. **[10]**

* * *

[6402]-115

S.E. (Robotics & Automation Engineering)
CONTROL SYSTEM ENGINEERING
(2019 Pattern) (Semester - IV) (211509)

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 right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1) a)** Explain Routh Hurwitz Stability Criteria. **[9]**
b) If $G = K/S (S+6) (S+8)$ and $H(S) = S+2$. Comment on stability. **[8]**

OR

- Q2) a)** What is stability? Explain stable, unstable, marginally and conditionally stable system with locations of roots in s plane. **[9]**
b) i) The System with Characteristics Equation $Q(S) = S^3 + 2KS^2 + (K+2)S + 4 = 0$ find range of K for stability
ii) Investigate the stability of system with Characteristics equation $Q(S) = S^5 + 5S^4 + 10S^3 + 10S^2 + 5S + 1 = 0$

[4+4=8]

- Q3) a)** Define phase margin and gain margin. Also draw a 40db/dec line passing through $w = 1$, 5 db till $w = 5$. **[8]**
b) What is frequency domain analysis? Explain any one stability criteria used in frequency domain to check the stability of system. **[9]**

OR

- Q4) a)** Draw the polar plot for $(S) = 1 + as$. **[8]**
b) Derive the expression for Resonant Frequency and Resonant Peak **[9]**

- Q5) a)** Define PLC? What are the necessity of PLC? Give advantages and disadvantages of PLC. **[9]**
b) State the sampling theorem explain the process of sampling and quantization with waveform. **[9]**

OR

P.T.O.

Q6) a) Explain digital control system in detail. Enlist its advantages and Applications. **[9]**

b) Explain the selection criteria used for PLC. **[9]**

Q7) a) Enlist phase lead design steps using bode diagram with effects, advantages, disadvantages of phase lead compensation. **[9]**

b) Explain the procedure to design of lag compensator using root locus. **[9]**

OR

Q8) a) Design a lead compensator for the system with open loop transfer function $G(S) = 9/S(S+3)$ to meet following specifications. **[11]**

i) Steady state error for ramp input be less than or equal to 0.05

ii) Phase margin of at least 45 degree.

b) Explain the Procedure to design of lead compensator using root locus. **[7]**

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4155

[Total No. of Pages : 4

[6402]-116

S.E. (Robotics & 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) Explain Along with Sketch different Types of Screw Threads. [4]
- b) Derive expression for efficiency of square threads and Maximum efficiency of square threads. [8]
- c) An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300mm/min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate power of the motor. [6]

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 [9]

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

P.T.O.

- b) The lead screw of a lathe has single-start ISO metric trapezoidal threads of 52 mm nominal diameter and 8 mm pitch. The screw is required to exert an axial force of 2 kN in order to drive the tool carriage during turning operation. The thrust is carried on a collar of 100 mm outer diameter and 60 mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30 rpm. Calculate (i) the power required to drive the lead screw; and (ii) the efficiency of the screw. [9]

Q3) a) List out the Different Material Used in Spring. [5]

- b) Define the Following Terms : Solid length, Free length, Spring index, Spring rate. [4]

- c) 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]

OR

Q4) a) Explain the concept of Surge in Springs. [4]

- b) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, $G = 84 \text{ kN/mm}^2$. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. [6]

- c) At the bottom of a mine shaft, a group of 10 identical close coiled helical springs are set in parallel to absorb the shock caused by the falling of the cage in case of a failure. The loaded cage weighs 75 kN, while the counter weight has a weight of 15 kN. If the loaded cage falls through a height of 50 metres from rest, find the maximum stress induced in each spring if it is made of 50 mm diameter steel rod. The spring index is 6 and the number of active turns in each spring is 20. Modulus of rigidity, $G = 80 \text{ kN/mm}^2$ [7]

Q5) a) Write a short note classification of Gear. [4]

- b) Comparison Between Involute and Cycloidal Gears Explain. [4]

- c) 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 can be taken as $Y = 0.154 - 0.912 / \text{No of Teeth}$ and Velocity factor $C_v = 3/3+v$ [10]

OR

- Q6)** a) Explain Causes of Gear Tooth Failure in detail. [4]
- b) A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 r.p.m. and the speed of the compressor shaft is desired to be 200 r.p.m. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine: 1. Module and face width of the gears using 20 degrees' stub teeth, and 2. Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor. [9]
- c) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. [5]
- Q7)** a) Explain in Details Types of Bearing. [4]
- b) A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing. [7]
- 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. [6]

OR

- Q8)** a) Write A short on Lubrication and Mounting of Bearing. [5]
- b) A 22KW, 1440 rpm Electric Motor is directly coupled to a shaft of 25 mm diameter, which supported by cylindrical roller bearing. The shaft transmits power to another line shaft through the flat pulley of 300 mm diameter which is placed mid-way between two bearing. The coefficient of friction between the belt and pulley.is 0.3,while angle of lap is 180° . The belt is horizontal, the load factor is 1.5 if expected life is 50,500 hours, select bearing from manufacturing catalogues Bearing No - NU2205 and NU-2305 having basic dynamic Capacity C KN is 15.99 and 31.39 Respectively. [8]
- c) Write a short note on Selection of Bearing Life [4]



Total No. of Questions : 8]

SEAT No. :

PD-4156

[Total No. of Pages : 2

[6402]-117

S.E. (Robotics & Automation)
METROLOGY & QUALITY ASSURANCE
(2019 Pattern) (Semester - IV) (211511)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat Diagram must be drawn wherever necessary.*
- 5) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

Q1) a) Sketch & describe gear tooth vernier caliper. [8]

b) Explain with neat sketch Floating Carriage Micrometer. [9]

OR

Q2) a) Derive an expression for measuring of effective diameter using Two Wire Method. [8]

b) Explain the Base Tangent Method & Derive an expression for the value of base tangent length. [9]

Q3) a) Draw & Explain OC curve. [9]

b) Explain with suitable example Process capability & Natural Tolerance. [9]

OR

Q4) a) Differentiate between Random (Chance) Causes & Assignable (Special) Causes. [9]

b) What is Statistical Quality Control? State its Objectives & Advantages. [9]

Q5) a) Write a short note on Q.F.D. [8]

b) Write a short note on Total Quality Management. [9]

OR

P.T.O.

- Q6)** a) With neat sketch explain Juran's Trilogy. [8]
b) Explain any three new quality control tools with neat sketch. [9]

- Q7)** a) Explain history & evolution of ISO 9000 series. [9]
b) Explain function, methodology, and advantages of quality audit. [9]

OR

- Q8)** a) Explain the Concept of ISO 14000. [9]
b) State & Explain prerequisites for implementing ISO 9000 quality standards. [9]



[6402]-118
S.E. (Robotics and Automation)
COMPUTER GRAPHICS FOR ROBOTICS
(2019 Pattern) (Semester - IV) (211512)

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) Use of Calculator is allowed.
- 4) Assume the suitable data, if necessary.
- 5) Neat diagrams must be drawn wherever necessary.

- Q1) a)** For the following data, predict y at $x = 1.5$ using forward difference method. **[12]**

x	1	3	5	7
y	8	5	6	10

- b) Explain with suitable example, the application of finite difference method for 3D interpolation. **[5]**

OR

- Q2) a)** For the following data, use inverse distance weighting method to interpolate at $x = 2, y = 1$. **[10]**

x	0	1	2	3
y	1	3	2	2
z	20	58	23	105

- b) Explain with suitable example: Lagrange method of interpolation. **[7]**

- Q3) a)** A line with end point (3, 5,0) and (6, 2, 0) is revolved about x -axis by 360° to generate surface of revolution. Obtain the point on this surface for $t = 0.4$ and $s = 0.6$. Where t is parameter for line and s is parameter for revolution. **[7]**

- b) Explain with suitable example the steps to obtain x, y , and z co-ordinate of a point on the quadratic Bазier surface patch using given control points. **[10]**

P.T.O.

OR

- Q4)** a) Explain the applications of B spline and Bezier curves in robot path planning. [10]
b) Derive an equation of a point on Cubic spline surface in matrix form.[7]

- Q5)** a) Determine the point of intersection of following two lines: Line AB: A(6,8,4), B(12,15,4) and Line CD: C(6,8,2), D(12,15,6). [10]
b) Explain the method to obtain equation of line of intersection of two given planes. [8]

OR

- Q6)** a) A plane contains vectors $a = 5i + 32j - 2k$ and $b = i + 2k$. A point in the plane is (2, 3, 1). Obtain the equation of plane. [10]
b) A triangle has vertices P1(2, 3), P2(5, 5), P3(4, 7). Determine whether point P(3, 5) lies inside the triangle, outside triangle or on the edge. If it is on the edge then mention that edge. [8]

- Q7)** a) Demonstrate with example, the outer product of 2 vectors in 3 dimensional space. [9]
b) Explain the applications of applied geometric algebra for modelling of robotics physics. [9]

OR

- Q8)** a) What do you mean by an outer product? What are the properties of outer product? [9]
b) Show that the multiplication of basis blades e_{12} and e_{13} is $-e_{23}$. [9]



Total No. of Questions : 8]

SEAT No. :

PD4158

[Total No. of Pages : 5

[6402]-119

S.E. (Automobile & Mechanical/Mechanical S.W/Automation & Robotics)

SOLID MECHANICS

(2019 Pattern) (Semester - III) (202041)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.

Q1) a) The cross section of beam is as shown in fig. 1 (a)

Determine maximum tensile and compressive stresses when the beam is subjected Uniformly Distributed Load of 2 kN/m and length of span is 3m for

- i) Cantilever and
- ii) Simply supported beam. The beam resist bending moment about neutral horizontal axis. **[9]**

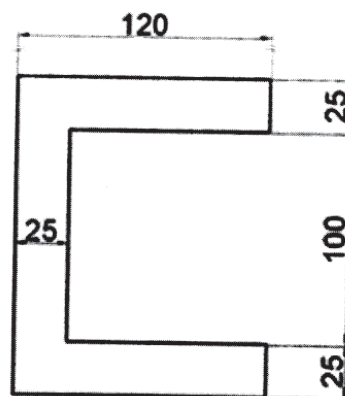


Fig. 1 (a)

All dimensions are in mm

P.T.O.

- b) A beam of symmetrical I section $200 \text{ mm} \times 400 \text{ mm}$ in size. The thickness of flange is 20 mm and web is 15 mm . The beam is carrying maximum shear force 80 kN . Find shear stress value at Neutral axis, A, B, C, D, E and F. Also draw stress distribution diagram over the depth of section. [9]

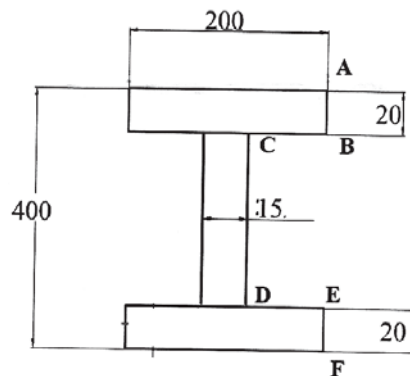


Fig. 1 (b)

All dimensions are in mm

OR

- Q2) a) A horizontal steel girder having uniform cross section of 14 m long and is simply supported at its ends. It carries two concentrated loads as shown in Fig. 2 (a)

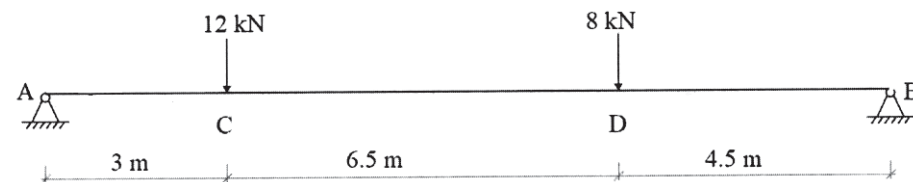


Fig. 2 (a)

Calculate the deflection of the beam under the loads C and D. Take $E = 200 \text{ GPa}$ and $I = 160 \times 10^6 \text{ mm}^4$ [9]

- b) A simply supported beam of 8 m span carrying UDL of 10 kN/m and permissible stress in the material of beam is 30 N/mm^2 . Find the dimensions. [9]

- depth (d) and
- width (b) of beam cross section, if depth to width ratio is 2.

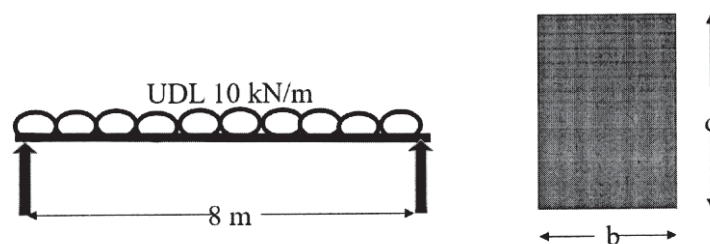


Fig. 2 (b)

Q3) a) Determine the diameter of solid shaft which will transmit 275 kW at 300 rpm. The maximum shear stress should not exceed 30 N/mm² and twist should not be more than 1° in a shaft of 2 m. The modulus of rigidity of the material is 1×10⁵ N/mm² [8]

b) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under tensile load of 60 kN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube taking a factor of safety as 5. [9]

OR

Q4) a) A solid circular bar 25 m long and 120 mm diameter was found to extend 1.2 mm under tensile load of 52 kN. The bar is used as strut. Determine crippling load and also safe load taking factor of safety as 5 with the following end conditions. [9]

Both ends are fixed

b) A composite shaft consists of copper rod of 20 mm diameter enclosed in a steel tube of 60 mm external diameter and 20 mm thick. The shaft is required to transmit to torque of 1200 N-m. Determine the shear stresses developed in the copper and steel if both the shaft have equal length and welded to a plate at each end so that their twists are equal. Take modulus of rigidity for steel as twice that copper. [8]

Q5) a) Construct the Mohr's circle for a point in the machine member subjected to pure shear of 50 MPa. Determine the maximum and the minimum stresses induced and orientation of their planes. [9]

b) A bolt is under an axial pull of 12 kN together with a transverse shear force of 6 kN. Calculate the diameter of bolt using Maximum shear stress theory. The elastic limit of bolt material is 300 MPa and Poisson's ratio = 0.3. Factor of safety is 3. [9]

OR

Q6) a) At a point in a strained material the normal stresses acting are +50 MPa and -30 MPa at a plane right angle to each other, with a shear stress of 20 MPa. [9]

Determine

i) Principal stresses and their nature

ii) Normal and tangential stresses on a plane inclined at an angle of 25° with the plane +50 MPa

b) The stresses induced at a critical point in a machine component made of steel are as follows: [9]

$$\sigma_x = 100 \text{ N/mm}^2, \sigma_y = 40 \text{ N/mm}^2, \tau_{xy} = 80 \text{ N/mm}^2,$$

Calculate the factor of safety by:

i) Maximum shear stress theory

ii) Maximum normal stress theory,

iii) Maximum distortion energy theory. Assume $S_{yt} = 380 \text{ N/mm}^2$

- Q7) a)** 4 column $1.2 \text{ m} \times 1.2 \text{ m}$ is subjected to an eccentric load 600 N as shown in fig 7 a. Find the stresses at the corner A, B, C and D. [9]

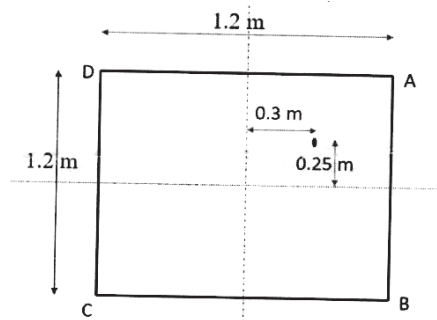
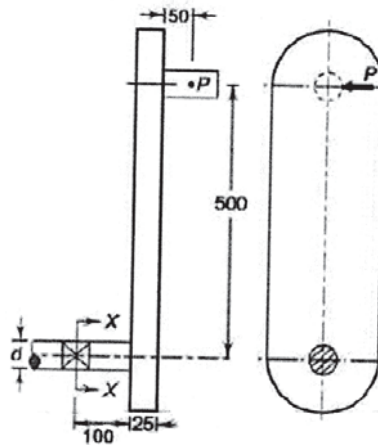


fig 7 a

- b)** The dimensions of overhang crank are shown in fig 7 b. The force P acting at crankpin is 1 kN . The crank is made of steel 30C8 with allowable shear stress 100 MPa . Using shear stress theory of failure, determine the diameter at section XX. [8]



Dimensions are in mm

Fig. 7 b

OR

- Q8) a)** A hollow circular column of external diameter (d_o) 250 mm and internal diameter (d_i) 200 mm carries projecting bracket on which a load of 20 kN rests. The center of load from center of column is 500 mm . Find the stresses at the sides of column and plot stress distribution across circular column. [9]

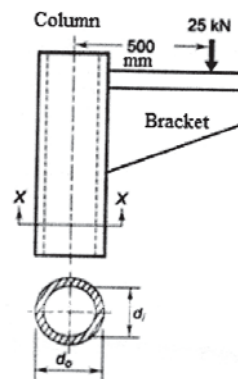


Fig 8 a

- b) The shaft of an overhang crank is subjected to a force P of 2 kN as shown in fig. 8 b. The shaft is made of 30 Mn2 steel having allowable shear strength equal to 100N/mm^2 . Determine the diameter of the shaft. [8]

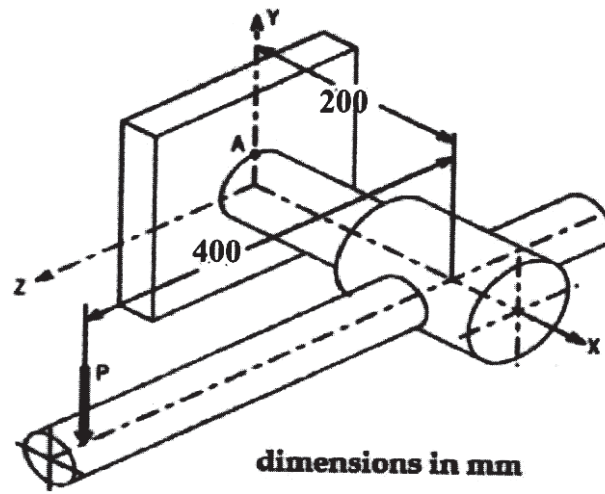


Fig. 8 b



Total No. of Questions : 8]

SEAT No. :

PD4159

[Total No. of Pages : 2

[6402]-120

**S.E. (Automobile & Mechanical Engineering/Mechanical Sandwich/
Automation and Robotics Engineering)
SOLID MODELING AND DRAFTING
(2019 Pattern) (Semester - III) (202042)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a)** Explain Boundary Representation with its advantages and disadvantages? **[8]**
- b) Explain the concept of Half Space in solid modeling with its different types. **[9]**

OR

- Q2) a)** Explain the concept of feature based modeling with its advantages and disadvantages. **[9]**
- b) What do you mean by assembly modeling? Also differentiate between bottom up assembly and top down assembly. **[8]**

- 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)** 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)
- b) What is Geometric Projection? Explain any two types of projections in details. **[10]**

- Q5) a)** Explain CAD Kernels in details with its different types. **[9]**
- b) Explain Direct Data Translators with neat sketch. **[8]**

OR

P.T.O.

- Q6)** a) What is Additive Manufacturing? Explain the 3D printing with principal of working, advantages and disadvantages? **[9]**
b) Explain the concept of CAD Geometry Clean-up with suitable example?**[8]**

- Q7)** a) Explain the concept of Product and Manufacturing Information in details with neat sketch? **[9]**
b) What is CAD customization? Explain Need for CAD Customization.**[9]**

OR

- Q8)** a) Explain Application Programming Interface in details with its advantages & disadvantages. **[9]**
b) Explain CAD Automation with types and suitable examples? **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4160

[Total No. of Pages : 3

[6402]-121

S.E.(Automobile & Mechanical Engg./Mechanical Sandwich)

ENGINEERING THERMODYNAMICS

(2019 Pattern) (Semester-III) (202043)

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 and Q.7 or Q.8.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Assume suitable data wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of steam tables is allowed if required.*

- Q1)** a) State and explain the Clausius theorem. [5]
- b) A solid metal sphere at temperature 400°C is dropped in an insulated water bath containing 10 kg water at 25°C. The water bath reaches steady state temperature of 50°C. C_p of water is 4.186 kJ/kg.K. Find the change of entropy for the metal sphere and the water bath. Comment on to the reversibility of the process. [6]
- c) Explain Availability and Unavailability. [6]

OR

- Q2)** a) State and explain the Third Law of Thermodynamics. [5]
- b) A Carnot engine receives heat from a source at 350°C causing an increase in entropy of 5kJ/kgK. The engine delivers 1000kJ/kg of work. Determine the efficiency of the cycle and lowest temperature in the cycle. [12]
- Q3)** a) State and Explain different components of Thermal Power Plant. [6]
- b) Explain the effect of following operating parameters on performance of Rankine Cycle. [4]
- i) Boiler Pressure
 - ii) Condenser Pressure

P.T.O.

- c) Explain in brief the following. [8]
- i) Enthalpy of evaporation
 - ii) Enthalpy of dry saturated steam
 - iii) Enthalpy of superheated steam
 - iv) Specific volume of wet steam

OR

- Q4)** a) Explain with the help of a neat diagram, the working of separating and throttling(combined) steam calorimeter. [6]
- b) What is Mollier Diagram or Enthalpy-Entropy Diagram for water and steam? Draw and Explain following lines on it. [12]
- i) Dryness Fraction Lines
 - ii) Constant Volume Lines
 - iii) Constant Pressure Lines
 - iv) Isothermal Lines
 - v) Isentropic Lines

- Q5)** a) Explain with a neat sketch working of Bomb Calorimeter. [8]
- b) The percentage analysis by mass of a solid fuel is as follows: C = 87%, H₂ = 3%, O₂ = 3%, N₂ = 1%, S = 1% and remaining is ash. If 50% excess air is supplied, Find: [9]
- i) Theoretical amount of air required for complete combustion of fuel.
 - ii) Total mass of flue gases.

