

Total No. of Questions : 8]

SEAT No. :

**P1474**

[Total No. of Pages : 3

[6002]-101

**S.E. (Civil)**

**BUILDING TECHNOLOGY AND ARCHITECTURAL  
PLANNING**

**(2019 Pattern) (Semester-III) (201001)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1) a)** Draw a neat labeled sketch of semicircular-arch and explain. [8]
- i) Key stone
  - ii) Crown
  - iii) Springing line
  - iv) Voussoir.
- b) Explain Battened & Ledged Doors with sketch. [5]
- c) Write a short note on protective coatings, its necessity and types. [5]

OR

- Q2) a)** Draw the sketch of Window. [8]
- i) Bay window
  - ii) Clerestorey Window
  - iii) Pivoted window
  - iv) Lantern window
- b) Enlist any four types of floor finishes and explain mosaic flooring. [5]
- c) Explain the procedure of Fixing door and window in detail? [5]

- Q3) a)** Write a short note on rating system for green building. [4]
- b) Draw the sketch of stair. [8]
- i) Helical stair
  - ii) Spiral stair
  - iii) Half turn geometrical stair
  - iv) Three-Quarter-Turn stair.
- c) What are the fundamental requirements of residential building? [5]

OR

*P.T.O.*

- Q4) a)** What are the salient features of Green building? [5]
- b) Plan a residential building having G+1 framed structure with the following requirements. Calculate the total built up area and give schedule of doors and windows. The external wall thickness is 230 mm and internal wall thickness is 150mm. [12]

(Refer Table). Indicate N-Line

Sr. No.	Type of Unit	No. of Units	Internal area of unit in sq m
1	Living room	1	20
2	Bedroom	2	14 each
3	Master bedroom with attached toilet	1	18
4	Kitchen	1	12
5	WC	1	1.2
6	Bath	1	2.8
7	Staircase	1	Use suitable Dimensions

- Q5) a)** It is proposed to construct a single-storied shopping complex with the following data: [12]
- Entrance : 60 m<sup>2</sup>
  - Big shops : 8 nos., 30 m<sup>2</sup> each.
  - Small shops : 12 nos., 20 m<sup>2</sup> each
  - Telephone booths : 4 nos. of suitable size.
  - Separate sanitary blocks for ladies and gents.
  - Staircase for future expansion.
  - All passages 2.5 m wide.
  - RCC framed structure.
  - Assume additional data if necessary. Draw to a scale of 1 : 50 or suitable, line plan with north line.
- b) Draw a line plan to a suitable scale for single story bank building. Built up area is limited to 200 m<sup>2</sup>. [6]

OR  
2

- Q6) a)** It is proposed to construct a bungalow for a Dean of Medical college the following are the requirements for accommodation: **[12]**
- i) A drawing hall-20 m<sup>2</sup>
  - ii) Living room-30m<sup>2</sup>
  - iii) Kitchen cum dining room-20 m<sup>2</sup>
  - iv) Guest bedroom-20 m<sup>2</sup>
  - v) Children's room-20 m<sup>2</sup>
  - vi) Master bedroom-20 m<sup>2</sup> provide adequate verandahs, passages, sanitary units, staircase etc. The structure may be planned as G+1 RCC framed structure. Draw detailed ground floor plan.
- b) What are the salient features of vegetable market building? **[6]**

- Q7) a)** Write a short note on Maharashtra Regional and town planning (MRTP)Act. **[6]**
- b) Write a short note on. **[6]**
- i) Fire load
  - ii) Earthquake resistance structure.
- c) Compare fire resisting properties of concrete and stone. **[5]**

OR

- Q8) a)** What is TDR in construction? How does it work? **[6]**
- b) What is reverberation time and how is it calculated? **[6]**
- c) Write a short note on 7/12 abstract, its important and meaning of every term on it? **[5]**



Total No. of Questions : 8]

SEAT No. :