OR

- Q6)** a) Explain with a neat labelled diagram explain working of an Orsat Apparatus. [7]
- b) Define the following terms: [10]
- i) Mass Fraction
 - ii) Mole fraction
 - iii) Stoichiometric A/F Ratio
 - iv) Theoretical air
 - v) Excess air

Q7) a) Write a short note on classification of Boilers. [5]

b) The following results are recorded during a boiler trial. [8]

Pressure of steam: 12 bar, Mass of feed water = 4500kg/hr, Temp. of feed water=75°C, dryness fraction of steam=0.96, Fuel used=490 kg/hr, Calorific value of fuel= 35700 kJ/kg, mass of dry flue gases= 18.57 kg/kg of fuel, Temp. of flue gases=300°C, Boiler house temp = 16°C, Specific heat of flue gases = 0.97 kJ/kg-K, ash and unburnt coal collected in the ash pit =2% by mass., moisture in coal = 4%by mass. Draw heat balance sheet per kg of fuel.

P(bar)	Tsat (°C)	h_f (kJ/kg)	h_{fg} (kJ/K)
12	187.96	798.4	1984.3

c) Differentiate between Boiler Mountings and Boiler accessories. [5]

OR

Q8) a) Derive an expression for height of chimney in case of Natural draught.[6]

b) Calculate the height of chimney required for producing a draught equivalent to 19mm of water. The flue gas temperature is 290°C and ambient temperature is 25°C. Amount of air required per kg of fuel is 23 kg. [6]

c) Differentiate between Low Pressure and High Pressure boilers. [6]



Total No. of Questions : 8]

SEAT No. :

PD4161

[Total No. of Pages : 2

[6402]-122

S.E. (Mechanical/Automobile/Mechanical S/w/ Automation & Robotics)

ENGINEERING MATERIALS AND METALLURGY

(2019 Pattern) (Semester - III) (202044)

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) *Figures to the right indicate full marks.*
- 3) *Use Graph paper for graphical solution.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

Q1) a) With neat labels draw Iron-Iron Carbide equilibrium diagram. [6]

b) Briefly describe the phenomenon of coring and why it occurs. Discuss undesirable consequence of coring. [6]

c) Draw a self-explanatory cooling curves for [6]

i) Binary Solid Solution Alloys

ii) Binary Eutectic Alloys

OR

Q2) a) Define Phase, System and Solid Solution? Give metallurgical example of each? [6]

b) With phase transformation mention critical temperature in Iron-Carbon equilibrium diagram. [6]

c) State Gibbs Phase rule? List application and Limitation of Gibbs Phase rule? [6]

Q3) a) Explain the austenite to pearlite transformation with a suitable sketch. [6]

b) With the help of neat sketch explain flame hardening process. Also state its application. [6]

c) Define Annealing Process? List advantages of annealing process? Gives type of Annealing with use of them? [5]

OR

P.T.O.

- Q4)** a) Draw time temperature transformation diagram. [6]
b) Explain Martempering process with a neat sketch. Also state the advantages and disadvantages of it. [6]
c) What is retain austenite. List advantages and limitation of retain austenite. [5]
- Q5)** a) Examine the effect of alloying element on alloy steel? Give suitable example? [6]
b) Define Cast Iron? State the classification of cast iron. What are the advantages of cast iron over steels? [6]
c) Explain need of Designation of Steel? State the composition of the following steel which is specified as per SAE Designation System: [5]
i) 1018
ii) 1340
iii) 4340

OR

- Q6)** a) With neat diagram explain term sensitization of stainless steel? How to avoid sensitization of stainless steel? [6]
b) Draw the microstructure of Grey Cast Iron, White Cast Iron and Nodular Cast Iron. [6]
c) What is SAE designation of materials? Explain in detail with two examples. [5]
- Q7)** a) Suggest suitable non-ferrous material for the following applications and write its composition and properties. [6]
i) Bells
ii) Bullet envelopes
iii) Measuring tapes
b) Write short note on Age Hardening? What are advantage and disadvantage of age hardening? [6]
c) Differentiate between Ferrous and Non-ferrous Materials considering industrial application and Mechanical properties? [6]

OR

- Q8)** a) Write a short note on (Composition, Properties and Applications): [6]
i) Alnico
ii) Y-Alloy
b) List Essential Properties of Bearing Materials? Suggest Bearing material for Food Processing & Heavy-duty applications in aircrafts. [6]
c) What is Additive Manufacturing? Explain required properties of additive manufacturing materials? List any two additive manufacturing materials?[6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4162

[6402]-123

[Total No. of Pages : 3

S.E. (Automobile/Mechanical/Mechanical Sandwich)
ELECTRICAL AND ELECTRONICS ENGINEERING
(2019 Pattern) (Semester - III) (203156)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Draw a neat sketch of a 4-Pole DC machine. Label main parts of it. State the function of any three parts. **[6]**
- b) A 210V, DC shunt motor runs at 1200 rpm when the armature current is 20 A. Calculate the speed if the torque developed is doubled. Given that armature resistance is 0.25 Ω . **[6]**
- c) Explain regenerative braking of a DC shunt motor with the help of neat diagrams. **[6]**

OR

- Q2)** a) Explain any one method of speed control of DC shunt motor with neat diagram. **[6]**
- b) Draw and explain the characteristics of a DC shunt motor. **[6]**
- c) A 220 V DC shunt motor with armature resistance of 0.5 Ω runs at 800 rpm on full load and draws an armature current of 20 A. If resistance of 1 Ω is added in series with armature winding, find the speed at half load condition. Assume that the flux is maintained constant. **[6]**

P.T.O.

- Q3)** a) Differentiate between a squirrel cage and a slip ring induction motor; writing any six points. [6]
- b) Draw and explain the Torque-Slip characteristics of a 3-phase induction motor with respective mathematical expressions. Clearly mark the two regions and point of maximum torque and starting torque. [6]
- c) A 3-phase, 8 pole, 50 Hz induction motor has a slip of 1% at no load and 2% at full load. Determine : [5]
- i) synchronous speed
 - ii) no load speed
 - iii) full load speed
 - iv) frequency of rotor current at standstill
 - v) frequency of rotor current at full load

OR

- Q4)** a) Derive the expression for the torque developed in a three phase induction motor under running conditions. [6]
- b) State different types of starters used for starting a three phase Induction motor and explain any one of them with the help of neat diagram. [6]
- c) The output of a three phase induction motor running at 4% slip is 38 KW. Find the rotor copper loss and motor efficiency if the stator losses and mechanical losses are 3500W and 1300W respectively. [5]
- Q5)** a) Draw the block diagram of an Electric Vehicle (EV) structure and explain the function of major parts in it. [6]
- b) Differentiate between Battery EV and Hybrid EV. [6]
- c) Draw and explain Vehicle to Grid (V2G) technology with the help of suitable block diagram. [6]

OR

Q6) a) Enlist and explain the subsystems of an Hybrid Electric Vehicle (HEV) with suitable diagram. [6]

b) Explain the configuration of a parallel Hybrid EV with suitable sketch.[6]

c) Elaborate the impact of usage of EV on power grid. [6]

Q7) a) Write voltage, specific energy, C-rate, cycle life, thermal runaway and applications of LFP battery. [6]

b) Explain the factors for selection of motors for an EV. [6]

c) What is a supercapacitor? How can it be useful in the making of an EV?[5]

OR

Q8) a) Explain the operation of a three phase induction motor drive for an EV with the help of a block diagram. [6]

b) Draw the block diagram of Battery Management System (BMS) and explain the working of it. [6]

c) Explain the use of hydrogen fuel cell in EVs. [5]



[6402]-124

S.E. (Mechanical)/(Automation & Robotics Engg.)/(Automobile & Mechanical Engg.)/(Mechanical Sandwich)

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 wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

- Q1) a)** For the engine mechanism shown in Fig. 1. The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are OA = 150mm; AB = 450 mm; PB = 240 mm; BC = 210 mm; CD = 660mm. **[10]**

Using relative velocity and acceleration method. Determine :

- i) Velocity of the slider D
- ii) Acceleration of the slider D
- iii) Angular acceleration of link CD

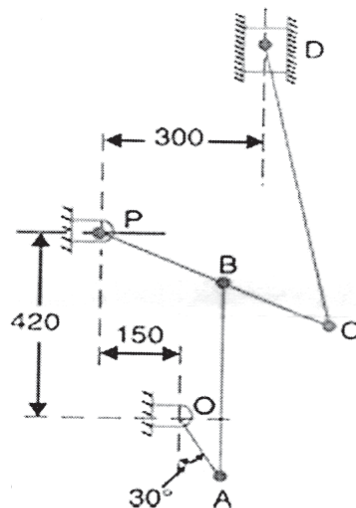


Fig.1

- b)** Explain Coriolis component of acceleration with neat sketch. **[7]**

OR

P.T.O.

- Q2) a)** The mechanism of a wrapping machine, as shown in Fig.2, has the following dimensions: $O_1A = 100\text{mm}$; $AC = 700\text{mm}$; $BC = 200\text{mm}$; $O_3C = 200\text{mm}$; $O_2E = 400\text{mm}$; $O_2D = 200\text{mm}$ and $BD = 150\text{mm}$. The crank O_1A rotates at a uniform speed of 100 rad/s . Find **[10]**
- Velocity of the point B
 - Velocity of point D
 - Velocity of point E of the bell crank lever by instantaneous Center method.

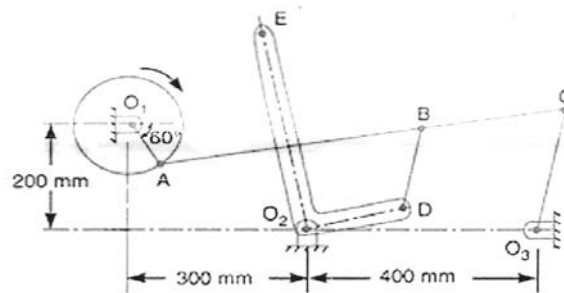


Fig.2

- Explain with neat sketch Kennedy's theorem. **[7]**
- Q3) a)** Synthesize a four-bar mechanism using inversion method with input link and output link for 3 successive positions. Assume following data. **[10]**
- Length of the fixed link is 100 mm and input link length is 30mm
 - Initial position of input link is 30° ,
 $\theta_{12} = 30^\circ$, $\theta_{13} = 60^\circ$ (Input angle = θ)
 - $\phi_{12} = 20^\circ$, $\phi_{13} = 40^\circ$ (Output angle = ϕ)
- Explain the following terms: **[8]**
 - Type synthesis
 - Number synthesis
 - Dimensional synthesis

OR

- Q4) a)** A four-bar mechanism is to be designed, by using three precision points, to generate the function $y = x^{1.5}$, for the range $1 \leq x \leq 4$ Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x , y , θ and ϕ corresponding to the three precision points. **[10]**
- Explain the following terms: **[8]**
 - Function generation
 - Path generation
 - Motion generation
 - Structural errors

Q5) a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10mm addendum. **[10]**

find :

- i) Length of path of contact,
 - ii) Length of arc of contact,
 - iii) Contact ratio.
- b)** Define in case of Spur gear: **[7]**
- i) Module
 - ii) Addendum
 - iii) Circular Pitch
 - iv) Pressure angle
 - v) Path of contact
 - vi) Arc of Contact
 - vii) Contact ration

OR

Q6) a) In an epicyclic gear train of the 'sun and planet' type shown in Fig.3. The Annulus gear D rotates at 300 rpm about the axis of fixed sun gear B which has 80 teeth. A three-Armed spider is driven at 180rpm. Determine the number of teeth required on planet C. **[10]**

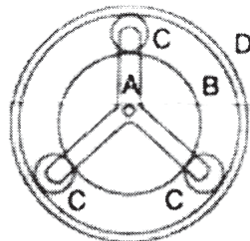


Fig 3

- b)** Define in case of helical gear. **[7]**
- i) Helix angle
 - ii) Transverse circular pitch
 - iii) Transverse module
 - iv) Normal Circular Pitch
 - v) Axial Pitch
 - vi) Lead
 - vii) Normal Module

Q7) a) A cam is to be designed for a knife edge follower with the following data: **[10]**

- i) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
- ii) Dwell for the next 30°
- iii) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
- iv) Dwell during the remaining 180°

Draw the profile of the cam when the line of stroke is offset 20mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

b) Explain with sketches the different types of cams and followers. **[8]**

OR

Q8) a) Explain **[10]**

- i) Types of automation with suitable example
- ii) Different type of transfer mechanism

b) Write Short note: **[8]**

- i) AI's Role in Manufacturing Industry.
- ii) Buffer Storages.

* * *

[6402]-124A

S.E. (Automobile & Mechanical)
KINEMATICS OF MACHINERY
(2019 Pattern) (Semester - IV) (202047)

Time : 2½ Hours]

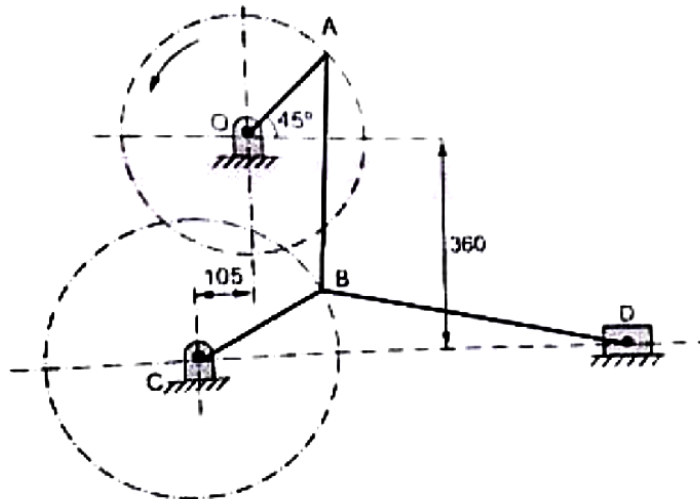
[Max. Marks : 70

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 wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data wherever necessary.

Q1) a) 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/s^2 . The dimensions of links are OA = 180 mm, CB = 240 mm, AB = 360 mm, BD = 540 mm. For the given configuration find [10]

- i) Velocity of slider D.
- ii) Angular velocity of links AB, CB and BD,
- iii) Acceleration of slider D
- iv) Angular acceleration of BD.



b) Explain velocity image principle With neat sketch.

[7]

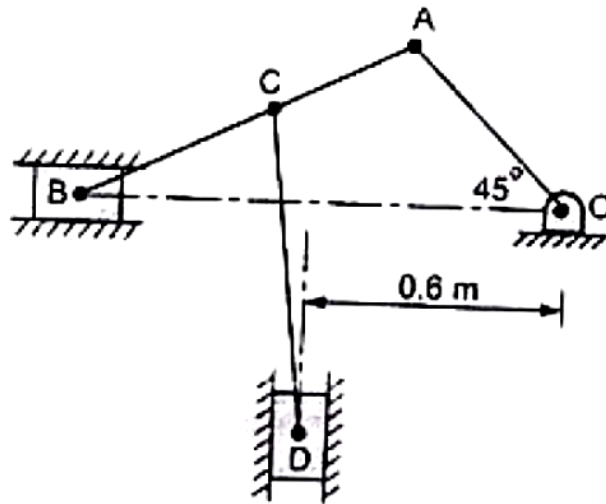
OR

P.T.O.

Q2) a) The length of various links of mechanism as shown in figure are $OA = 0.3\text{m}$, $AB = 1\text{ m}$, $CD = 0.8\text{m}$, $AC = CB$. Determine for the given configuration [10]

- 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 an ICR method.



b) Explain with neat sketch Kennedy's theorem. [7]

Q3) a) Explain with neat sketches three position synthesis of four bar chain mechanism using relative pole method [9]

b) Explain in short : [9]

- i) Type synthesis,
- ii) Number synthesis,
- iii) Dimensional synthesis

OR

Q4) a) Determine the Chebyshev spacing for function $y = x^{1.5}$ for the range of $0 \leq x \leq 3$ where three precision points are required. For three precision points determine $\theta_1, \theta_2, \theta_3$ and ϕ_1, ϕ_2, ϕ_3 , if $\Delta\theta = 40^\circ$ and $\Delta\phi = 90^\circ$ [10]

b) Explain the term path generation with neat sketch. [8]

Q5) a) Two involute gears in a mesh have a module of 8 mm and a pressure angle of 20° . The larger gear has 57 teeth while the pinion has 23 teeth. If the addenda on pinion and gear wheels are equal to one module, Find the [10]

- i) Contact ratio
- ii) Angle of action of the pinion and the gear wheel
- iii) Ratio of the sliding to rolling velocity at the
 - I) beginning of contact
 - II) pitch point
 - III) end of contact

b) State and Derive law of Gearing. [7]

OR

Q6) a) Two spiral gears in mesh have the following data :
Friction angle = 6° , Normal pitch = 19 mm, shaft angle = 50° , speed ratio = 2, approximate center distance = 37.5 cm. For the same spiral angles of the driver and driven wheel, Assume spiral gears of same hand. Determine : (i) The exact center distance ii) Number of teeth on each wheel iii) Efficiency of drive [10]

b) Explain with sketch and one example of the following : [7]

- i) Simple gear train
- ii) Compound gear train
- iii) Reverted gear train
- iv) Epicyclic gear train

Q7) a) The following data relates to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent. [10]

Minimum radius of cam = 25 mm

Roller diameter = 7.5 mm

Lift = 28 mm

Offset of follower axis = 12 mm towards right

Angle of ascent = 60°

Angle of descent = 90°

Angle of dwell between ascent and descent = 45°

Draw cam profile

b) What is Jump Phenomenon? Derive the expression for jump velocity for the eccentric cam with flat face follower system. [8]

OR

- Q8)** a) Enlist types under linear and rotary transfer mechanisms. Explain any two in each of linear and rotary transfer mechanisms. **[10]**
- b) Explain the concept of Artificial Intelligence in automation. Write any four advantages and disadvantages of Artificial Intelligence in automation. **[8]**



Total No. of Questions : 8]

SEAT No. :

PD4164

[Total No. of Pages : 2

[6402]-125

S.E. (Automobile & Mechanical)
APPLIED THERMODYNAMICS
(2019 Pattern) (Semester - IV) (202048)

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 right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

Q1) a) Explain the **[9]**

- i) Rich Air-fuel mixture
- ii) Lean Air-fuel mixture
- iii) Stoichiometric Air-fuel mixture, used at various operating condition of the engine. Show the combustible range of Air-fuel ratio on a diagram.

b) Explain with neat sketch Detonation in SI engine and state any four parameters affecting detonation. **[8]**

OR

Q2) a) What are the functions of fuel injector nozzle? Explain any three types of nozzles used in CI engines with diagram. **[9]**

b) Explain with neat sketch Knocking in CI engine and state any four parameters affecting knocking. **[8]**

Q3) a) The following observations were made during the test on an engine: B.P. of the engine = 31.5kW, Fuel used = 10.5 kg/hr, C.V. of fuel = 43,000kJ/kg, Jacket circulating water = 540 kg/hr, Rise in temperature of cooling water = 56°C. Exhaust gases are passed through the exhaust gas calorimeter for finding the heat carried away by exhaust gases. Water circulated through the exhaust gas calorimeter for finding the heat carried away by exhaust gases. Water circulated through exhaust gas calorimeter = 454 kg/hr. Rise in temperature of water passing through exhaust gas calorimeter = 36° C. Temperature of exhaust gas leaving the exhaust gas calorimeter = 82°C. A : F ratio = 19:1, Ambient temperature = 17°C, C_p for exhaust gases = 1kJ/kg.K.

Draw up the heat Balance sheet on minute basis. **[10]**

b) List various methods used to measure friction power? Explain Willian's line method with a neat sketch. State the limitations in the evaluation of friction power. **[8]**

OR

P.T.O.

- Q4) a)** State different emissions & methods to control emission? Explain any one with neat sketch? [9]
- b)** Short note on: [9]
- i) Euro Norms
 - ii) Bharat Norms

- Q5) a)** What are the harmful effects of IC engines overheating? Explain any one cooling system with neat schematic sketch? [9]
- b)** What are the different objectives of lubricating system? Desirable properties of lubricants used in automobiles. [8]

OR

- Q6) a)** What are the various methods of supercharging and explain any one method with neat sketch? [9]
- b)** Explain TCI and CDI ignition system with circuit diagram? [8]

- Q7) a)** Draw P-V and T-S diagram for a single stage reciprocating air compressor, without clearance. Derive the expression for work done when compression is isothermal and isentropic. [8]
- b)** A single stage single acting reciprocating air compressor enters at 1 bar 20°C and compression occurs following polytropic process with index 1.2 up to delivery pressure 12 bar. The compressor runs at a speed of 240 rpm and has L/D ratio of 1.8. The mechanical efficiency of compressor is 0.88. Determine isothermal efficiency and actual power required to run compressor which admits $1\text{ m}^3/\text{min}$. [10]

OR

- Q8) a)** Write the classification of rotary compressors. Compare reciprocating compressor with rotary compressor. [8]
- b)** A single cylinder single acting reciprocating compressor takes in $6\text{ m}^3/\text{min}$ of air at 1 bar & 15°C & compresses into 6 bar. Calculate the saving in the power required when the compression process is changed from adiabatic compression to isothermal compression. [10]

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4165

[Total No. of Pages : 3

[6402]-126

S.E. (Mechanical & Automobile Engg.)

FLUID MECHANICS

(2019 Pattern) (Semester - IV) (202049)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1, or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of electronic pocket calculator is allowed.

Q1) a) Define the following: [4]

- i) Path line
- ii) Stream line
- iii) Stream Tube
- iv) Streak line

b) Write various types of flow with example. [6]

c) A pipe of 40cm diameter conveying water, branches into two pipes of diameters 25cm & 20cm respectively. If the velocity in 40cm diameter pipe is 1.5m/s & that of an in 20 cm diameter pipe is 2.5m/s then determine:

Discharge in pipe of 40cm diameter. [7]

OR

Q2) a) Define stream function & velocity potential function . [4]

b) Derive an expression for continuity equation in 3-D. [6]

c) A stream function for 2-D flow is given by $\psi = 3x^2 - y^2$. Determine equation of streamline. Find the components of velocity at (2,2). [7]

P.T.O.

- Q3)** a) Explain Hydraulic Grade Line (H.G.L) & Total Grade Line (T.G.L). [4]
 b) Derive Euler's equation for flow along stream line and deduce the Bernoulli's equation from same. [6]
 c) An orifice meter with 15cm diameter is inserted in a pipe of 30cm. The pressure difference measured by a mercury oil differential monometer gives a reading of 0.5 m of Hg. If sp.gr. of oil is 0.9, Find flow rate. $C_d=0.64$. [8]

OR

- Q4)** a) Explain in short hydrodynamically smooth and rough boundaries. [4]
 b) Derive an expression for the pressure drop for a steady laminar flow through circular pipe. [6]
 c) Determine : [8]
 i) The pressure gradient
 ii) The shear stress at the two horizontal parallel plates
 iii) The discharge per meter width.
 iv) Mean velocity of oil flowing with maximum velocity of 2.5m/s. The horizontal fixed parallel plates are 150 mm apart. Take $\mu=2.5 \text{ Pa.s}$

- Q5)** a) Explain the minor losses during internal flow. [4]
 b) Explain the boundary layer separation and effect of boundary layer separation. [6]
 c) The rate of flow of water through a horizontal pipe is $0.25 \text{ m}^3/\text{s}$. The dia. of the pipe which is 200mm is suddenly enlarged to 400mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2 . Find
 i) Loss of head due to sudden enlargement.
 ii) Pressure intensity in the large pipe.
 iii) Power lost due to enlargement. [8]

OR

- Q6)** a) Explain boundary layer along a thin plate. [4]
 b) Explain siphon. Determine pressure head at summit. [6]
 c) A square plate of side 2m is moved in a stationary air of density 1.2 kg/m^3 with a velocity of 50kmph. If coefficients of drag and lift are 0.2 and 0.8 respectively. Determine [8]
 i) Lift force
 ii) Drag force
 iii) Resultant force
 iv) Direction of resultant force.

- Q7)** a) Explain dimensional homogeneity with suitable example. [4]
 b) Define: [4]
 i) Euler's Number
 ii) Mach number
 c) Using Buckingham π theorem prove that the discharge over weir is given by : [9]

$$Q = VL^2 \left[\frac{gL}{V}, \frac{H}{L} \right]$$

OR

- Q8)** a) Explain Froude's model law [4]
 b) Define [4]
 i) Reynold's Number
 ii) Froude's number
 c) The pressure drop (ΔP) in a venturimeter varies with fluid density (δ), velocity (V) at inlet diameter (D) and the diameter of throat (d). Using Buckingham's π theorem method. Obtain the relationship for pressure drop (ΔP). [9]



[6402]-127

S.E. (Automobile & Mechanical/Automation & Robotics)

MANUFACTURING PROCESSES**(2019 Pattern) (Semester - IV) (202050)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates:**

- 1) All questions are compulsory i.e. Solve Q1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q. 7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume Suitable data jf necessary and mention it clearly.

- Q1) a)** Explain Punching and Blanking operations with neat sketch. Name any 2 components manufactured using each operation. **[6]**
- b)** A cup without flanges and height 190 mm and diameter 90mm is to be drawn from sheet metal 1mm thickness with ultimate tensile strength 300 MPa. The corner radius is 1.6mm. Assume percentage reduction of 45%, 35%, 25% etc. for each draw without annealing. (consider trimming allowance 3.2 mm for 25mm diameter). $C = 0.6$ for drawing pressure. Find i) Blank size. ii) Percentage reduction, iii) Numbers of draws. iv) Drawing pressure. **[12]**

OR

- Q2) a)** Explain strip layout with suitable example? **[6]**
- b)** Find centre of pressure for a MS part as shown in fig. 1. with 1 mm thickness. Take ultimate shear strength of MS as 200 MPa **[12]**

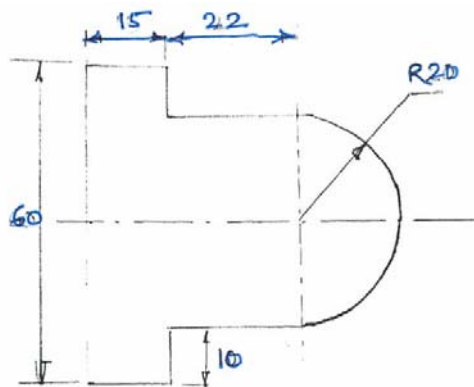


Fig. 1

P.T.O.

- Q3)** a) Explain Submerged Arc Welding process with neat sketch? [6]
b) Classify welding process. Explain Arc welding process. [6]
c) List defects in welding joints and discuss its remedies. [5]

OR

- Q4)** a) Differentiate between soldering and brazing [6]
b) Explain spot and projection resistance welding. [6]
c) Explain working principal of Tungsten inert Gas welding with neat sketch. [5]

- Q5)** a) Discriminate between thermoplastic and thermosetting. [6]
b) Explain transfer molding process with neat sketch. [6]
c) Explain Injection molding process with neat sketch. Name any 3 application of it. [6]

OR

- Q6)** a) Discriminate Pressure forming and Vacuum forming process. [6]
b) Explain Rotational molding process. Name any 4 application of it. [6]
c) Explain plastic extrusion process with neat sketch. Name any 3 application of it. [6]

- Q7)** a) Describe metal matrix composites. [6]
b) Describe ceramic matrix composites. [6]
c) Explain spray lay-up composite manufacturing process. [5]

OR

- Q8)** a) Explain Hand lay-up composite manufacturing process. [6]
b) Explain Resin transfer molding process. [6]
c) Explain vacuum bag molding composite manufacturing process. [5]



Total No. of Questions : 9]

SEAT No. :

PD-4167

[Total No. of Pages : 5

[6402]-128

S.E. (Automobile & Mechanical/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 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) Choose the correct option.

- i) Mean and variance of binomial distribution are 6 and 2 respectively. The value of p is [2]

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

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

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

d) 1

- ii) The curve is given by $\vec{r} = t\vec{i} + 2t\vec{j} + t^2\vec{k}$ then tangent vector to the curve at $t = 1$ is [2]

a) $\vec{i} + 2\vec{j} + 2\vec{k}$

b) $\vec{i} - 2\vec{j} + 2\vec{k}$

c) $\vec{i} + 2\vec{j} - 2\vec{k}$

d) $\vec{i} - 2\vec{j} - 2\vec{k}$

- iii) Coefficient of variation of the data 1,3,5,7,9 is [2]

a) 54.23

b) 56.57

c) 55.41

d) 60.19

P.T.O.

- Q3) a)** The scores obtain by two batsman A & B in 10 matches are given below. Determine who is more consistant and who is batter run gether? [5]

Batsman A	30	44	66	62	60	34	80	46	20	38
Batsman B	34	46	70	38	55	48	60	34	45	30

- b) A simply supported beam carries a concentrated Load $p(\text{kg})$ its middle point. Corresponding to various values of P , the maximum deflection Y cms is tabulated as : [5]

P	100	120	140	160	180	200
Y	0.90	1.10	1.20	1.40	1.60	1.70

Find a law of the form $y = aP + b$ by using least square method.

- c) Determine the equation of regression lines for the following data. [5]

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

and obtain an estimate of y for $x = 4.5$.

- Q4) a)** A has 2 tickets in a lottery in which there are 3 prizes and 5 blanks; B has 3 tickets in a lottery in which there are 4 prizes and 6 blanks. Show that A' chance of success is to B's as 27:35. [5]

- b) The number of industrial injuries per week in a particular factory follows a poisson distribution with mean 0.5. Find the probability that during a week, there will be at the most one injury. [5]

- c) The height of students in a class follows a normal distribution with mean 190 cm and variance 80 cm^2 . Among the 1,000 students from the school, how many are expected to have height above 200 cm? [5]

[Given : $z = 1.118, A = 0.3686$]

OR

- Q5) a)** An urn contain 10 white and 3 black balls, white another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second urn and then ball is drawn from the latter. What is the probability that it is a white ball? [5]

- b) A fair coin is tossed 5 times. What is the probability of getting at least two heads? [5]

- c) The theory predicts the proportion of bean in the four groups A,B,C and D should be 9:3:3:1. In an experiment among 1600 beans, The numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? [Given $\chi^2_{3,0.05} = 7.815$] [5]

Q6) a) Find the angle between tangents to the curve [5]

$$\vec{r} = t^3 \vec{i} + 4t \vec{j} + 2t^2 \vec{k} \text{ at } t = 0, t = 1$$

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

c) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = x^2 \vec{i} + 2xy \vec{j} + z \vec{k}$ where C is the straight line joining (0,0,2) to (3,1,1). [5]

OR

Q7) a) Show that $\vec{F} = (2xz^3 + 6y)\vec{i} + (6x - 2yz)\vec{j} + (3x^2 z^2 - y^2)\vec{k}$ is irrotational. Find scalar potential ϕ such that $\vec{F} = \nabla \phi$. [5]

b) Solve any one [5]

i) Show that $\vec{b} \times \nabla [\vec{a} \cdot \nabla \log r]$

$$= \frac{\vec{b} \times \vec{a}}{r^2} - \frac{2(\vec{a} \cdot \vec{r})}{r^4} (\vec{b} \times \vec{r})$$

ii) Show that $\nabla^2 (r^5 \log r) = r^3 (30 \log r + 11)$

c) Use Stoke's theorem evaluate [5]

$\iint_S (\nabla \times \vec{F}) \cdot d\vec{s}$ where $\vec{F} = 3y\vec{i} - xz^2\vec{j} + yz\vec{k}$ S is surface of paraboloid $2z = x^2 + y^2$ bounded by $z = 2$.

Q8) a) The temperature at any point of the insulated metal rod of one meter length $l = 1$ is governed by the differential equation [8]

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

Find the temperature $u(x,t)$ subject to the following conditions.

i) $u(0,t) = 0^\circ \text{C} \forall t$,

ii) $u(l,t) = 0^\circ \text{C} \forall t$,

iii) $u(x,0) = 40^\circ \text{C}$

b) A string is stretched and fastened to two points l apart, motion is

stretched by displaying the string in the form of $u = a \sin\left(\frac{\pi x}{l}\right)$ 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 plate is bounded by parallel edges in y - direction and an end at right angles to them. The breadth of the plate is π . This end is maintained at the constant temperature 40°C ($u(x,0) = 40, 0 < x < \pi$) at all points and other edges at zero temperature. Find the steady state temperature $u(x,y)$. **[8]**

b) Using Fourier sine transform solve the partial differential equation

$$\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0 \text{ subject to} \quad \text{[7]}$$

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

ii) $u(x,0) = e^{-x}, x > 0,$

iii) $u \text{ and } \frac{\partial u}{\partial x} \rightarrow 0 \text{ as } x \rightarrow \infty$



Total No. of Questions : 8]

SEAT No. :

PD4168

[Total No. of Pages : 3

[6402]-129

S.E. (Mechanical Sandwich)

FLUID MECHANICS AND MACHINERY

(2019 Pattern) (Semester - IV) (202062)

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

Q1) a) Explain the following Dimensionless number along with mathematical expressions: **[8]**

- i) Reynolds Number
- ii) Froude's Number
- iii) Euler's Number
- iv) Weber Number

b) Derive an expression of velocity and Shear stress distribution for laminar flow between fixed Parallel plates. **[9]**

OR

Q2) a) Explain the concept of equivalent pipe and derive Dupit's Equation. **[8]**

b) Assuming the viscous force F exerted by a fluid on sphere of diameter D depends on viscosity (μ), mass density (ρ) and velocity of sphere (v). Obtain expression for the viscous force. **[9]**

Q3) a) State the difference between impulse and reaction turbine. **[9]**

b) A 7.5 cm diameter jet having velocity of 12m/s impinges on a smooth plate at an angle of 60° to the normal to the plate. What will be the force when

- i) The plate is stationary and
- ii) When the plate is moving in the direction at jet at 6m/s. Determine the work done per second on the plate in each cases. **[9]**

OR

P.T.O.

Q4) a) Explain the term unit speed, unit discharge and unit power And derive the expression for the same. [9]

b) A Pelton wheel has 2.5m of diameter operates under a following conditions [9]

Net Head = 300m

Speed = 300 rpm

Jet deflection angle = 165°

$C_v = 0.98$, Jet Diameter = 0.2m

Relative velocity at outlet = 0.95 times relative velocity at inlet.

Mechanical efficiency = 95%

Calculate the power delivered by the runner, Specific speed, Hydraulic Efficiency, Overall efficiency and Draw velocity triangle.

Q5) a) Compare Francis and Kaplan Turbine. [9]

b) A Kaplan Turbine working under head of 20m develops 11772 kW shaft power. [9]

Outer diameter = 3.5m

Hub diameter = 1.75m

Guide blade angle at extreme edge of runner is 35°

Hydraulic efficiency = 87%

Overall efficiency = 84 %

Determine:

i) Vane angle at extreme edge

ii) Speed of turbine

iii) Specific speed.

OR

Q6) a) What is specific speed of turbine? State its significance and derive an expression for the same. [9]

b) A reaction turbine works at 450 rpm under head of 120m, diameter at inlet is 120 cm and flow area is 0.4 m^2 . Angles made by absolute and relative velocity are 20° and 60° respectively at inlet. Determine [9]

i) volume flow rate

ii) Power developed

iii) Hydraulic efficiency

Assume whirl velocity at outlet is zero

- Q7) a)** What is the significance of specific speed? Derive the expression for the same for centrifugal pump. **[8]**
- b)** A centrifugal pump running at 800 rpm is working against a head of 20.2m. The external diameter of impeller is 480 mm and its width is 60mm. If the vane angle at exit is 40° and manometric efficiency is 70% find, **[9]**
- i) Flow velocity at outlet
 - ii) Absolute velocity of water leaving the vane
 - iii) Angle made by the absolute velocity at outlet with direction of motion at the outlet.
 - iv) Discharge
 - v) Specific speed

OR

- Q8) a)** Explain cavitation and NPSH in centrifugal pump. **[8]**
- b)** A centrifugal pump having outer diameter equal to two times inner diameter and running at 1200 rpm works against a total head of 75m. The velocity of flow through the impeller is constant and equal of 3m/s. The vanes are set back at width at an angle 30° at outlet. If the outer diameter of the impeller is 600mm and width at outlet is 50mm, determine: **[9]**
- i) Vane angle at inlet
 - ii) Work done per second by impeller
 - iii) Manometric efficiency

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4169

[Total No. of Pages : 3

[6402]-130

**S.E. (Mechanical Sandwich Engineering)
Manufacturing Engineering
(2019 Pattern) (Semester - IV) (202063)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) *All questions are compulsory i.e. Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data if necessary and mention it clearly.*
- 4) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Compare GTAW with GMAW welding processes with sketch. [8]

b) Demonstrate the principle of Spot Welding process in brief. How 'Heat Balance' to be obtained in resistance welding? Explain. [9]

OR

Q2) a) What is Heat Affected Zone (HAZ) in welding? Explain arc welding set-up in detail. [8]

b) Explain the method of obtaining weld in horizontal position by SAW. What are the advantages and limitations of SAW. [9]

Q3) a) Define the term i) Cutting Speed ii) Feed rate iii) Depth of cut Calculate the time required for machining a work-piece 50 mm diameter 350 mm long, turned all over in 4 passes. The approach length 10 mm and over travel is 12 mm, The feed is 0.5 mm/rev. and cutting speed is 35m/min. [9]

b) List various types of chips produced during metal cutting. Describe the conditions in which these types of chips are produced. [9]

OR

P.T.O.

Q4) a) Draw a geometry of a single point cutting tool and explain the significance of various angles. **[9]**

b) What are factors affecting tool life? The Taylor's tool-life equation for machining C-40 steel with HSS cutting tool is given by $VT^n = C$, where n and C are constant. If Cutting velocity and Tool Life is: **[9]**

V , (m/min) 35 45

T (Mim) 80 20

Calculate: i) n and C ,

ii) Recommend the cutting speed for a desired tool life of 60 mins.

Q5) a) Index for 87 divisions by compound indexing using following Plates. **[8]**

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

b) Explain the working of universal indexing head with neat sketch. Compute the index crank movement to divide the periphery of job into 60 equal divisions by simple indexing mounted with Brown and Sharpe Plate. **[9]**

OR

Q6) a) Sketch and explain following operation can be performed on drilling machine

i) Reaming,

ii) Counter-boring,

iii) Counter sinking

iv) Spot Facing **[8]**

b) A plain surface 70 mm wide and 600 mm long is to be face milled on a vertical milling machine. The machining allowance is 3 mm, to be removed in one pass. Take cutter diameter as 110 mm and cutting speed as 172.78 m/min. Find machining time, if number of teeth on the cutter is 4 and feed is 0.2 mm/tooth. **[9]**

- Q7)** a) Explain the followings in relation to grinding wheel [6]
i) Loading and Glazing ii) Dressing and Truing
b) Explain surface grinding machine with neat sketch. [6]
b) Draw a neat sketch of broach and enlist types of broaches'. [6]

OR

- Q8)** a) Draw a neat sketch of tool and cutter grinding machine and explain. [6]
b) Explain any one type of broaching machine with neat sketch. [6]
c) Explain the terms Grit, Grade and structure of Grinding Wheel. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4170

[Total No. of Pages : 4

[6402]-131

S.E. (Mechanical Sandwich Engineering)

THERMAL ENGINEERING

(2019 Pattern) (Semester - IV) (202061)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve Question no. 1 or 2, Question no 3 or 4, Question no 5 or 6, Question no 7 or 8.
- 2) Figures to the right indicate full marks.
- 3) Draw neat, well labelled sketch wherever necessary.
- 4) Assume suitable data if necessary.
- 5) Use of calculator is allowed.

- Q1) a) Explain with neat sketch Summer air conditioning system. [8]
- b) The DBT and WBT of air are 40°C and 28°C respectively. Find the following [9]
- i) Partial pressure of water vapour.
 - ii) Specific humidity.
 - iii) Relative humidity
 - iv) Enthalpy of air.

The atmospheric pressure is 1.013 bar.

OR

- Q2) a) Explain what are the factors affecting human comfort. [8]
- b) 30 m³/min of moist air at 15°C DBT and 13°C WBT are mixed with 12 m³/min of moist air at 25°C DBT and 18°C WBT. Determine Specific humidity and enthalpy of mixture. Also find DBT and WBT of the mixture assuming barometric pressure is 76 mm of Hg. Use Psychrometric chart. [9]
- Q3) a) Derive the expression for air standard efficiency of diesel cycle. [9]
- b) An engine works on Otto cycle. The initial pressure and temperature of the air are 1 bar and 40°C. Heat supplied per kg of air at the end of compression is 825 kJ. Find the temperature and pressure at all salient points if compression ratio is 6. Also find air standard efficiency of the cycle. [9]

P.T.O.

OR

- Q4) a)** Explain layout and thermodynamic cycle of turbocharging. [9]
- b) A simple gas turbine plant operating on Joule cycle, air is compressed from 1 bar and 15°C and compresses it to 6 bar and then heats to 1000 K in the heating chamber and expanded back to 1 bar. Assume isentropic efficiencies of turbine and compressor are 90 % and 85 % respectively. Calculate [9]
- i) Cycle efficiency
- ii) Work ratio

- Q5) a)** Explain the stages of combustion in SI engine. [6]
- b) What are the limitations of supercharging in SI and CI engine. [4]
- c) In a Morse test with six-cylinder petrol engine, the following data were obtained for particular setting and speed [8]
- BP when all cylinders fired = 50 kW
- BP when No 1 cylinder cut off = 40.1 kW
- BP when No 2 cylinder cut off = 39.5 kW
- BP when No 3 cylinder cut off = 39.1 kW
- BP when No 4 cylinder cut off = 39.6 kW
- BP when No 5 cylinder cut off = 39.8 kW
- BP when No 6 cylinder cut off = 40 kW
- Estimate the indicated power, friction power of the engine and its mechanical efficiency.