**P1475**

**[6002]-102**

[Total No. of Pages : 3

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Assume Suitable data, if necessary.*
- 3) *Use of Non-Programmable calculator is allowed.*

- Q1) a)** A simply supported beam of rectangular section 230 mm wide and 450 mm deep is subjected to uniformly distributed load of 60 kN/m on entire span of 4m. Determine maximum bending stress and draw Bending stress Distribution diagram. **[8]**
- b) A symmetric 'I' section having flanges each of 150 mm × 20 mm and web of 200 mm × 20mm is subjected to a shear force of 100 kN. Draw shear stress Distribution diagram of the beam. **[9]**

OR

- Q2) a)** A cantilever beam of span 1m is subjected to two point loads, 100kN at the free end and 50kN at the centre of the beam. The beam is rectangular in section having width of 300 mm and depth 600mm. Determine maximum bending stress and draw Bending stress Distribution diagram. **[8]**
- b) A beam of 'T' section having flange of 300 mm × 50mm and web of 400mm × 50mm, is subjected to maximum shear force of 200 KN. Draw Shear stress Distribution diagram. **[9]**
- Q3) a)** A solid aluminium shaft of 80mm diameter is to be replaced by a hollow steel shaft of 80mm outer diameter. The two shafts have same angle of twist per unit torque over the total length. If the shear modulus of steel is three times the shear modulus of aluminium. Find the inner diameter of the shaft. **[9]**
- b) The principal tensile stresses at a point are 85N/mm<sup>2</sup> and 55N/mm<sup>2</sup>. Find the normal, tangential and resultant stress on a plane at 25° with major principal plane. Also find the angle of obliquity. **[8]**

OR

*P.T.O.*

**Q4) a)** Find maximum torque that can be safely applied to a shaft of 75mm diameter. The permissible angle of twist is  $1^\circ$  in a length of 4m and permissible shear stress is 40 Mpa. [9]

Take  $G = 80 \text{ GPa}$ .

b) Direct stresses of  $150 \text{ N/mm}^2$  and  $80 \text{ N/mm}^2$ , both tensile exists on two perpendicular planes at a point in a body. Shear stress is also acting along with these direct stresses. [8]

If the greatest principal stress at the point is  $200 \text{ N/mm}^2$ , determine the magnitude of shear stress on the two planes. Also find the maximum shear stress at the point.

**Q5) a)** A steel column of 4m long and of 100mm diameter is fixed at one end and free at other end. Determine the crippling load by Euler's formula. [6]

Take  $E = 200 \text{ GPa}$ .

b) Determine the safe load, an angle strut  $75\text{mm} \times 75 \text{ mm} \times 10\text{mm}$  can carry. The length of the strut is 2m and it is fixed at one end and hinged at the other. Consider factory of safety as 1.5. Minimum radlics of gyration 12.5mm and  $6c = 400\text{mpa}$  (crosting 8 trem)

$$a = \frac{1}{7500}$$

Use Rankine's formula. [6]

c) Determine core section for a hollow rectangular column of external size  $B \times D$  and internal size  $b \times d$  respectively. [6]

OR

**Q6) a)** State assumptions and limitations of Euler's theory. [6]

b) Determine ratio of Crippling load given by Euler's and Rankine's formula for a circular column of 60mm diameter and 2.5m long. [6]

Take yield stress as 310 MPa.

Rankines constant =  $1/7500$  and

$E = 210 \text{ GPa}$ .

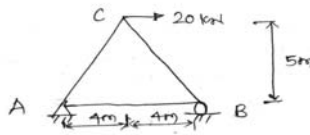
c) A rectangular column  $300\text{mm} \times 250\text{mm}$  is subjected to compressive load of 160 kN acting at an eccetricity of 45 mm in a plane bisecting 250 mm side. [6]

Determine maximum and minimum stresses.