OR

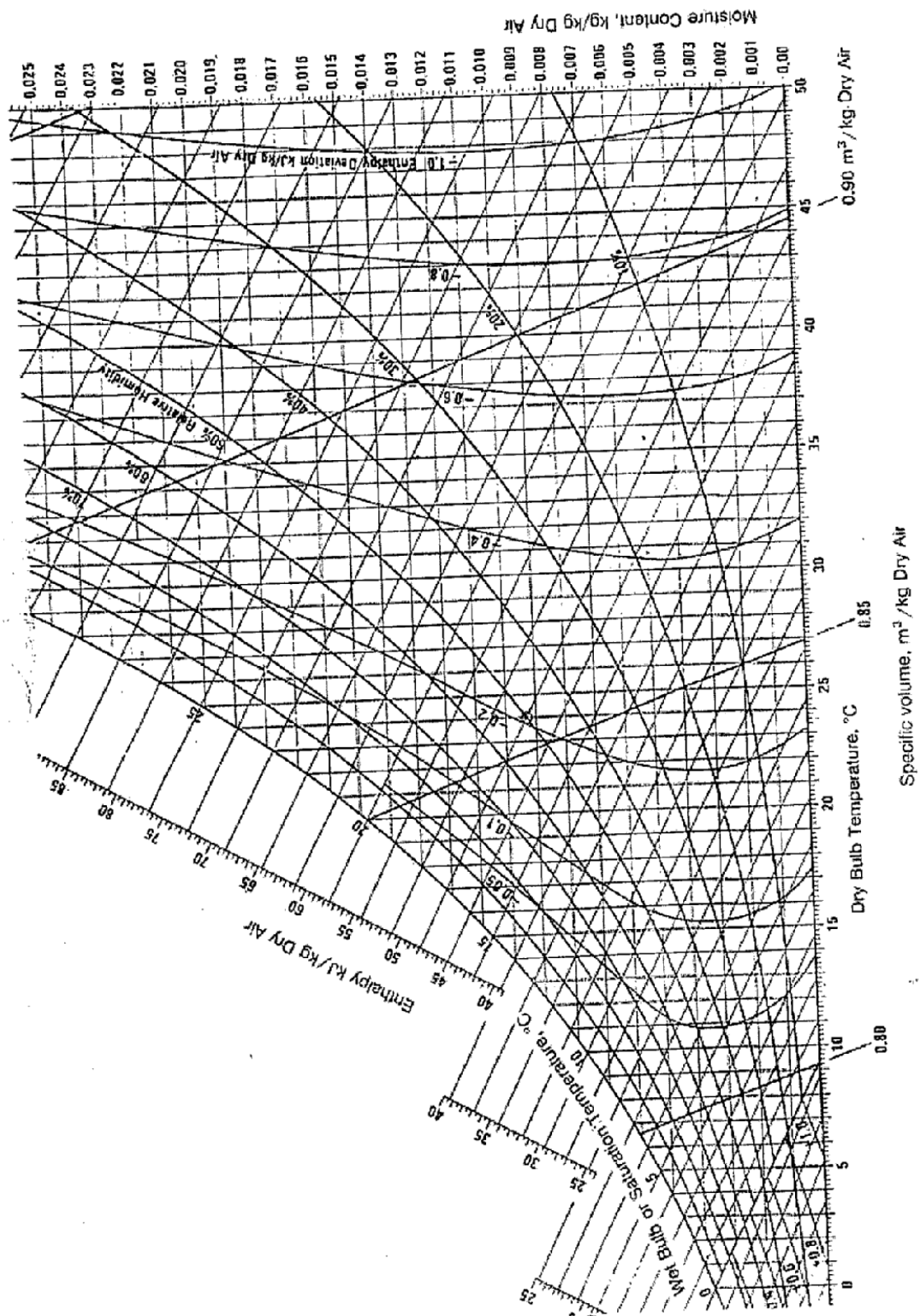
- Q6) a)** Explain with neat sketch Battery ignition system. [6]
- b) Explain the factors affecting the ignition lag in SI engine. [4]
- c) The observations were made during trial on oil engine. BP = 31.5kW, Fuel used 10.5 kg/hr, CV of fuel = 43000 kJ/kg, Jacket circulating water = 540 kg/hr, rise in temperature of cooling water = 56°C, Temperature of exhaust gas = 82°C, Ambient temperature = 17°C, C_p for exhaust gas = 1 kJ/kg, Mass of exhaust gas = 3.5 kg/min. Draw up heat balance sheet on minute basis and percentage basis. Also find brake thermal efficiency. [8]

- Q7) a)** Compare knocking in SI and CI engine. **[9]**
b) What are the different methods to find friction power of engine. Explain Willians line method. **[8]**

OR

- Q8) a)** What are different methods to control emission. Explain Catalytic converter. **[9]**
b) Explain with neat sketch flame ionisation detector (FID). **[8]**





Total No. of Questions : 8]

SEAT No. :

PD4171

[Total No. of Pages : 3

[6402]-132

S.E.(Automation & Robotics Engineering)

ELECTRICAL TECHNOLOGY

(2019 Pattern) (Semester-III) (202521)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and 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) Draw and explain the equivalent circuit of a three-phase induction motor. [6]

b) Explain the operation of stator resistance starter used for a three phase induction motor with the help of a neat schematic. [6]

c) Explain working principle of a capacitor start and run motor with the help of a suitable diagram. Also state it's any two applications. [6]

OR

Q2) a) Distinguish between squirrel cage and slip ring induction motors considering their constructional features, characteristics and applications. [6]

b) List out the methods of speed control of a 3-phase slip ring induction motor and explain any one of them in brief. [6]

c) Explain the construction and working of a linear induction motor with the help of suitable diagram. Also state it's any two applications. [6]

Q3) a) Derive an expression for induced emf of an alternator. [6]

b) State any two applications for each of the following machines: [6]

i) Stepper Motor

ii) Servo Motor

iii) Universal Motor

c) List the factors deciding the size of an electric motor for an industrial application. [5]

OR

P.T.O.

- Q4)** a) Explain the construction of a synchronous machine with the help of a suitable diagram. Mention its types. [6]
 b) What is a brushless alternator? Explain its working principle. [6]
 c) What is a duty cycle in case of electric motors? State types of duty cycles for electric motors. [5]

- Q5)** a) Draw the typical layout of structure of a power system involving generation and utilisation of electrical power. [6]
 b) Briefly discuss the advantages and operational problems of HVDC transmission system. [6]
 c) Compare the DC and AC systems for transmission and distribution of electrical power. [6]

OR

- Q6)** a) Draw the line diagram of the typical HVDC transmission system and explain it in detail. [6]
 b) Explain the necessity of EHV transmission lines as an essential part of the grid. [6]
 c) Classify the types of HVDC links. Discuss the applications of each of these links. [6]

- Q7)** a) Distinguish between open loop and closed loop control system with significant points. [6]
 b) Using Mason's gain formula, determine the transfer function $C(s)/R(s)$ for the system shown in fig. below. [6]

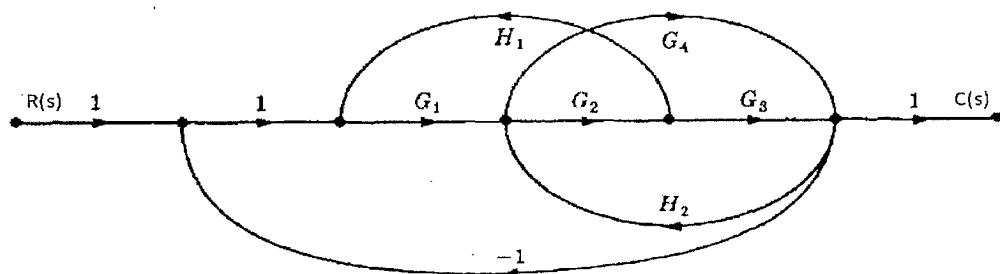


Fig. Q. 7 b)

- c) Derive the transfer function of a field controlled DC servomotor with usual notations. [5]

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) Explain the principle of working and use of a tacho-generator as a control system element. [6]
- c) Derive the transfer function of an AC servomotor with usual notations. [5]



Total No. of Questions : 8]

SEAT No. :

PD4172

[6402]-133

[Total No. of Pages : 3

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 additional 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]

OR

- 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. [6]

Inputs: I1, I2 Outputs : Q1, Q2, Q3

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

P.T.O.

- 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]

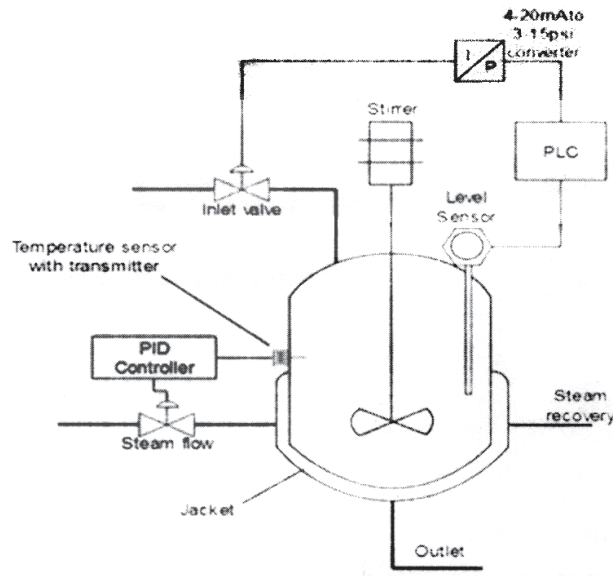
OR

- 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 SV1 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]



Total No. of Questions : 8]

SEAT No. :

PD4173

[Total No. of Pages : 2

[6402]-134

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

- Q1)** a) Differentiate between soft and hard gripper with examples. [4]
b) How is a robot end-effector specified? Discuss the design considerations in the robot end-of-the-arm tooling. [6]
c) Explain working principle of magnetic Grippers with neat sketch. [8]

OR

- Q2)** a) State the factors used for design of the gripper. [4]
b) Sketch and explain pneumatic gripper with its industrial application. [6]
c) Write short notes on: [8]
i) Contactless grippers
ii) Soft Robotic Grippers.

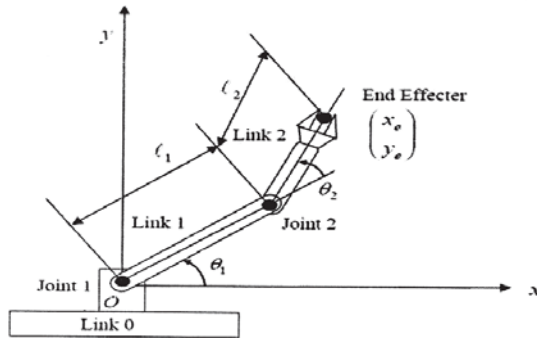
- Q3)** a) Explain the working of torque sensor with neat diagram. [4]
b) What are safety sensors? Discuss the use of light curtain in industrial robots. [6]
c) Sketch and explain the working of an ultrasonic sensor. [7]

OR

- Q4)** a) Describe the design considerations and sensor selection for robotic applications. [4]
b) Explain the characteristics of sensors used in the robotics. [6]
c) With proper diagram explain the working of optical encoder and list its applications. [7]

P.T.O.

- Q5)** a) Differentiate between forward and inverse kinematics. [4]
 b) Consider the forward transformation of the two-joint manipulator shown in fig. Given that the length of joint 1, $L_1 = 100\text{mm}$, the length of joint 2, $L_2 = 100\text{ mm}$, the angle $\theta_1 = 45^\circ$ and the angle $\theta_2 = 30^\circ$, compute the coordinate position for the end - of - the-arm P_w . [6]



- c) Discuss the major parameters of DH convention for robot manipulator.[8]

OR

- Q6)** a) What are homogeneous transformations of coordinates? Write the homogeneous transformation matrix for translation in 3D space. [4]
 b) If $a_{xyz} = (4, 3, 1)^T$ and $b_{xyz} = (6, 2, 3)^T$ are the coordinates with respect to the reference coordinate system, determine the corresponding points a_{uvw} and b_{uvw} with respect to the rotated O_{uvw} coordinate system if it has been rotated 60° about OZ axis. [6]
 c) Explain the steps involved in DH parameters for 2 P Robot. [8]
- Q7)** a) Write note on robot machine loading application. [4]
 b) What are the robot simulators? Enlist few robot simulators generally used. [6]
 c) Write a simple pick and place Robot program by using VAL Language. [7]

OR

- Q8)** a) Sketch and explain with suitable example “A Robot Program as a path in Space”. [4]
 b) Write short notes on: [6]
 i) Robot cell design
 ii) Service robots
 c) Write a program for doing nut and bolt assembly by Robot using VAL Language. [7]

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4174

[Total No. of Pages : 3

[6402]-135

S.E. (Automation and Robotics Engineering)

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 necessary.*

Q1) a) What do you understand by a pipe. Explain the losses occurring in the pipe. **[9]**

b) Two reservoirs containing water have difference of levels of 70m and are connected by a 250mm diameter pipe which is 4 km long. The pipe is tapped midway between reservoirs and water is drawn at rate of 0.04 m³/sec. Assuming friction factor =0.04, determine rate at which water enters in the lower reservoir. **[9]**

OR

Q2) a) Explain the construction and working of Siphon. **[9]**

b) A 2500 m long pipeline is used for transmission of power. 120kW power is to be transmitted through the pipe in which water having a pressure of 4000kN/m² at inlet is flowing, If the pressure drop over the length of pipe is 800kN/m² and $f = 0.006$. Find **[9]**

- i) Diameter of the pipe
- ii) Efficiency of transmission.

Q3) a) What is hydraulic actuator? Discuss its construction and working. **[8]**

b) What is ball valve? Where it is used? With the help of neat figure the construction and working of ball valve. **[9]**

OR

P.T.O.

- Q4) a)** Define control valve. Explain the classification of control valve. [8]
b) Discuss the desired characteristics of control valves. [9]

- Q5) a)** Explain the following terms related to compressor :
i) Free air delivery.
ii) Capacity of compressor
iii) Volumetric efficiency. [9]
- b)** A single stage, single acting reciprocating air compressor delivers 0.7 kg of air per min at 6 bar. The suction, temperature and pressure are 25 C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of swept volume. Assuming index of compression and expansion to be 1.3, find: [8]
i) Volumetric efficiency of the compressor.
ii) Power supplied to drive the compressor if mechanical efficiency is 85%.
iii) Speed of the compressor (R.P.M.).

OR

- Q6) a)** What is the necessity and advantages of multi-staging in air compressor? [8]
b) Determine the size of the cylinders for a single acting single stage compressor consuming 35kW. Also calculate, mean effective pressure. Intake conditions are 1 bar and 15 C and polytropic index is 1.3, speed is 100 rpm and mean piston speed is 152 m/min, delivery pressure is 6 bar. Also calculate isothermal power. Neglect clearance. [9]
- Q7) a)** Write a short note on 'Heat Pipe'. [9]
b) A plane wall is 15 cm thick of surface area 4.5m². Thermal conductivity of the wall is 9.5 W/mK. The inner and outer surface temperature of the wall are maintained at 150 C and 45 C respectively. Determine, [9]
i) Heat flow rate across the wall
ii) Temperature gradient in the flow direction
iii) Temperature of surfaces at 5 cm and 10 cm away from the inner surface.

OR

- Q8)** a) State Fourier's law of heat conduction with assumptions? Explain the concept of Thermal conductivity and thermal diffusivity. **[9]**
- b) A horizontal plate ($K=30 \text{ W/mk}$) $600 \text{ mm} \times 900 \text{ mm} \times 30 \text{ mm}$ is maintained at 300°C . The air at 30°C flows over the plate. If the convective heat transfer coefficient over the plate is $22 \text{ W/m}^2\text{k}$ and 250 W heat is lost from the plate by radiation, calculate the bottom surface of the plate. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4175

[Total No. of Pages : 2

[6402]-136

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.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Use of drawing instruments, electronic pocket calculators are allowed.
- 4) Figures to the right indicates 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]

OR

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 expression 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

OR

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]

P.T.O.

- 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 Boltzmann'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]



Total No. of Questions : 8]

SEAT No. :

PD4176

[Total No. of Pages : 2

[6402]-137

S.E. (Mechatronics Engineering)

DIGITALELECTRONICS

(2019 Pattern) (Semester - III) (217543)

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) Assume suitable data if necessary.

Q1) a) What is register? Explain with neat diagram working of left shift register. Draw necessary timing diagram. **[9]**

b) Explain the internal diagram of IC 7490. Design MOD 24 Counter using IC 7490. **[9]**

OR

Q2) a) Draw and explain ring counter using D flip-flop. Also draw the necessary timing diagram. **[9]**

b) Draw and explain 3-bit ripple UP-counter. Also draw the necessary timing diagram. **[9]**

Q3) a) Draw ASM chart for 2-bit UP counter. **[8]**

b) Draw and explain block diagram of PLD device. **[9]**

OR

Q4) a) What is ASM chart? Explain components of ASM chart. What are applications of ASM chart in digital system design? **[8]**

b) Implement the following functions using PLA : **[9]**

$$f_1(A, B, C) = m(0, 3, 4, 7)$$

$$f_2(A, B, C) = m(1, 2, 5, 7)$$

Q5) a) Explain logic family of integrated circuit in details. **[9]**

b) Draw and explain the circuit diagram of CMOS inverter. **[9]**

OR

P.T.O.

- Q6)** a) Explain the working of three input TTL NAND gate with Totem pole output. [9]
b) Explain the standard characteristics of TTL in details. [9]

- Q7)** a) What is microprocessor? Explain 8086 microprocessor with diagram.[8]
b) Explain the registers in microprocessor. [9]

OR

- Q8)** a) Explain basic Arithmetic operations using ALU IC 74181? [8]
b) Write a short note on Memory organization. [9]



[6402]-138

S.E.(Mechatronics Engineering)

ANALYSIS OF MECHANICAL STRUCTURE

(2019 Pattern) (Semester-III) (217544)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.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)** A T section with 200 mm × 50 mm and web 200 mm × 50 mm as shown in figure 1 is subjected to vertical shear force of 200 kN. Calculate the shear stress at the junction of flange and web and shear stress at the neutral axis. Sketch the shear stress distribution diagram. [9]

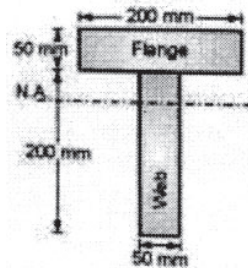


Figure 1

- b) For simply supported beam shown in figure 2. Find: [8]
- i) Slope at each end
 - ii) Deflection at C and D, Take $E=200 \text{ kN/mm}^2$ and $I = 6.5 \times 10^4 \text{ mm}^4$.

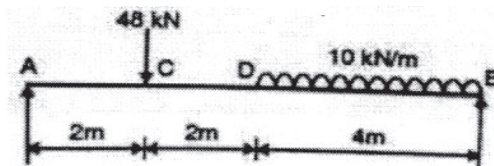


Figure 2

OR

P.T.O.

- Q2) a)** A rolled steel joist of I-section has the dimensions as shown in figure 3. The beam of I section carries a U.D.L of 40 kN/m run on span of 10 m. Calculate the maximum stress produced due to bending. Also draw the bending stress distribution across the depth of section. [9]

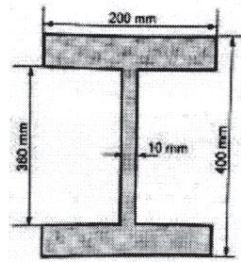


Figure 3

- b)** A simply supported beam of 8 m length is loaded as shown in figure 4. Find deflection under each load. Take $E = 210 \text{ GPa}$ and $I = 180 \times 10^6 \text{ mm}^4$. [8]

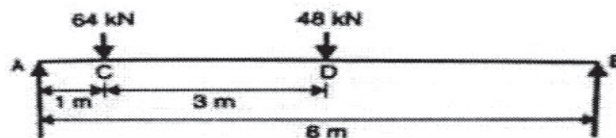


Figure 4

- Q3) a)** Figure 5 shows a horizontal shaft ABCD fixed to a rigid base at D and subjected to torques. A hole 60 mm in diameter has been drilled into the part CD of the shaft. Determine the angle of twist at the end A. Take $G = 7.7 \times 10^4 \text{ MPa}$. [9]

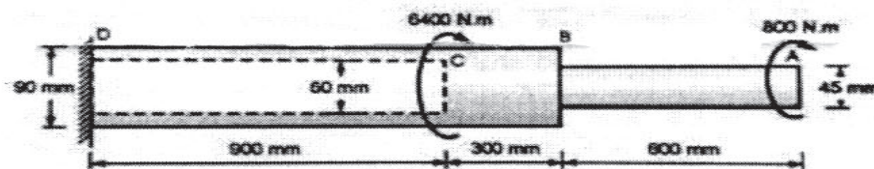


Figure 5

- b)** A steel bar of rectangular cross section $60 \text{ mm} \times 80 \text{ mm}$ and pinned at each end is subjected to axial compression. If the proportional limit of the material is 210 MPa and $E = 210 \text{ GPa}$, Determine the minimum length for Euler's equation may be used to determine the buckling load. [8]

OR

- Q4) a)** A hollow circular shaft has an external diameter of 120 mm and internal diameter of 100 mm. The maximum permissible shear stress is 100 MPa and twist is not to exceed 3.6° in length of 3 m. Maximum torque is 25 % more than average torque. The shaft is rotating at 2 RPS. If the shear modulus is 80 GPa. Find safe power that can be transmitted. [9]

- b) A solid circular 25 m long and 120 mm in diameter was found to be extended 1.2 mm under load of 52 kN. Now the same bar is used as strut. Determine critical load and safe load taking FOS = 3 with the following end conditions: [8]

- i) Both ends are fixed.
- ii) One end is fixed and other end hinged.

- Q5) a)** A plane element is subjected to stresses as shown in figure 6. Determine the principal stresses ,maximum shear stress and position of principal plane. [9]

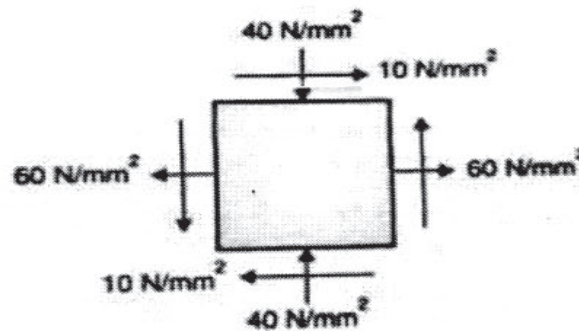


Figure 6

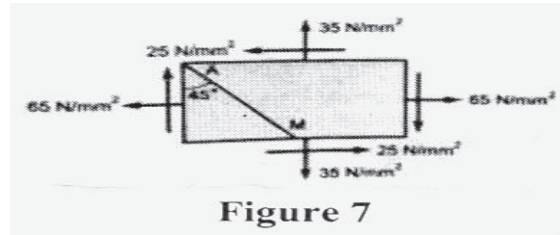
- b) A bolt is subjected to an axial pull of 40 kN and a transverse shear force of 15 kN. Determine the diameter of the bolt required based on: [9]
- i) Maximum shear stress theory
 - ii) Maximum principal stress theory. Take elastic limit in simple tension is equal to 230 Mpa and poisson's ratio =0.3. Assume FOS=2.

OR

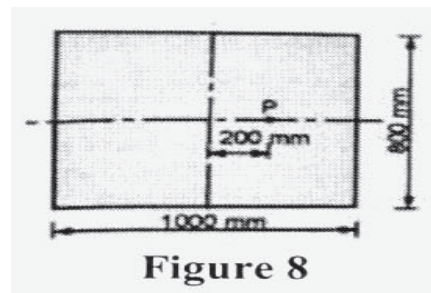
- Q6) a)** The stress induced to a critical point in a machine component made of steel are as follows $\sigma_x = 100 \text{ N/mm}^2$, $\sigma_y = 40 \text{ N/mm}^2$, $\tau_{xy} = 80 \text{ N/mm}^2$ calculate the factor of safety by [9]

- i) Maximum shear stress theory
- ii) Maximum normal stress theory
- iii) Maximum distortion energy theory Assume $\sigma_{yt} = 380 \text{ N/mm}^2$.

- b) A point in a strained material is subjected to stress as shown in figure 7. using Mohr's circle method. Determine the magnitude and direction of major and minor principal stress. [9]



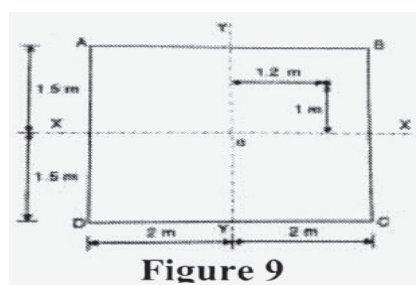
- Q7)** a) A column support load of 400 kN is shown in figure 8. Find the stresses at the corner of the column at its base. [9]



- b) A rectangular column of 240 mm × 150 mm is subjected to a vertical load of 10 kN placed at an eccentricity of 60 mm in a plane bisecting 150 mm side. Determine the maximum and minimum stress intensities in the section. [9]

OR

- Q8)** a) A masonry pier 3 m × 4 m supports a vertical load of 600 kN at a point as shown in figure 9. Find the stresses at the corners of the pier. [9]



- b) A short column 200 mm × 100 mm is subjected to an eccentric load of 60 kN at an eccentricity of 40 mm in the plane bisecting the 100 mm side. Find the maximum and minimum intensities of the stresses at the base. [9]



Total No. of Questions : 8]

SEAT No. :

PD4178

[Total No. of Pages : 2

[6402]-139

S.E. (Mechatronics Engineering)

ENGINEERING MATERIAL

(2019 Pattern) (Semester - III) (217541)

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 Peritectic and Eutectic transformation reaction in the iron-carbon system diagram. **[6]**
- b) What do you understand about a Solid solution? Explain the different types of Solid solutions with the help of a neat diagram. **[6]**
- c) Draw self-explanatory cooling curves for binary eutectic. Calculate the degree of freedom (F) for all regions. **[6]**

OR

- Q2) a)** Draw an Iron Carbon Equilibrium diagram and show critical temperatures and various phases on it. **[10]**
- b) Draw the equilibrium diagram for Antimony and Bismuth. **[4]**
- c) Explain the factors that govern Hume Rothery's rule of Solid Solubility. **[4]**

- Q3) a)** Explain with a suitable figure the transformation of austenite into pearlite, martensite, and bainite. **[6]**
- b) Differentiate between full annealing and process annealing. **[5]**
- c) Write the process and mechanism for carburizing & nitriding. **[6]**

OR

- Q4) a)** Explain the critical cooling rate with a neat diagram. **[5]**
- b) Explain the terms: Martempering, Austempering and sub zero treatment. **[6]**
- c) Draw a schematic diagram showing continuous cooling transformation (CCT) diagram for Annealing, Martempering. **[6]**

P.T.O.

- Q5)** a) Write the classification of steels based on application in detail. [6]
b) Enlist the properties and advantages of white cast iron. [6]
c) Give a classification of the ferrous alloy and its applications. [6]

OR

- Q6)** a) Write the classification of steels based on deoxidation in detail. [6]
b) Write short notes on: [6]
i) Alloy cast iron
ii) Gray cast iron
c) Explain the classification of Alloying elements of steel concerning the relation with carbon. [6]

- Q7)** a) Classify the copper-based alloys based on the percentage of Cu and Zinc. [6]
b) Enlist the differences between brass and bronze in tabular form. [5]
c) State bronze and explain in brief the types of bronze with suitable examples. [6]

OR

- Q8)** a) Draw a phase diagram of brass showing all phases. [6]
b) Explain brass and its types with suitable examples. [5]
c) Write the typical composition, important properties, and application of Cartridge brass, Admiralty brass, & Statuary brass. [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4179

[6402]-140

[Total No. of Pages : 2

S.E. (Mechatronics Engineering)
APPLICATION 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 Triangular wave Generator using OP-Amp. [6]
- c) Draw and explain sample and hold circuit 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 with Diagram binary weighted resistor type of DAC. [5]
- b) Explain the operation of Dual Slope ADC. [5]
- c) Write a short note on Performance parameter of ADC. [8]

OR

P.T.O.

- Q4)** a) With the help of neat Diagram, Explain in details the Flash ADC. [5]
b) Draw ADC using DAC. [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) Write a short note on Basic operation of Power Amplifier LM 380. [5]
c) Draw circuit diagram of multiplier 534. [7]

OR

- Q6)** a) What is Voltage controlled Oscillator 566 and write its applications? [5]
b) Draw circuit diagram of wave form generator XR 2206. [5]
c) Calculate the change in the output frequency if the supply voltage is varied between 9v to 11v. Assume $V_{cc} = 12v$, $R_t = 6.8\text{ K}\Omega$, $C_t = 75\text{ pf}$, $R_T = 15\text{ K}\Omega$ and $R_2 = 100\text{ K}\Omega$. [7]

- Q7)** a) What is the function of Voltage Regulator and functional diagram of 723 regulator? [10]
b) Write a short note on IC LM 317. [7]

OR

- Q8)** a) Design the voltage regulator for the following specification $V_0 = 18 \pm 3$ volts and $I_L = 50\text{Ma}$. [10]
b) Write a short note on : [7]
i) Current limiting Feature
ii) Current fold back protection



[6402]-141

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)** Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism shown in Fig. 1 The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are: OA = 150mm; AB = 450mm; PB = 240mm; BC = 210mm; CD = 660mm.

[10]

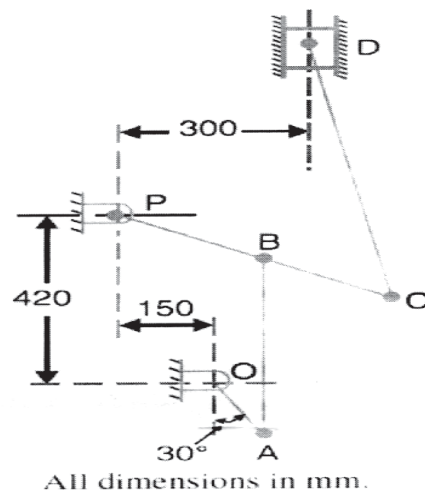


Fig. 1

- b) Explain Method of Locating Instantaneous Centres in a Mechanism. [8]

OR

P.T.O.

- Q2) a)** Locate all the instantaneous centres of the slider crank mechanism as shown in Fig. 2 The lengths of crank OB and connecting rod AB are 100 mm and 400mm respectively. If the crank rotates clockwise with an angular velocity of 10rad/s, find: **[10]**
- Velocity of the slider A, and
 - Angular velocity of the connecting rod AB.

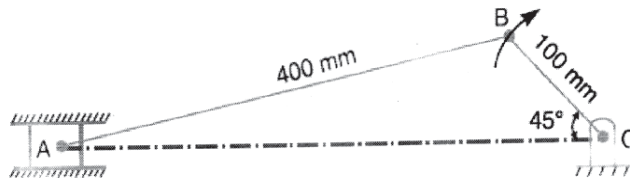


Fig.2

- b)** Explain Three Centres in Line Theorem **[8]**
- Q3) a)** Synthesize a slider crank mechanism so that the displacement of the slider is proportional to the square of the crank rotation in the interval $45^\circ \leq \theta \leq 135^\circ$. Use three precision points with Chebyshev's spacing. **[11]**
- b)** Explain: **[6]**
- Type synthesis,
 - Number synthesis,
 - Dimensional synthesis

OR

- 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)** List the types of gear train. Explain anyone with neat. **[4]**
- b)** Compare spur gear and helical gear. **[3]**
- c)** A pair of gears having 50 & 25 teeth respectively rotates in mesh externally, the speed of the smaller being 1000 rpm. Determine the velocity of sliding between the gear teeth at the point of start of engagement and end of engagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute tooth form, addendum is 5 mm and the module is 5 mm. Also find contact ratio. **[10]**

OR

- Q6) a)** State the different methods to avoid the interference. Explain any one with a neat sketch. [4]
- b)** Define the terms [3]
- Pitch angle
 - Helix angle
 - Lead angle
- c)** An epicyclic gear consists of three gears A, B and C as show in Fig.3 [10]

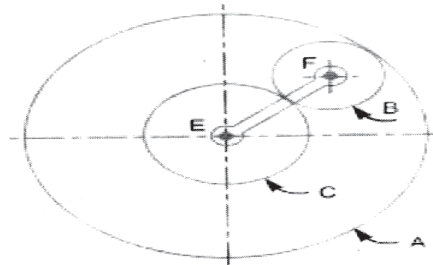


Fig.3

The gear A has 90 internal teeth and gear C has 40 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 25 r.p.m. in anticlockwise sense. If the gear A is fixed, determine the speed of gears B and C.

- Q7) a)** A cam is to give the following motion to a knife edged follower. [13]
- Outstroke with uniform velocity during 60° of cam rotation.
 - Dwell for next 30° of cam rotation.
 - Return stroke with S.H.M. during next 60° of cam rotation.
 - Dwell for the rest of the cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50mm. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of the camshaft.

- b)** Explain the different types of Industrial automations. [5]
- OR

- Q8) a)** A cam with a minimum radius of 25 mm to give the following motion to a roller follower. [14]
- to raise the follower through 50 mm with uniform acceleration and uniform retardation during 120° cam rotation.
 - dwell for next 60° cam rotation.
 - to lower the follower through 50 mm with S.H.M. during the next 60° cam rotation.
 - dwell for rest of the cam rotation

The diameter of roller follower is 20mm. Draw the cam profile when the axis of the follower passes through the center of the cam.

- b)** Classify the methods of transporting workpieces on flow lines. Explain any one in detail. [4]



[6402]-142

S.E. (Mechatronics Engineering)
FLUID MECHANICS & MACHINERY
(2019 Pattern) (Semester - IV) (217548)

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

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

- Q1) a)** A fluid of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2 . Find the i) Pressure gradient ii) Reynold number of the flow iii) Average velocity. **[6]**
- b) Derive an expression for Darcy-Weisbach equation. **[6]**
- c) Prove that, in case of steady laminar flow through a circular pipe average velocity is half of the maximum velocity. **[6]**

OR

- Q2) a)** A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres per sec. Find the head lost due to friction for a length of 50 m of the pipe. **[6]**
- b) Derive an expression of velocity & shear stress distribution for laminar flow passing through circular pipe. **[6]**
- c) Derive an expression of velocity & shear stress distribution for laminar fluid flow passing through parallel plates. **[6]**

- Q3) a)** Determine the dimensions of the quantities given below **[5]**
- | | |
|--------------|------------|
| i) Volume | ii) Area |
| iii) Force | iv) Torque |
| v) Work done | |
- b) Write a short note on Dimensionless number and their significance (give any four) **[6]**
- c) The efficiency η of a fan depends on density ρ , dynamics viscosity μ , of the fluid, angular velocity ω , diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters. **[6]**

P.T.O.

OR

- Q4) a)** Write a short note on following [5]
- | | |
|---------------------|------------------|
| i) Reynold's number | ii) Euler Number |
| iii) Mach Number | iv) Weber Number |
| v) Froude's Number | |
- b) State and explain Buckingham's Pi theorem. What are the steps involved in selection of repeating variables? [6]
- c) Write a short note on Dimensionless number and their significance (give any four) [6]

- Q5) a)** Explain construction and working principle of Francis turbine with application. [6]
- b) Explain the working principle of kaplan turbine with neat sketch. [6]
- c) Write a short note on the draft tube. Explain with neat diagram. [6]

OR

- Q6) a)** Explain construction and working principle of Pelton turbine with application. [7]
- b) Explain the classification of Turbine based on hydraulic action, direction of flow and specific speed in detail. [9]
- c) Explain the following for hydraulic turbine. [2]
- | | |
|---------------|--------------|
| i) Gross Head | ii) Net Head |
|---------------|--------------|

- Q7) a)** The internal and external diameter of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20 and 30 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the flow velocity and work done by the impeller per unit weight of water. [9]
- b) Explain the working principle of reciprocating pump. Also classify different types of the reciprocating pump. [8]

OR

- Q8) a)** Draw Velocity diagram for centrifugal pump. [5]
- b) What is a centrifugal pump? Write the classification of centrifugal pumps. [6]
- c) Explain in detail classification, of hydraulic pump. [6]



Total No. of Questions : 8]

SEAT No. :

PD-4182

[Total No. of Pages : 2

[6402]-143

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

- Q1) a)** Write a short note on permanent magnet synchronous machine. **[6]**
- b)** Explain the construction of synchronous motor with neat diagram. **[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

OR

- Q2) a)** Explain open circuit and short circuit test to determine synchronous reactance. **[6]**
- b)** Explain the development of the circuit model of a synchronous machine in steps. **[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) List and explain the components of an electrical drive system with the help of suitable diagram. [6]
b) List the selection factors of electrical drives. Explain any one selection factor of electrical drives in detail. [6]
c) Elaborate the steady state stability of an electrical drive. [5]

OR

- Q4)** a) What is an electrical drive? State and explain any four major advantages of an electrical drive. [6]
b) What are Load Torque components? Classify Load Torque. [6]
c) Explain the Motor-Load dynamics in the context of electrical drives with the help suitable mathematical equations. [5]

- Q5)** a) Explain any two methods of controlling the speed of a DC shunt motor. [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) What is multi-quadrant operation of a motor? Explain the multi-quadrant operation of a DC motor with the help of appropriate diagrams. [6]
c) Discuss the transient analysis of a DC motor drive. [6]

- Q7)** a) Differentiate between a PMAC motor and a BLDC motor. [6]
b) Draw the generalized diagram of closed loop control of induction motor drives and explain the process of speed control. [6]
c) What is a stepper motor drive? Write its merits and demerits. [5]

OR

- Q8)** a) Explain the principle of V/f control in a three phase induction motor. [6]
b) Explain the rotor resistance control of a three phase induction motor with the help of suitable diagram. [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]



Total No. of Questions : 8]

SEAT No. :

PD-4183

[Total No. of Pages : 2

[6402]-144

**S.E. (Mechatronics Engineering)
SENSORS AND ACTUATORS
(2019 Pattern) (Semester- IV) (217550)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) Solve Q.1 or Q.2., Q.3. or Q.4., Q.5. or Q.6. and Q.7 or Q.8.*
- 2) Neat diagrams should be drawn wherever necessary.*
- 3) Use of Non- programmable Calculator is allowed.*
- 4) Assume suitable data if necessary.*

Q1) a) Enlist the different types of temperature transducers. Explain any one in detail. **[9]**

b) With neat diagram explain seeback effect and peliter effect. **[8]**

OR

Q2) a) Write a short note on bourdon tube. **[8]**

b) Explain in breif the magnetic flow meters. **[9]**

Q3) a) Explain the construction and working principle of induction motor. **[9]**

b) Explain the concept of heat dissipation in DC motor. **[9]**

OR

Q4) a) Explain the construction and working of DC motor. **[9]**

b) Write a short note on characteristics of a Stepper motor with neat diagram. **[9]**

P.T.O.

Q5) a) Explain with neat diagram the working of accumulator in hydraulic system. **[9]**

b) Explain in brief the radial and piston operated pumps. **[8]**

OR

Q6) a) Explain with neat diagram the working of pneumatic system. **[9]**

b) Write a short note on control valves and its characteristics. **[8]**

Q7) a) Enlist the criteria for selection of actuator based on energy considerations. **[9]**

b) Give the selection of actuator based on bandwidth. **[9]**

OR

Q8) a) With neat diagram explain the control system for temperature measurement. **[9]**

b) Write a short note on torque/ speed characteristics of DC motor. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4184

[Total No. of Pages : 4

[6402]-145

**S.E. (Computer Science and Engineering) (Data Science)
MATHEMATICAL FOUNDATION FOR DATA SCIENCE - I
(2019 Pattern) (Semester - III) (210641)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Define with the help of example:

[6]

- i) Probability
- ii) Random Experiment
- iii) Sample Space
- iv) Event
- v) Independent Event
- vi) Conditional Probability

b) Disks of polycarbonate plastic from a supplier are analyzed for scratch and shock resistance. The results from 100 disks are summarized as follows:

[6]

		Shock Resistance		Total
		High	Low	
Scratch Resistance	High	70	9	79
	low	16	5	21
	Total	86	14	100

Let A denote the event that a disk has high shock resistance, and let B denote the event that a disk has high scratch resistance. If a disk is selected at random, determine the following probabilities:

- i) $P(A)$
- ii) $P(B)$
- iii) $P(A')$
- iv) $P(A \cap B)$
- v) $P(A \cup B)$
- vi) $P(A' \cup B)$

c) State & Explain The Law of Large Numbers.

[6]

OR

P.T.O.

- Q2) a)** Define [6]
- Probability
 - Impossible event
 - Certain event.

What are the different approaches to assess the probability of an uncertain event?

- b) Define the random variable that follows normal distribution? Why it is relevant in Central Limit Theorem? [6]
- c) Samples of emissions from three suppliers are classified for conformance to air-quality specifications. The results from 100 samples are summarized as follows: [6]

		Conforms		Total
		Yes	No	
Suppliers	1	22	8	30
	2	25	5	30
	3	30	10	40
	Total	77	23	100

Let A denote the event that a sample is from supplier 1, and let B denote the event that a sample conforms to specifications. If a sample is selected at random, determine the following probabilities:

- $P(A)$
- $P(B)$
- $P(A')$
- $P(A \cap B)$
- $P(A \cup B)$
- $P(A' \cap B)$

- Q3) a)** Explain the process of Hypothesis Testing in detail. [6]
- b) Explain the Wilcoxon Signed-Rank Test. [6]
- c) Define the following terms with the help of example: [5]
- Population
 - Sample
 - Statistic
 - Parameter
 - Estimate

OR

- Q4) a)** What do you mean by Parameter Estimation? Define the following. [6]
- Point Estimate
 - Unbiased Estimator
 - Minimum variance unbiased estimator (MVUE)
- b) Differentiate between z-test and t-test. [6]
- c) Explain any one of the following. [5]
- Method of Moments
 - Maximum likelihood estimates

Q5) a) Write the steps involved in finding the root of function $f(x)$ using Bisection Method. [6]

b) Solve the following system by Gauss-Seidel iteration method. [6]

$$20x + 2y + z = 30$$

$$x - 40y + 3z = -75$$

$$2x - y + 10z = 30$$

Give the solution correct upto three significant figures.

c) Using the following table of values, find a polynomial representation of $f'(x)$ and then compute $f'(0.5)$ [6]

x	0	1	2	3
$f(x)$	1	3	15	40

OR

Q6) a) Write the steps involved in finding the root of function $f(x)$ using Newton-Raphson Method. [6]

b) Use Cramer's rule to solve the following system: [6]

$$\begin{bmatrix} 2 & -3 & 1 \\ 3 & 1 & -1 \\ 1 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$$

c) Compute the approximate value of $\int_0^2 x^4 dx$ by taking four sub-intervals and compare it with the exact value. [6]

Q7) a) Define with the help of example: [6]

i) Set

ii) Subset

iii) Proper Subset

iv) Power Set

v) Disjoint Sets

vi) Cardinality of Set

b) Determine whether each of the following statement formula is tautology, contradiction or contingency [6]

i) $(p \wedge q) \wedge \sim (p \vee q)$

ii) $(p \rightarrow q) \leftrightarrow (q \vee \sim p)$

c) i) The company has 10 members on its board of directors. In how many ways can they elect a president, a vice-president, a secretary and a treasurer? [5]

ii) In how many ways we can select 6 balls out of 10 balls in the box?

OR

- Q8) a)** In a Discrete Mathematics (DM) class, every student is major in CS or math or both. The number of students having CS as a major is 25, the number of students having math as major is 13 and number of students majoring in both CS and math is 8. So how many students in class. Also draw a necessary Venn Diagram to support your answer. **[6]**
- b) Write short note on syntax and semantics of Propositional Logic. **[6]**
- c) i) Let $A = \{x, y, z\}$ and R is the relation defined on A . $R = \{(x,x), (y,y), (y,z), (z,y), (z,z)\}$. Determine whether R is an equivalence relation or not? **[5]**
- ii) Let $X = \{1, 2, 3\}$ and $Y = \{4, 5\}$. Find whether the following subsets of $X \times Y$ are functions from X to Y or not.
- 1) $f = \{(1,4), (1,5), (2,4), (3,5)\}$
- 2) $g = \{(1,4), (2,4), (3,4)\}$



Total No. of Questions : 8]

SEAT No. :

PD4185

[Total No. of Pages : 2

[6402]-146

S.E. (Computer Science & Engineering) (Data Science)

DATA STRUCTURES & ALGORITHMS

(2019 Pattern) (Semester - III) (210642)

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) Write pseudo code for basic operations of stack. [9]

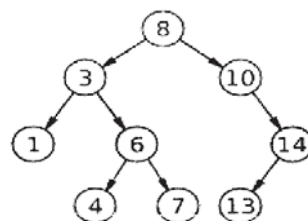
b) Explain array implementation of priority queue with all basic operations.[9]

OR

Q2) a) What is need to convert the infix expression into postfix ; convert the following expression into postfix expression $(a+b)*d + e/(f + a*d)+c$ [9]

b) What is circular queue? Explain the advantages of circular queue area linear queue. [9]

Q3) a) For the given binary tree perform inorder, preorder and postorder traversal [9]



b) Write an algorithm for binary search. Derive recurrence relation and find out time complexity of the search. [9]

OR

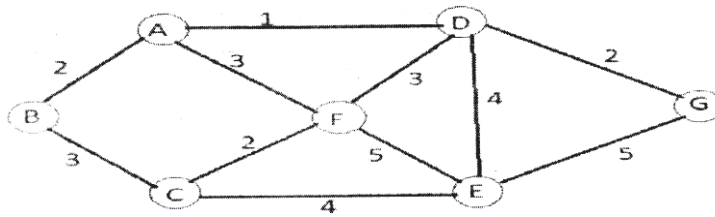
Q4) a) Explain threaded binary trees with diagram. [9]

b) Construct binary search tree for the following data [9]

21,28, 14, 18, 11,32,25,23,37,27,5, 15, 19, 30, 12, 26.

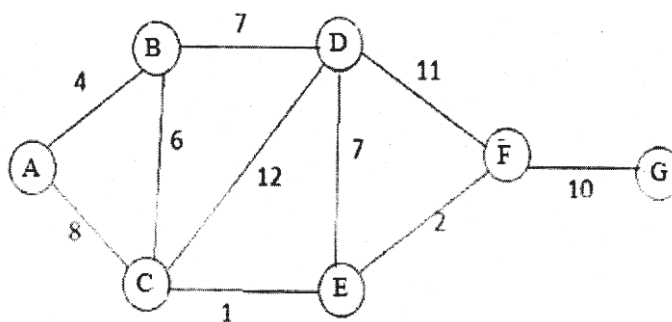
P.T.O.

- Q5) a)** Explain with suitable example, DFS and BFS traversal of a graph. [8]
b) Find minimum Spanning tree using prims algorithm. [9]



OR

- Q6) a)** Find shortest path from vertex 'A' to vertex 'G' using Dijkstra's algorithm. [8]



- b)** Define an explain with an example. [9]
 i) Undirected graph
 ii) Directed graph
 iii) Weighted graph
- Q7) a)** Explain chaining techniques of hashing with example. [8]
b) Explain different types of file organization. [9]

OR

- Q8) a)** What is hash function ?Enlist characteristics of a good hash function. Explain modulo division and folding method. [8]
b) Define sequential file organization. State advantages and disadvantages of sequential organization. Write pseudo code for insertion of records in sequential file. [9]



Total No. of Questions : 8]

SEAT No. :

PD4186

[Total No. of Pages : 3

[6402]-147

S.E. (Computer Science & Engineering) (Data Science)

OBJECT ORIENTED PROGRAMMING (OOP)

(2019 Pattern) (Semester-III) (210643)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Explain the concept of polymorphism and its types with examples. How does polymorphism contribute to object-oriented programming? [6]
- b) What is operator overloading in C++? Illustrate with an example how to overload binary operators. [6]
- c) Differentiate between implicit and explicit type casting in C++. What are the potential pitfalls of operator overloading and type conversion? [6]

OR

- Q2)** a) What is function overloading in C++? How does it differ from operator overloading? Provide an example. [6]
- b) Explain runtime polymorphism in C++ using pointers to the base class and virtual functions. Why is this feature important in C++? [6]
- c) Define a pure virtual function and explain its significance in C++. How do abstract base classes contribute to runtime polymorphism? [6]

- Q3)** a) Describe the stream classes hierarchy in C++ and their role in file handling. [6]
- b) Discuss common stream errors in file I/O and their handling in C++. [6]
- c) How is disk file I/O performed using streams in C++? Write a program to read from and write to a text file. [5]

OR

P.T.O.

- Q4)** a) Explain file pointers and their usage in file I/O operations. Write a program to demonstrate the use of seekg() and seekp() functions. [6]
- b) Describe how file I/O can be handled using member functions in a class. Provide an example program. [6]
- c) How can the extraction (>>) and insertion (<<) operators be overloaded in C++? Write a program to overload these operators for a user-defined class. [5]
- Q5)** a) Explain the fundamentals of exception handling in C++ and give an example of handling a “divide by zero” error. [6]
- b) Explain the concept of multiple exception handling in C++ and provide an example of handling different types of exceptions in a single program. [6]
- c) What are templates in C++? Discuss the power of templates and provide an example of a function template. [6]

OR

- Q6)** a) Explain class templates and non-type parameters in C++. Provide an example that demonstrates a class template with a non-type parameter. [6]
- b) What is the use of the ‘export’ keyword in templates, and how does it differ from the ‘typename’ keyword? [6]
- c) What is rethrowing an exception in C++? Write a code snippet demonstrating rethrowing an exception. [6]
- Q7)** a) Explain the concept of Standard Template Library (STL) in C++. Discuss its components and the role of each in the C++ programming language. [6]
- b) Differentiate between sequence containers and associative containers in STL with examples. [6]
- c) What are container adapters in STL? Describe the different types of container adapters available and their applications. [5]

OR

- Q8)** a) Illustrate the use of vector and list container classes in STL. Highlight their differences and when one would be preferred over the other. [6]
- b) Explain the basic searching and sorting algorithms in STL. Describe how they can be used with container classes like vector. [6]
- c) Explain the min-max algorithm and how STL handles it. Provide an example of using the `min_element` and `max_element` functions with an STL container. [5]



Total No. of Questions : 8]

SEAT No. :

PD4187

[Total No. of Pages : 2

[6402]-148

**S.E. (Computer Science and Engineering) (Data Science)
SOFTWARE ENGINEERING AND PROJECT MANAGEMENT
(2019 Pattern) (Semester - III) (210645)**

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 right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Is it possible to estimate software size before coding? Justify your answer with suitable examples. [6]
b) Explain the various activities during software project planning. [5]
c) Explain COCOMO II model. [6]

OR

- Q2)** a) How to calculate FP and How it is used in estimation of software project? [6]
b) Compare the LOC and FP based estimation techniques with suitable example. [5]
c) Write a note on Reusable Software Resources. [6]
- Q3)** a) Explain Quality attributes considered in software design. [6]
b) Explain following design concepts. [6]
i) Modularity
ii) Architecture
c) Write note on Design Model. [6]

OR

- Q4)** a) Explain Component Level Design Elements. [6]
b) Explain following design concepts: [6]
i) Refinement
ii) Information Hiding
c) What are the design quality guidelines?

[6]

P.T.O.

- Q5)** a) What are the advantages of SCM Repository? Explain functions performed by SCM Repository. [6]
b) Explain Risk Projection and Risk Refinement in detail. [6]
c) What is risk identification? What are different categories of risks? [6]

OR

- Q6)** a) What is Risk mitigation, monitoring and management (RMMM)? [6]
b) Define software Risk in detail. What are different types of Software Risk? [6]
c) What is Software Configuration Management (SCM). [6]
- Q7)** a) What are difference between white box testing and black box testing. [6]
b) Discuss Strategies in WebApp testing. [5]
c) Explain criteria for Validation Testing. [6]

OR

- Q8)** a) Explain the Integration testing approaches. [6]
b) Explain Unit Testing in OO Context. [5]
c) What are Strategies for Software Testing. [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4188

[6402]-149

[Total No. of Pages : 2

S.E. (Computer Science and Engineering) (Data Science)

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2019 Pattern) (Semester - III) (210644) (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) Distinguish between combinational and sequential switching circuits also write examples of both. [6]
- b) What are the applications of Flip-Flop? Explain shift register. [6]
- c) Explain how shift register are used as twisted ring counter. [6]

OR

- Q2)** a) What are the advantages of MS JK flip flop? Explain the working of MS JK flip flop in detail. [6]
- b) Convert Following Flip flops : [6]
- i) SR to T
 - ii) JK to D
- c) What is an ASM Chart? Name the elements of an ASM chart and define each of them. [6]

- Q3)** a) What is the difference between PAL and PLA? [6]
- b) Implement following Boolean function using PLA. [6]
- $F1(A, B, C) = \sum m(2, 3, 7)$ $F2(A, B, C) = \sum m(3, 4, 6)$
- c) What is FPGA? Explain its basic Architecture. [5]

OR

P.T.O.

- Q4)** a) Draw the ASM chart for a 2-bit binary counter having one enable line E such that E = 1 counting enabled and E = 0 counting disabled. [6]
b) Draw a block diagram of the PLA device and explain. [6]
c) What is CPLD? Explain its basic architecture. [5]

- Q5)** a) Draw and explain CMOS inverter. [6]
b) Compare CMOS and TTL logic family. [6]
c) Explain the wired logic output of TTL with neat diagram. [6]

OR

- Q6)** a) Explain with a neat diagram CMOS NAND Gate. [6]
b) Define the following terms and mention the standard values for TTL logic Family. [6]
i) Fan-out
ii) Power Dissipation
iii) Propagation Delay.
c) With the help of a neat diagram, explain the working of two - input TTL NAND gate. [6]

- Q7)** a) What is Microprocessor? List different applications of Microprocessor. [6]
b) Explain the Memory organization of the microprocessor. [6]
c) What are the different types of buses used in Microprocessor? [5]

OR

- Q8)** a) Write a short note on ALU IC 74181. [6]
b) With the help of a block diagram explain the fundamental units of a microprocessor. [6]
c) Explain in brief basic arithmetic operations using ALU IC 74181. [5]



[6402]-150

S.E. (Computer Science and Engineering/Data Science)
MATHEMATICAL FOUNDATION FOR DATA SCIENCE - II
(2019 Pattern) (Semester - IV) (210652)

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 right indicate full marks.
- 4) Assume suitable data, if necessary.

- Q1)** a) Give the applications of linear regression in data science with examples. [6]
 b) Obtain coefficient of correlation given the table of values [6]

x	6	2	10	4	8
y	9	11	5	8	7

- c) Fit the line $y = ax + b$ using least square method in simple linear regression. [6]

x	0	1	2	3	4	5	6	7
y	2	-3	4	-4	3	9	11	12

OR

- Q2)** a) Write the difference between Simple Linear Regression & Multiple Linear Regression. [6]
 b) Compute the regression lines for the following data. [6]

x	6	2	10	4	8
y	9	11	5	8	7

And estimate y for x = 5

- c) Fit a parabola $y = ax^2 + bx + c$ for following data in multiple linear regression. [6]

x	-3	-2	-1	0	1	2	3
y	8	4	1	2	8	10	5

- Q3)** a) Define time series analysis. Why it is important in data science? [6]
 b) What is the Autoregressive Integrated Moving Average (ARIMA) model? Describe its components and usage in time series forecasting. [6]
 c) Explain Forecasting Techniques in Time Series Analysis. [5]

OR

- Q4)** a) Explain with example stationarity & autocorrelation in time series. [6]
 b) Explain applications of time series in data science with the help of an examples. [6]
 c) Give a brief note on ARIMA model. [5]

- Q5)** a) Explain the types of machine learning with examples. [6]
 b) Compare decision trees with other supervised learning models. What are the advantages and limitations of decision trees? [6]
 c) What is the K-Nearest Neighbors (KNN) algorithm? Describe its algorithmic steps with an illustration. [6]

OR

- Q6)** a) Explain the applications of Machine Learning in data science. [6]
 b) Differentiate between Classification & regression problems in context of supervised learning. [6]
 c) Explain Bias-Variance Tradeoff in Machine Learning with suitable example. [6]

- Q7)** a) Explain the types of optimization in machine learning & data science. [6]
 b) Find minimum value of $f(x,y) = x^2 + y^2$ subject to condition $x + y = 1$ by using Method of Lagrange's Multipliers. [6]
 c) Justify the use of penalty methods in constrained optimization problems and compare it with barrier methods. [5]

OR

- Q8)** a) Explain the concept of the Lagrange multiplier method. How is it useful in optimization problems with constraints. [6]
 b) Explain convex optimization, convex set and by using it find Minima of $f(x) = x^2 + 3x + 4$. [6]
 c) Explain any five Meta- Heuristic Optimization Algorithms with example. [5]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4190

[Total No. of Pages : 2

[6402]-151

S.E. (Computer Science and Engineering/Data Science)

OPERATING SYSTEMS

(2019 Pattern) (Semester - IV) (210653)

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 following terms. [9]

- i) Synchronization
- ii) Semaphore with it's types

b) Explain Reader Writer problem in details. [8]

OR

Q2) a) Define Deadlock, how it occurs. Explain the necessary conditions for Deadlock. [9]

b) Explain following synchronization problems with semaphore solution.[8]

- i) Explain any problem with "Mutual Exclusion" and "Progress".
- ii) Dinning Philosopher problem.

Q3) a) For the following reference string. [12]

1, 2, 3, 2, 4, 1, 3, 2, 4, 1

Count the number of page faults and Hit that occur with 3 frames using FIFO, optimal and LRU page replacement methods. Demand paging use.

b) Write a short note on Paging with proper example. [6]

OR

Q4) a) Explain Non-contiguous memory allocation with the help of paging. [9]

b) Explain Contiguous memory allocation with it's two types. Also explain how internal and external fragmentation problem occur with example. [9]

P.T.O.

Q5) a) A disk drive has 200 tracks, numbered 0-199. The drive is currently serving the request at track no. 50. The queue of pending requests in FIFO order is 82, 170, 43, 140, 24, 16, 190. Starting from the current head position what is the total distance that disk arm moves to satisfy all the pending requests for the following disk scheduling algorithms. Assume that head is moving towards inner track for SCAN and LOOK. [12]

i) FCFS

ii) SSTF

iii) SCAN

iv) LOOK

b) Define following terms: [6]

i) Virtual Memory

ii) Segmentation

OR

Q6) a) Explain file attributes and operations on file in detail. [6]

b) Explain in brief different I/O buffering techniques. [6]

c) Explain the storage management with suitable example. [6]

Q7) a) What is buffer overflow? How does it work and how can it be detected or prevented? [5]

b) Explain Intrusion Detection Systems (IDS). What are the types and how they work. [6]

c) Define and explain the following terms with suitable examples: [6]

i) Threats

ii) Attacks

iii) Intruder

OR

Q8) a) Describe various methods of malware defense in Operating system? [5]

b) Explain Virus, Worm and Malware with suitable example. [6]

c) What is Rootkit? How does it work and how can it be detected and prevented? [6]

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4191

[Total No. of Pages :2

[6402]-152

S.E. (Computer Science & Engg.)(Data Science)

DATA STORYELLING & VISUALIZATION

(210653) (2019 Pattern) (Semester - IV)

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 Scientific Calculator is permitted.*

- Q1)** a) Describe the differences between network and hierarchical visualizations. Why is color a crucial aspect of data visualization? [6]
- b) Compare and contrast the effectiveness of different big data visualization categories. [6]
- c) Identify ineffective data visualization and redesign it to be more effective. [4]

OR

- Q2)** a) Define temporal, hierarchical and network visualizations. What are multidimensional and geospatial visualizations used for? [6]
- b) Create a chart for visualization of proper story, with proper explanation. [6]
- c) How does the improper use of color impact data storytelling? explain with one example. [6]

- Q3)** a) Differentiate between exploratory and explanatory analysis in the context of data visualization. [6]
- b) What is the significance of relationships in data visualization? How does static visualization differ from interactive visualization in terms of user experience? [6]
- c) What are the Gestalt principles in the context of design and visualization? Define the principle of proximity in Gestalt theory. [5]

P.T.O.

OR

- Q4)** a) How does aesthetic design impact the understanding of data visualizations? Explain in brief. [6]
b) Analyze the advantages and disadvantages of using bar charts versus stacked bars to represent data comparisons. [6]
c) How would you apply the Gestalt principles of proximity in designing a dashboard? And How can you make visualization more accessible for users with visual impairments? [4]
- Q5)** a) Explain how GIS tools can be used to analyze and visualize geospatial data. Describe the difference between a time-series plot and an animation in temporal data visualization. [6]
b) What is a node-link diagram and how is it used in network visualization? [6]
c) Analyze how time-series data can be used to forecast trends and explain the advantages of using animations over static plots in this context. [6]

OR

- Q6)** a) What is GIS, and how is it used for geospatial visualization? Name two tools commonly used for geospatial data visualization. [6]
b) Define the term "time-series analysis" in the context of data visualization. [6]
c) Explain the different types of Representing hierarchical structures with examples. [5]
- Q7)** a) How would you assess the effectiveness of data visualizations used in marketing reports and presentations? [6]
b) How can financial dashboards be used to monitor real-time stock market movements and portfolio performance? [6]
c) What are some common metrics used to measure social media performance. [5]

OR

- Q8)** a) How can healthcare data visualization help in tracking disease outbreaks and patient outcomes? [6]
b) What ethical considerations must be kept in mind when visualizing data for public policy decisions or social media campaigns? [6]
c) What insights can be gained from analyzing customer behavior data in visual formats. [5]



Total No. of Questions : 8]

SEAT No. :

PD-4192

[Total No. of Pages : 2

[6402]-153

**S.E. Computer Science & Engineering (Data Science)
DATABASE MANAGEMENT SYSTEM
(2019 Pattern) (Semester- IV) (210655)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

- 1) *Solve Q.1 or Q.2., Q.3. or Q.4., Q.5. or Q.6. and Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Make suitable assumptions whenever necessary.*

Q1) a) What is the Need .of Normalization? Explain 1 NF with suitable example. **[9]**

b) What is the impact of insert, update, delete anamoy on overall database design? **[9]**

OR

Q2) a) What are relational integrity constraints? Explain with example Domain constraints, Referential Integrity and enterprise constraints. **[9]**

b) What is Normalization Explain 2NF and 3NF with suitable example? **[9]**

Q3) a) What is log based recovery scheme? Explain with suitable example. **[8]**

b) What is the Need of Concurrency Control? Explain two phase locking protocol for concurrency control. **[9]**

OR

P.T.O.

- Q4) a)** Differentiate between Centralized and Client-Server Architectures. **[8]**
- b) What is distributed Databases? Explain data replication in Distributed Data Storage. **[9]**

- Q5) a)** Compare JSON and XML with example **[8]**

- b) Write short note on **[9]**
- i) SQLite
 - ii) Mobile Database
 - iii) Cloud Database

OR

- Q6) a)** Explain Map Reduce with example. **[9]**

- b) Differentiate between SQL and NoSQL Databases. **[8]**

- Q7) a)** What is Data Warehouse? Explain architecture of Data Warehouse. **[9]**

- b) Explain Knowledge Discovery Process in detail. **[9]**

OR

- Q8) a)** Define Data Mart. Compare the similarities and differences between a data mart and a Data Warehouse **[9]**

- b) What is Data Mining? Explain different data mining tasks. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD-4193

[Total No. of Pages : 2

[6402]-154

S.E. (Computer Science and Engineering) (Data Science)

COMPUTER GRAPHICS

(2019 Pattern) (Semester - IV) (210656)

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) What are the types of projection? Write in brief about each type of projections. [6]
- b) Differentiate between Parallel projection and perspective projection. [5]
- c) A triangle is defined by [6]

$$\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$$

Find transformed coordinates after the following transformation :

- i) 90 deg rotation about the origin.
- ii) Reflection about line $X = Y$

OR

- Q2) a) Derive 3D transformation matrix for rotation about a principal axis. [6]
- b) Differentiate between Orthographic Projection and Isometric Projection. [5]
- c) Perform 45 deg. rotation of a triangle A(0, 0), B(1, 1) and C(5, 2). [6]

Find transformed coordinates after rotation

- i) About origin,
- ii) About P (-1, 1)

P.T.O.

- Q3)** a) What is Halftone shading? How it works? [6]
b) Compare Gouraud shading and Phong shading. [5]
c) Write and explain Painter's algorithm. [6]

OR

- Q4)** a) What is Backface? Explain backface detection and removal. [6]
b) Compare RGB and HSV color model. [5]
c) Explain the following terms with examples : [6]
i) Specular Reflection
ii) Diffuse reflection

- Q5)** a) Write a short note on interpolation and approximation. [4]
b) Explain the Bezier curve. List its properties. [7]
c) Explain Hilbert's curve with an example. [7]

OR

- Q6)** a) What is animation? What are the types of Animation? [4]
b) Explain the method of controlling animation. [7]
c) What are fractals? Explain Triadic Koch in detail. [7]

- Q7)** a) What is virtual reality? And list out its applications? [4]
b) Draw and explain three I's of virtual reality. [7]
c) Explain graphics display with any of two graphics displays? [7]

OR

- Q8)** a) What are trackers? Enumerate some important tracker characteristics. [4]
b) What is the difference between an absolute and a relative position input device? [7]
c) What is haptic feedback and how human haptic system works? [7]



Total No. of Questions : 8]

SEAT No. :

PD-4194

[Total No. of Pages : 2

[6402]-155

S.E. (Electronics Engg.) (VLSI Design & Technology)
FPGA BASED SYSTEM DESIGN USING VERILOG
(2019 Pattern) (Semester - III) (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 right indicates full marks.*

- Q1)** a) What are the system task and compilers directives in verilog? Explain it. [6]
b) Write the difference between task and function. [5]
c) What are the operators used in verilog? Explain them. [6]

OR

- Q2)** a) Explain the data type of verilog in details. [5]
b) Write short note on lexical conventions used in verilog. [6]
c) List modelling styles in verilog. Explain any two with example. [6]

- Q3)** a) Write a verilog code for 4 bit up down counter. [6]
b) Write a verilog code for full adder. [6]
c) Write a verilog code for 2:1 max. [6]

OR

- Q4)** a) Write a verilog code for 4 bit shift right register. [6]
b) Write a verilog code for D flip flop using behaviour modelling. [6]
c) Write a code for 2:4 decoder. [6]

- Q5)** a) Draw and explain Moore Machine. [6]
b) Design 1 bit serial adder using FSM. [6]
c) Give comparison of Mealy machine and Moore machine. [6]

OR

P.T.O.

- Q6)** a) Design a sequence detector for the sequence..110... using Mealy machine. [6]
 b) Write short notes on following [6]
 i) State diagram
 ii) State table
 iii) State assignment
 c) Draw a state diagram using mealy machine for given state table. [6]

NS			Output	
P _s	$x = 0$	$x = 1$	$x = 0$	$x = 1$
a	c	b	1	1
b	d	c	0	0
c	e	d	0	1
d	e	d	1	0
e	a	d	1	0

- Q7)** a) Explain the term "Reconfigurable systems" with respect to FPGA. [5]
 b) Design interface of VGA with FPGA. [6]
 c) Explain the interface of keyboard with FPGA. [6]

OR

- Q8)** a) Explain dynamic Architecture of FPGA. [5]
 b) Draw and design LCD interface with FPGA. [6]
 c) Design Real Time clock interface with FPGA. [6]



Total No. of Questions : 8]

SEAT No. :

PD4195

[Total No. of Pages : 2

[6402]-156

S.E. (E & C Engg.) (Advanced Communication Technology)

PRINCIPLES OF COMMUNICATION ENGINEERING

(2019 Pattern) (Semester - III) (204202)

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 right indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1) a)** Explain FM generation by Armstrong's Indirect method, with a neat diagram. **[6]**
- b)** Derive the mathematical presentation of FM (Frequency Modulation). **[6]**
- c)** Compare AM, FM and PM with neat diagrams. **[5]**

OR

- Q2) a)** Explain the relationship between Phase modulation and Frequency modulation. **[4]**
- b)** Illustrate the differences between Narrowband FM signal and wideband FM signal. **[5]**
- c)** A frequency modulated signal is represented by voltage equation $e_{fm} = 10 \sin [6 \times 10^8 t + 5 \sin 1250 t]$. Calculate **[8]**
- i) Carrier frequency f_c
 - ii) Modulating frequency
 - iii) Maximum deviation
 - iv) What power will this FM wave dissipates in 20 ohm resistor?

- Q3) a)** Explain the Generation and detection of PWM with a neat diagram. **[6]**
- b)** Distinguish between PPM, PWM & PPM with necessary waveforms. **[6]**
- c)** Explain time division multiplexing with neat diagrams. **[5]**

OR

P.T.O.

- Q4)** a) What is sampling. Explain different types of sampling with necessary diagrams. [6]
b) Consider the signal $\{3\cos(200\pi t) + (5\sin 6000\pi t) + 10\cos 1200\pi t\}$, what is the Nyquist rate of this signal? [5]
c) What is aliasing effect & Explain in detail about Guard band. [6]

- Q5)** a) Explain the Generation of Delta modulation with its slope overload & granular noise. [6]
b) Explain the Generation and reconstruction of Pulse Code modulation with a neat diagram. [6]
c) Write a short note on A-law and μ -law. [6]

OR

- Q6)** a) What is Quantization error. Explain Uniform Quantization and Non-Uniform Quantization with a neat diagram. [6]
b) Draw block diagram of Digital communication system & explain function of each block. [6]
c) Describe the technique of Adaptive Delta modulation with necessary diagrams. [6]

Q7) Write a short note on the following.

- a) Synchronization and its types. [6]
b) Scrambling and Unscrambling. [6]
c) Properties of line codes. [6]

OR

Q8) Write a short note on the following.

- a) Draw AT & T hierarchy multiplexing system & explain it in detail. [4]
b) Intersymbol Interference and its elimination in communication. [6]
c) Line codes for Unipolar RZ, Polar NRZ, AMI & Split phase Manchester for the bit stream 101110101. [8]

* * *

Total No. of Questions : 8]

SEAT No. :

PD-5329

[Total No. of Pages : 2

[6402]-157

**S.E. (Electronics & Communication-Advanced
Communication Technology)**

**DIGITAL COMMUNICATION ENGINEERING
(2019 Pattern) (Semester - IV) (204204)**

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.*
- 4) *Solve Q.1, or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*

- Q1)** a) Explain the concept of pulse shaping in ISI. [6]
b) Compare digital modulation systems. [6]
c) Sketch the waveforms of MSK for the given bit stream 11001001. [6]

OR

- Q2)** a) What is inter symbol interference? Explain the causes and its ideal solution to control ISI. [6]
b) Explain M-ary FSK (MFSK) transmitter with suitable block diagram. [6]
c) Draw PSD and signal space representation and bandwidth for M-ary PSK. [6]
- Q3)** a) With neat block schematic and waveforms explain DSSS generation and detection. [6]
b) A coherent BPSK - DSSS is used to transmit data at 250 bps with probability of error of 5×10^{-5} . Determine minimum chipping rate, if the jamming signal is 300 times stronger than the received signal. [6]
c) Explain : Code Division Multiple Access (CDMA) [6]

P.T.O.

OR

- Q4)** a) A pseudo random sequence is generated using a feedback shift register of length $m = 4$. The chip rate is 10^7 chips per second. Find the following
- i) PN sequence length
 - ii) Chip duration of PN sequence
 - iii) PN sequence period
- [6]
- b) Explain the concept of OFDM. [6]
- c) Mention about the run property. What is called jamming effect. [6]
- Q5)** a) Explain the concepts of MAP and ML detection in receiver. [9]
- b) Illustrate the conversion process of continuous AWGN channel to vector channel. [9]

OR

- Q6)** a) Explain : Optimum Filter & Matched Filter. [9]
- b) Explain minimum error test with suitable example. [9]
- Q7)** Explain the term (Any two) : [16]
- a) Correlation receiver
 - b) Gaussian MSK
 - c) DEPSK

OR

- Q8)** Explain the term (Any two) : [16]
- a) Minimum shift keying
 - b) Non coherent BFSK
 - c) DPSK



Total No. of Questions : 8]

SEAT No. :

PD4196

[Total No. of Pages : 2

[6402]-158

S.E. (Computer Science)

COMPUTER GRAPHICS FOR DATA VISUALIZATION

(2019 Pattern) (Semester - III) (210244)

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 right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Derive transformation matrix for 2-D rotation about an arbitrary point. [6]
b) Write transformation matrix for [6]
i) 2-D Rotation clockwise direction
ii) 2-D Scaling
iii) 2-D translation
c) Perform 45° rotation of a triangle A(0,0), B(1,1) and C(5,2). Find transformed coordinates after rotation, [6]
i) About origin,
ii) About P (1,1)

OR

- Q2)** a) What is 3D Transformations? Discuss 3D transformation matrix for Scaling and Translation. [6]
b) Explain the types of Perspective projections with example. [6]
c) Discuss the types of Parallel Projections with example. [6]
- Q3)** a) Explain the CIE chromaticity diagram. [6]
b) Explain ambient light and diffuse reflection with examples. [6]
c) Compare Gouraud shading and Phong Shading. [5]

OR

- Q4)** a) Write short note on Warnock's Algorithm. [6]
b) Explain Back-face Detection and Removal algorithm. [6]
c) Discuss Painter's algorithm. [5]

P.T.O.

- Q5)** a) Explain Triadic Koch Curve in detail. [6]
b) Explain Hilbert's curve with an example. [6]
c) Discuss fractals and its applications? Explain the term fractal Dimensions. [6]

OR

- Q6)** a) Write a short note on interpolation and approximation in terms of curve. [6]
b) Discuss the properties and limitations of Bezier curve. [6]
c) Explain Blending function in terms of curve. [6]

- Q7)** a) What is segments? Explain the term segment table with suitable example. [6]
b) Discuss creation and deletion operation of a segment with example. [6]
c) Explain renaming and closing of a segment with suitable example. [5]

OR

- Q8)** a) Explain architecture of 1860. [6]
b) Discuss the various Motion specification methods. [6]
c) Explain the term Morphing and list out the applications of morphing. [5]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4197

[6402]-159

[Total No. of Pages : 2

S.E. (Computer Science)

DIGITAL ELECTRONICS AND VLSI 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 Q4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Assume suitable data, if necessary.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Design using 8:1 MUX and logic gate- $F = \sum m(0,2,5,8,10,15)$. [6]
b) Design and implement Binary to Gray code converter using logic gates. [5]
c) Design Full subtractor using MUX. [6]

OR

- Q2)** a) Implement 8:1 MUX using 4:1 MUX. [6]
b) Design two-bit comparator using gates. [5]
c) Differentiate between Demultiplexer and Decoder. [6]

- Q3)** a) Design J-K flipflop using S-R flipflop. [6]
b) What is race around condition? How it can be avoided? [6]
c) Draw the logical diagram of 4-bit bidirectional shift register. Explain Shift left and shift right operation. [6]

OR

- Q4)** a) Design 2-bit synchronous up counter using j-k flipflop. [6]
b) Explain with neat diagram 3-bit universal Shift register. [6]
c) Draw and explain the behavior of M-S JK flipflop. [6]

P.T.O.

- Q5)** a) Write VHDL code for i) AND gate ii) NOR Gate iii) EXOR Gate. [6]
b) Differentiate between function and Procedure. [5]
c) Write VHDL code for Full Adder. [6]

OR

- Q6)** a) Draw and explain HDL design flow. [6]
b) Explore any four attributes in VHDL with suitable example codes. [6]
c) Explain various VHDL operators. [5]

- Q7)** a) Differentiate Between Mealy and Moore Machine. [6]
b) What is mean by configuration of PLD? What are the methods of configuration? [6]
c) Write VHDL code for 4:1 MUX. [6]

OR

- Q8)** a) Write VHDL code for 4-bit shift register for SISO operation. [6]
b) With neat schematic explain the architectural building blocks of CPLD.[6]
c) Draw FSM state diagram for 11011 Mealy sequence detector & write VHDL Code for it. [6]



Total No. of Questions : 8]

SEAT No. :

PD-5301

[Total No. of Pages : 2

[6402]-160

S.E. (Computer Science)

MICROPROCESSOR & MICROCONTROLLER

(2019 Pattern) (Semester - IV) (210554)

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

Q1) a) Explain the Segment Translation Process with a neat diagram of 80386. [7]

b) Differentiate and explain GDTR, LDTR, and IDTR. [8]

OR

Q2) a) Demonstrate General Descriptor Format available in various descriptor tables. [7]

b) With the necessary diagram, explain the page translation process in 80386. [8]

Q3) a) Explain the TSS descriptor of 80386 with a neat diagram. [7]

b) Explore the role of Task Register in multitasking and the instructions used to modify and read Task Register. [8]

OR

Q4) a) Draw and explain the Task State Segment of 80386. [7]

b) With the help of neat diagram Explain the Process of handling Interrupts in Protected mode. [8]

P.T.O.

- Q5)** a) Differentiate between Microprocessor and Microcontroller. [7]
b) Explain various features of the 8051 Microcontroller. [8]

OR

- Q6)** a) Explain the architecture of the 8096 microcontroller with a neat block diagram. [7]
b) Write a short note on the memory organization of the 8051 microcontroller. [8]

- Q7)** a) Explain the architecture of 8051 with a neat block diagram. [7]
b) List and elaborate on different applications of microcontrollers. [8]

OR

- Q8)** a) List and explain the important features of the 8096 microcontroller. [7]
b) Compare the architecture of 8051 and 8096 microcontrollers. [8]



Total No. of Questions : 8]

SEAT No. :

PD-5231

[Total No. of Pages : 2

[6402]-161
S.E. (Computer Science)
DESIGN THINKING
(2019 Pattern) (Semester - IV) (210555)

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) *Assume suitable data if necessary.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) What are the different sources of new idea generation? [6]
b) Write a short note on six thinking hats. [6]
c) Write a short note on : [6]
i) The Dreamer
ii) The Critic

OR

- Q2)** a) What are the different benefits of Walt Disney method? [6]
b) What is idea generation? Explain different stages of idea generation. [6]
c) Explain the principles of creativity. [6]

- Q3)** a) Explain Lean startup method for prototype development. [6]
b) Explain creative storyboard ideas. [6]
c) What is quick and dirty prototyping? Explain. [5]

OR

- Q4)** a) Explain the purpose of prototyping in design thinking. [6]
b) How ideas are converted into presentable form? Explain. [6]
c) What is mock-ups? Explain with suitable example. [5]

P.T.O.

- Q5) a)** What is Kano model? Explain its importance. [6]
b) What are the different techniques of ergonomic testing? Explain. [6]
c) Explain the importance of desirability testing. [6]

OR

- Q6) a)** What is prototype testing? Explain different types of prototype testing. [6]
b) Write a short note on : [6]
i) Interviews
ii) Surveys
c) What are the common uses of split testing? Explain. [6]

- Q7) a)** What is design activism? Explain in detail. [6]
b) What are the different manager tools? Explain. [6]
c) Write a short note on collaboration tools. [5]

OR

- Q8) a)** Design and innovation as an organizational strategy. Justify. [6]
b) Explain different success factors for implementation of ideas. [6]
c) Write a short note on idea management platforms. [5]



Total No. of Questions : 8]

SEAT No. :

PD4198

[Total No. of Pages : 2

[6402]-162

**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) What is a dead weight tester, discuss with diagram? how is it utilized in pressure calibration? **[8]**

b) Write the classification of manometers. Discuss one in detail with diagram and advantages and disadvantages. **[9]**

OR

Q2) a) Explain the detailed working of the bourdon tube pressure Gauge with a diagram. **[8]**

b) Discuss differential pressure cell in detail with a diagram. Can you use it to measure flow? How? **[9]**

Q3) a) Discuss 3-wire configuration of RTD with diagrams. What are its advantages and disadvantages. **[9]**

b) Draw and discuss the radiation pyrometer. Write the advantages and limitations of it. **[9]**

OR

Q4) a) How does bimetallic thermocouple works, discuss with diagram? Discuss any application of it in detail. **[9]**

b) Discuss the need for cold junction compensation. What are thermopiles? **[9]**

Q5) a) How will you measure flow with orifice. Discuss the procedure in detail with diagram. **[9]**

b) Draw and discuss Doppler flowmeter. **[8]**

OR

P.T.O.

Q6) a) Draw and discuss the working principle of venturi for flow measurement. Explain the complete setup. **[8]**

b) What are the types of orifice plate? What are the materials used for orifice plate? How will you measure flow using orifice plate? What is vena-contracta point? **[9]**

Q7) a) What is the basic principle behind radar-based level measurement? Discuss with diagram. **[9]**

b) What are the various types of level sensors? How will you measure level using the DP cell. **[9]**

OR

Q8) a) How does Searle's rotating cylinder viscometer determine viscosity? Discuss with diagram. **[9]**

b) What are resistive humidity sensors? how do they measure humidity? Discuss with diagram. **[9]**



Total No. of Questions : 8]

SEAT No. :

PD4199

[Total No. of Pages : 2

[6402]-163

S.E. (Instrumentation & Control)
LINEAR INTEGRATED CIRCUITS
(2019 Pattern) (Semester - III) (206262)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

Q1) a) Derive output voltage equation for three input summing amplifier. Draw neat circuit diagram. **[9]**

b) Draw neat diagram of grounded load V-I converter and derive the equation for output current. **[8]**

OR

Q2) a) Derive output voltage equation for Op-Amp. Integrator. Draw neat diagram of practical integrator. **[9]**

b) Write short note on an Isolation Amplifier. **[8]**

Q3) a) Illustrate with suitable circuit diagram precision full wave rectifier. Draw proper output wave forms. **[9]**

b) Elaborate with neat diagram operation of R-C phase shift oscillator. **[9]**

OR

Q4) a) Design Schmitt trigger circuit for $UTP = 1.5V$ and $LTP = -1.5V$. Where, $V_{cc} = +12V$ and $V_{ee} = -12V$. **[9]**

b) Draw and explain an inverting Zero Crossing Detector circuit with proper output wave forms. **[9]**

Q5) a) Design an astable multivibrator using timer 555 to generate 1 KHz frequency at 70% duty cycle. **[9]**

b) Illustrate operation of PLL with suitable block diagram. **[8]**

OR

P.T.O.

- Q6)** a) Describe the operation of voltage controlled oscillator with neat diagram. [8]
- b) Design monostable multivibrator using timer 555 to get output pulse width of 2 seconds. [9]

- Q7)** a) Design first order high pass filter for $f_L = 10$ KHz. And pass band gain of 2. [9]
- b) Illustrate with neat circuit diagram to generate +5V DC supply using IC7805. [9]

OR

- Q8)** a) Design second order high pass filter for $f_L = 1$ KHz. [9]
- b) Elaborate with neat circuit diagram, low voltage regulator using IC 723. [9]



Total No. of Questions : 8]

SEAT No. :

PD4200

[Total No. of Pages : 2

[6402]-164

S.E. (Instrumentation & Control)

ELECTRICAL MEASUREMENT & INSTRUMENTATION

(2019 Pattern) (Semester-III) (206263)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.*
- 5) *Assume suitable data, if nessacary.*

Q1) a) An electronically deflected CRT has a final anode voltage of 1500V and parallel deflecting plate 2.5 cm long and 5mm apart. If the screen is 45 cm from the center of depleting plate find: **[9]**

- i) Beam speed
- ii) Depletion sensitivity of the tube
- iii) Depletion factor of the tube

b) If the vertical amplifier of an oscilloscope has a bandwidth of 20MHz. What is the fastest rise time that an input may have to be displayed without distortion. **[9]**

OR

Q2) a) Elaborate with neat sketch measurement of phase using CRO. **[8]**

b) Describe the measurement of DC voltage using CRO. **[6]**

c) State the significance of electronics switch used in dual trace oscilloscope. **[4]**

Q3) a) Derive the equations for general AC bridge at balanced condition. **[9]**

b) Calculate the current through the galvanometer in wheatstone bridge. **[8]**

$R1=2.0k\Omega$

$R2=4k\Omega$

$R1 =7.0k\Omega$

$R4=20k\Omega$

The operating voltage is 8V

OR

P.T.O.

- Q4)** a) Derive the general bridge balance equations of Schering bridge. [9]
b) Calculate the equivalent parallel resistance and capacitance that causes a Wien's bridge to null with the following component values. [8]

$$R1=2.7k\Omega$$

$$C1=5\mu F$$

$$R2 =22k\Omega$$

$$R4=100k\Omega$$

The operating frequency is 2.2 kHz

- Q5)** a) For R-2R DAC, $R_f = R = 1000$ ohms. If the reference voltage is 10 volts, calculate the analog output voltage for digital input (11110011). [9]
b) Draw the block diagram of digital thermometer and explain function of each block. [9]

OR

- Q6)** a) Draw general block diagram of digital phase meter and describe the measurement of phase difference between two signals. [9]
b) Select appropriate digital instruments for the measurement of current and justify the selection with example. [9]

- Q7)** a) Describe the galvanometric type chart recorder with neat diagram. Enlist the types of tracing system? [9]
b) Elaborate different marking mechanism used in recorder. [8]

OR

- Q8)** a) State the significance of X-Y recorder with neat sketch. [9]
b) Elaborate with neat sketch LVDT Type recorder. [8]



Total No. of Questions : 8]

SEAT No. :

PD4201

[Total No. of Pages : 2

[6402]-165

S.E. (Instrumentation & Control)
CONTROL SYSTEM COMPONENTS
(2019 Pattern) (Semester - III) (206264)

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 right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Differentiate between the pneumatic and Hydraulic systems with applications. [6]
b) Explain the Bleed & Non bleed type Pneumatic relay with application. [6]
c) What is the purpose of using special cylinders in Pneumatic systems? Explain anyone. [6]

OR

- Q2)** a) What is meant by direction-controlled valves? Illustrate with proper example of the same. [6]
b) Differentiate the Single acting & Double acting cylinder with neat diagram and its applications. [6]
c) Define the pressure relieving valve with appropriate diagram and its application. [6]

- Q3)** a) Explain the sequencing of cylinders and Direction control in hydraulic circuits. [6]
b) Draw the Standard Symbols for developing hydraulic circuits. [6]
c) Define Hydraulic components and Hydraulic valves, list them with neat diagram. [5]

OR

- Q4)** a) Explain the reciprocating hydraulic circuit with appropriate diagram. [6]
b) How speed is controlled in any hydraulic circuits, Elaborate the same [6]
c) Explain in brief any one circuit of : Meter in, Meter out [5]

P.T.O.

- Q5)** a) Write down the working, characteristics and specifications of SCR. [6]
b) Write down the working, characteristics and specifications of TRIAC.[6]
c) Write down the working, characteristics and specifications of IGBT. [6]

OR

- Q6)** a) Write down the working, characteristics and specifications of DIAC.[6]
b) Write down the working, characteristics and specification of MOSFET.[6]
c) Give the definition of SCR, also explain the commutation of SCR. [6]

- Q7)** a) Draw a proper ladder diagram for Alarm annunciator with application.[6]
b) List down the NEC standards any six for Hazardous Area & Material classification. [6]
c) Define the Purging systems in terms of safety measures. [5]

OR

- Q8)** a) Explain the sealing and immersion in safety measures. [6]
b) Illustrate the definition of Intrinsic Safety also designing. [6]
c) Classify what is HAZOP in details. [5]

* * *

S.E. (Instrumentation Engineering)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - III) (207008)

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

- 1) *Question Nos. 1 is compulsory.*
- 2) *Attempt Q. 2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Write the correct option :**[10]**

a) Z-transform of $\{f(k)\} = \frac{2^k}{k!}, k \geq 0$, is given by **[2]**

i) e^{2z}

ii) $e^{z/2}$

iii) e^z

iv) $e^{2/z}$

b) There are 10 observations having mean 14. If two observations are incorrectly noted as 18 and 12 insted of 19 and 21 respectively. Then correct value of mean is **[1]**

i) 16

ii) 15

iii) 18

iv) 20

c) A ball is drawn from a box containing 6 red balls, 4 white balls and 5 black balls. Determine the probability that it is not red is **[2]**

i) $\frac{4}{15}$

ii) $\frac{1}{3}$

iii) $\frac{2}{5}$

iv) $\frac{3}{5}$

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

i) Find Z-transform of $f(k) = 2^k \cos(3k + 2), k \geq 0$

ii) Find $Z^{-1} \left\{ \frac{3Z^2 + 2Z}{Z^2 + 3Z + 2} \right\}, 1 < |Z| < 2$

b) Find inverse sine transform of $F_s(\lambda) = e^{-\lambda}, \lambda > 0$. **[4]**

c) Solve the integral equation, $\int_0^{\infty} f(x) \sin \lambda x dx = \begin{cases} 1, & 0 \leq \lambda < 1 \\ 2, & 1 \leq \lambda < 2 \\ 0, & \lambda \geq 2 \end{cases}$. **[6]**

Q4) a) Find the arithmetic mean and standard deviation of the following distribution. **[5]**

x	10	20	30	40	50
frequency	10	20	30	20	10

b) Average life span of computers produced by a company is 2,000 hours with standard deviation of 50 hours. From a consignment of 1,000 computers, find the expected number of computers whose life span is from 1,900 hours to 2,100 hours. **[5]**

(Area from 0 to 1 is 0.3413, Area from 0 to 2 is 0.4772)

c) Find regression line of y on x for the following data. **[5]**

x	1	3	5	6	10
y	2	0	4	7	8

OR

- Q5) a)** Find the first four moments about the arithmetic mean for the following distribution. [5]

x	2	3	5	7	8
-----	---	---	---	---	---

frequency	2	1	3	6	4
-----------	---	---	---	---	---

- b) A, B, C hit a target with probabilities $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$ respectively. If all of them fire at the target, find the probability 'P' that [5]

- i) none of them hits the target
ii) at least one of them hits the target

- c) The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination? [5]

- Q6) a)** Find directional derivative of $\phi = xy^2 + yz^3$ at $P(1,1,1)$ towards the point $Q(2,1,-1)$. [5]

- b) Show that the vector field [5]

$\vec{F} = (x + 2y + 4z)\hat{i} + (2x - 3y - z)\hat{j} + (4x - y + 2z)\hat{k}$ is irrotational. Also find corresponding scalar potential function ϕ such that $\vec{F} = \nabla \phi$.

- c) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = (2x + y^2)\hat{i} + (3y - 4x)\hat{j}$ and C is the curve $y = x^2$ joining points (0, 0) and (1, 1). [5]

OR

- Q7)** a) Find directional derivative of $\phi = xy^2 + yz^2 + zx^2$ at $(1, 1, 1)$ along the line $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{2}$. [5]
- b) Show that (any one): [5]
- i) $\nabla \times (\bar{a} \times \bar{r}) = 2\bar{a}$
- ii) $\nabla^2 (r^2 \log r) = 5 + 6 \log r$
- c) Find the work done in moving a particle along the path $x = 2t^2, y = t, z = t^3$ from $t = 0$ to $t = 1$ in force field $\bar{F} = (2y + 3)\hat{i} + xz\hat{j} + (yz - x)\hat{k}$. [5]

- Q8)** a) If $u = 2x - 2xy$ is harmonic find its harmonic conjugate and determine $f(z)$ in terms of z . [5]
- b) Evaluate $\oint_C \frac{\sin 2z}{\left(z + \frac{\pi}{3}\right)^2} dz$ where C is contour $|z| = 2$. [5]
- c) Find a bilinear transformation which maps the points $0, -1, i$ of Z -plane onto the points $2, \infty, \frac{1}{2}(5 + i)$ of W -plane. [5]

OR

- Q9)** a) If $f(z) = u + iv$ is analytic, find $f(z)$, if $u - v = (x - y)(x^2 + 4xy + y^2)$. [5]
- b) Evaluate: $\oint_C \frac{z+2}{z^2+1} dz$ where C is circle $|z+i| = \frac{1}{2}$. [5]
- c) Show that under the transformation $W = \frac{i-z}{i+z}$ x axis in z -plane is mapped onto circle $|W| = 1$. [5]



[6402]-167

S.E. (Instrumentation & Control Engineering)

CONTROL SYSTEMS

(2019 Pattern) (Semester - IV) (206268)

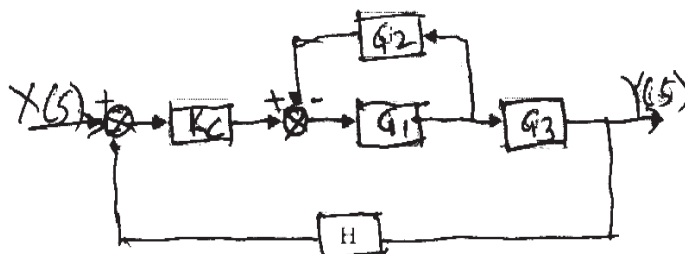
Time : 2½ Hours]

[Max. Marks : 70

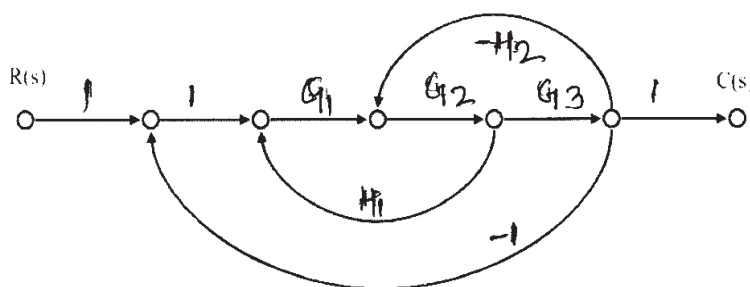
Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagram must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of non-programmable calculators/Log table is allowed.

Q1) a) Find the transfer function by using block diagram reduction techniques? [8]



b) Find $C(s)/R(s)$, by using Masons gain formula. [8]

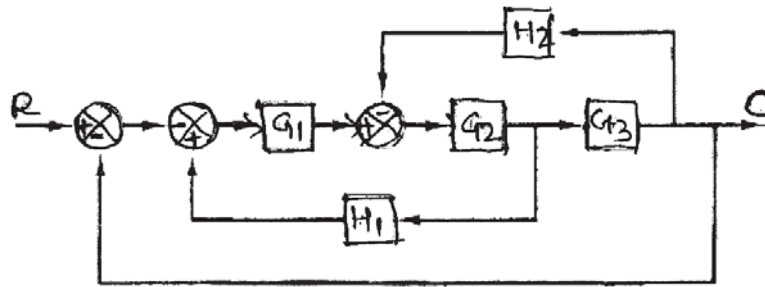


OR

P.T.O.

Q2) a) Solve using block diagram reduction technique.

[8]



b) Explain signal flow graph in detail. Also write steps to solve Signal flow graph. Explain Mason's Gain formula in brief. [8]

Q3) a) A unity feedback system is given by $\frac{C_s}{R_s} = \frac{K}{s+10}$. Determine the gain K where damping ratio is 0.5. so determine settling time, peak overshoot and time to peak overshoot for a unit step input? [10]

b) Explain in detail static error constants (k_p , k_v , k_a) and steady state error(e_{ss}). [8]

OR

Q4) a) Consider the second order system where $\zeta = 0.6$ and $\omega_n = 5$ rad/sec. Find the rise time t_r , peak time t_p , maximum overshoot M_p and settling time t_s when the system is subjected to a unit-step input? [9]

b) A unity feedback system has $G(s) = \frac{60(s+3)}{s(s+1)(s+2)}$. Determine [9]

i) the type of system

ii) all error coefficients and error for ramp input with magnitude 10.

Q5) a) Examine the stability of given equation using Routh's method. [8]

$$p(s) = s^5 + s^4 + 2s^3 + 2s^2 + 3s + 10$$

b) Draw the approximate root locus diagram for a closed loop system whose loop transfer function is given by $G(s)H(s) = \frac{K(s+1)}{(s+2)(s+3)(s+4)}$ [10]

OR

- Q6) a)** Examine the stability of given equation using Routh's method. [8]
 $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0.$
- b)** Sketch the root locus of unity feedback system [10]

$$G(s) = \frac{k(s+1)}{s^2 + 4s + 13}$$

- Q7) a)** Explain in detail Gain margin & phase margin in details and how it will affect the stability of a system? [9]
- b)** Draw the bode plot for a unity feedback system $G(s)H(s) = \frac{0.5}{s(s^2 + s + 1)}$ and find gain margin and phase margin. [9]

OR

- Q8) a)** Consider a Type 0 system with open loop transfer function $G(s)H(s) = \frac{1}{s(1+Ts)}$. Where T is constant. Obtain polar plot. [9]
- b)** Draw the bode plot for a unity feedback system $G(s)H(s) = \frac{K}{s(s+1)(0.1s+1)}$. [9]

* * *

Total No. of Questions : 8]

SEAT No. :

PD4204

[Total No. of Pages : 2

[6402]-168

S.E. (Instrumentation & Control)

DIGITAL ELECTRONICS

(2019 Pattern) (Semester - IV) (206269)

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 rule, mollier charts, electronic pocket calculator and steam table is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Design 16:1 Multiplexer using two 4:1 Multiplexer. [9]

b) Design 8:1 multiplexer using following function. [8]

$$F(A, B, C, D) = \pi M(0, 3, 5, 7, 12, 15) + d(2, 9)$$

OR

Q2) a) Design 1:32 Demultiplexer using 1:16 Demultiplexer [9]

b) Design suitable decoder for the following MIMO function [8]

$$F_1(A, B, C) = \sum m(0, 4, 7) + d(2, 3)$$

$$F_2(A, B, C) = \sum m(1, 5, 6)$$

$$F_3(A, B, C) = \sum m(0, 2, 4, 6)$$

Q3) a) Convert JK Flip flop to D Flip flop [9]

b) Convert JK Flip flop to T Flip flop [8]

OR

Q4) a) Convert SR Flip flop to T Flip flop [9]

b) Convert D Flip flop to JK Flip flop [8]

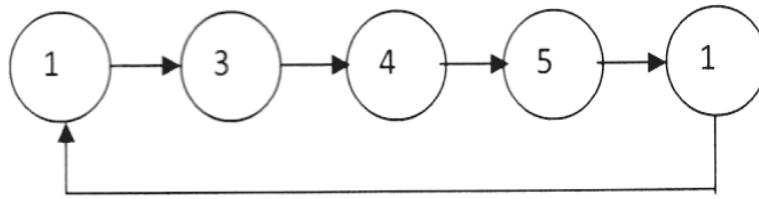
Q5) a) Design a divide by 75 counter using IC 7490. [9]

b) Design a MOD-9 counter using IC 7490. [9]

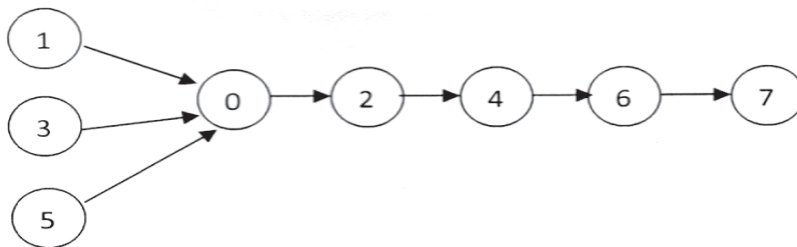
OR

P.T.O.

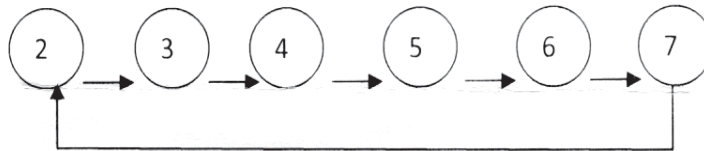
- Q6) a)** Design and draw a 3 bit synchronous counter which goes through the following state. [9]



- b)** Design a synchronous counter by using suitable flip flop that goes through the following states, Avoid lockout condition. [9]



- Q7) a)** Design sequence generator using T flip-flop. [9]



- b)** Elaborate the term interface circuit, Explain the interfacing of Interfacing CMOS with TTL Family. [9]

OR

- Q8) a)** Design PLA for the following function [9]

$$A(x, y, z) = \sum m(1, 2, 4, 6)$$

$$B(x, y, z) = \sum m(0, 1, 6, 7)$$

$$C(x, y, z) = \sum m(2, 6)$$

- b)** Design PLA for the following function. [9]

$$F(A, B, C, D) = \pi M(0, 3, 5, 7, 12, 15) + d(2, 9)$$

* * *

Total No. of Questions : 8]

SEAT No. :

PD-4205

[Total No. of Pages : 2

[6402]-169

S.E. (Instrumentation & Control Engineering)

PROCESS LOOP ELEMENTS

(2019 Pattern) (Semester - IV) (206270)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidate:

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

- Q1)** a) List limitations and write equation of P, I, and D control action and state the suitable solution to overcome the limitations of P, I, and D control action. **[9]**
- b) List continuous control modes used in process control system and explain PI and PD control modes with suitable example. **[9]**

OR

- Q2)** a) Explain direct and reverse action for controller in brief with suitable examples. **[9]**
- b) List discontinuous control modes used in process control system and explain ON- OFF and Multiposition control modes with suitable example. **[9]**
- Q3)** a) Explain Ziegler Nichols close loop tuning method in detail. **[8]**
- b) Derive an expression for digital PID position algorithm and state the limitation of position algorithm. **[9]**

OR

P.T.O.

- Q4)** a) Explain process reaction curve tuning method in detail. [8]
b) Derive an expression for digital PID velocity algorithm and state the merit of velocity algorithm. [9]
- Q5)** a) Explain cavitation in brief and suggest the method to reduce it. [9]
b) What is the necessity of sizing in control valve, list the selection criteria's for control valve and explain [9]
i) Rangeability, ii) Valve Capacity,
iii) Valve stem, iv) Turndown ratio.

OR

- Q6)** a) Explain flashing in brief and suggest the suitable method used to reduce it. [9]
b) What is the need of final control element in process and explain globe and butterfly control valve in detail with neat sketch. [9]
- Q7)** a) State the significance of volume boosters and explain volume booster in brief. [8]
b) What is the significance of pressure boosters and elaborate pressure booster in brief. [9]

OR

- Q8)** a) Enlist types of actuators, explain any one with neat sketch and state its advantages, disadvantages and applications. [8]
b) What is the need of positioners, state its application, types and discuss effect of positioner on performance of control valve. [9]



[6402]-170
S.E. (Instrumentation and Control)
SIGNALS AND SYSTEMS
(2019 Pattern) (Semester - IV) (206271)

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 side indicate full marks
- 4) Assume Suitable data if necessary.

Q1) a) Define Fourier Series. What all information we get about the signal after Fourier Series analysis? Explain. **[9]**

b) Enlist the properties of Continuous Time Fourier Series and explain the linearity and time shifting property in detail. **[9]**

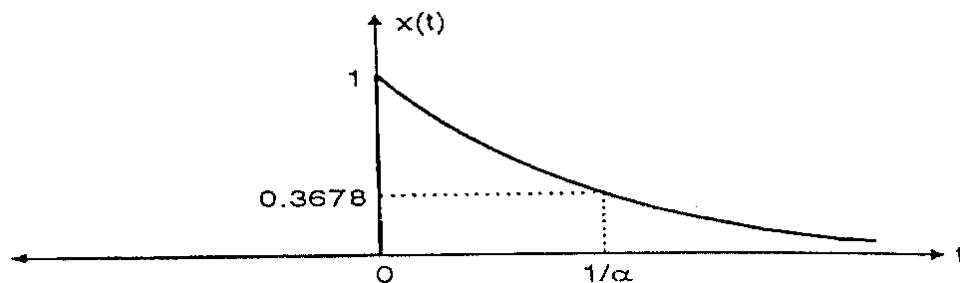
OR

Q2) a) Explain the Dirichlet condition for existence of Fourier Series. **[9]**

b) Write short notes on Orthogonality and basis functions in Fourier Series. **[9]**

Q3) a) Define Fourier Transform. Explain the Dirichlet condition for existence of Fourier Transform. **[8]**

b) Find the Fourier Transform of the decaying exponential pulse shown in figure below. **[9]**



P.T.O.

- Q4) a)** List the properties of Fourier Transform and explain any three properties of Fourier Transform in detail. [9]
- b)** Define Unit Impulse function and find its Fourier Transform. [8]

- Q5) a)** Define Laplace Transform. What are the advantages of Laplace Transform over Fourier Transform? [9]
- b)** Find the Laplace Transform and ROC of Unit Step signal. [9]

OR

- Q6) a)** List the properties of Laplace Transform and explain any two properties of Laplace Transform. [9]
- b)** Calculate Laplace Transform of $x(t) = e^{-2t}u(t) - e^{2t}u(-t)$ and plot the ROC. [9]

- Q7) a)** Define the following terms : [8]
- i) Probability
 - ii) Sample Space
 - iii) Random Variables
 - iv) Event
- b)** What is CDF? Explain the properties of CDF. [9]

OR

- Q8) a)** Define PDF. Explain the properties of PDF. [8]
- b)** A particular Electronic equipment becomes inoperative if two components X and Y both fails. The probability that X fails is 0.01 and the probability that Y fails is 0.005. However, the probability that Y fails increases by 5, if X has failed. Calculate the probability that the equipment becomes inoperative. Also find the probability that X will fail if Y has failed. Comment on the result of Conditional Probability. [9]



Total No. of Questions : 8]

SEAT No. :

PD-4207

[Total No. of Pages : 3

[6402]-171

S.E. (Instrumentation and Control)

DATA STRUCTURES

(2019 Pattern) (Semester - IV) (206272)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

Q1) a) Write down the functions used to perform the below mentioned operations on list : **[12]**

- i) Number of elements in the list
- ii) Remove object from a list
- iii) Find minimum value in list
- iv) Find maximum value in list

b) What is output of : **[6]**

- i)

```
import numpy as np  
  
arr = np.array([[1, 2, 3, 4, 5], [6, 7, 8, 9, 10]])  
  
print(arr[1, 1:4])
```
- ii)

```
import numpy as np  
  
arr = np.array([1, 2, 3, 4, 5, 6, 7])  
  
print(arr[1:5])
```

OR

P.T.O.

- Q2) a)** Explain following operations of list with example : **[8]**
 Append, extend, insert, remove
- b) Write a Python program to append a new item to the end of the array. **[4]**
- c) What is output of : **[6]**
- i) `13 = [34]`
`14 = [1]`
`print(13+ 14)`
- ii) `15 = [2, 3, 4, 5]`
`print(15*2)`
- Q3) a)** What are the advantages and disadvantages of Abstract Data Type? **[4]**
- b) Explain following operations of list with example : **[8]**
 Append, extend, insert, and remove
- c) `def myfunc(a, b) :` **[3]**
`return a + b`
`print (list(map(myfunc, ('Goa', 'Mumbai', 'Nashik'), ('India', 'Japan', 'Canada'))))`
 What is output of the above Python program?
- d) Write a short note on SET Abstract Data Type. **[2]**
- OR**
- Q4) a)** What are the mathematical operations that can be performed on SET Abstract Data Type? **[8]**
- b) What is the difference between `append()` and `extend()` functions when used in Multidimensional Arrays? **[4]**
- c) `a = [[2, 4, 6, 8, 10], [3, 6, 9, 12, 15], [4, 8, 12, 16, 20]]` **[5]**
`a[2].reverse()`
`print(a)`
 What is output of the above Python program?

- Q5)** a) Explain traversing the nodes in linked list with neat diagram. [8]
b) Compare python list and linked lists. [4]
c) Explain linked list sorting with example. [6]

OR

- Q6)** a) Write functions for : [8]
i) adding new item,
ii) Removing item
iii) To check if item is in Bag
iv) For making current node as head in Bag ADT.
b) Explain how nodes can be remove in tail reference using example. [4]
c) Explain how nodes are created, added and linked. [6]

- Q7)** a) Elaborate the Postfix evaluation algorithm stepwise. [9]
b) Describe the implementation of queue using a CircularArray. [8]

OR

- Q8)** a) Convert the following expression from Infix to Postfix expression. [9]
(A + B) * (C – D)
b) How the Queue ADT is implemented using a Python list. [8]