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



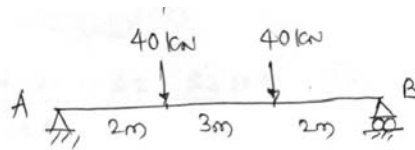
- b) Determine the vertical displacement at joint 'C' by using unit load method. Area of each member is  $500 \text{ mm}^2$ . [9]  
 $E = 210 \text{ Gpa}$ .



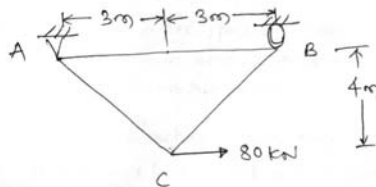
OR

- Q8) a) Determine maximum slope and deflection for a simply supported beam shown in figure below. [9]

Use Macaulay's method.



- b) Determine vertical displacement at joint 'C' using unit Load method. [9]  
 Area of each member is  $600 \text{ mm}^2$   
 $E = 200 \text{ GPa}$ .



Total No. of Questions : 8]

SEAT No. :

**P1476**

**[6002]- 103**

[Total No. of Pages : 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) Answers to the all questions should be written in single answer-book.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

- Q1) a)** The resistance force  $R$  experienced by a partially submerged body depends upon the velocity  $V$ , length of the body  $L$ , viscosity of the fluid  $\mu$ , density of the fluid  $\rho$ , and gravitational acceleration  $g$ . Using Buckingham-Pi method, prove that: **[8]**

$$R = \rho V^2 L^2 \phi \left( \frac{\rho V L}{\mu}, \frac{V}{\sqrt{g l}} \right)$$

- b) Explain following similarities as applicable to model studies: **[6]**
- i) Geometric similarity
  - ii) kinematic similarity
  - iii) dynamic similarity
- c) The velocity distribution in a boundary layer is given by **[4]**

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

Calculate displacement thickness.

OR

- Q2) a)** The velocity and discharge for a  $\frac{1}{50}$  scale model of a spillway are 0.35 m/sec and 0.11 m<sup>3</sup>/sec, respectively. Calculate corresponding velocity and discharge in the prototype. **[6]**

**P.T.O.**

- b) Explain the growth of boundary layer over a thin flat plate held parallel to the direction of flow in a real fluid. [6]
- c) Explain following similarity laws: [6]
  - i) Reynold's model law
  - ii) Froude's model law

- Q3)**
- a) Explain all types of minor losses in pipe. [7]
  - b) The water surface levels of two reservoirs differ by 12 m. They are connected by a 55 m long pipe. For the first 25 m length the diameter is 120 mm and for the remaining length diameter is 150 mm. The Darcy - Weisbach friction factor  $f$  for 120 mm diameter and 150 mm diameter pipes are respectively 0.024 and 0.02. Determine the discharge. Neglect minor losses. [7]
  - c) Draw typical velocity distribution diagrams for fully developed laminar and turbulent flow through pipe. Also state the nature of velocity profile for each. [3]

OR

- Q4)**
- a) Define following term applicable to turbulent flow through pipe: [6]
    - i) instantaneous velocity
    - ii) temporal mean velocity
    - iii) Prandtl's mixing length
  - b) Prove that for steady uniform laminar flow through circular pipe, the velocity distribution diagram is parabolic. [9]
  - c) Calculate the value of Darcy Weisbach friction factor if Reynold's Number for flow through pipe is 100. [2]

- Q5)**
- a) Explain specific energy curve. [5]
  - b) A trapezoidal channel has side slope of 1 V: 1.5 H and the slope of the channel bottom is 1 : 5000. Determine the dimensions of most efficient channel section, if it has to carry water at 10 m<sup>3</sup>/sec. Take Manning's  $n=0.012$ . [8]
  - c) Explain different four types of flows in open channel. [4]

OR



- Q6)** a) Calculate minimum specific energy and maximum discharge corresponding to specific energy of 1.8 m that may occur in a rectangular channel 5 m wide. [8]
- b) Define following terms applicable for uniform flow computation: [3]
- i) normal depth
  - ii) conveyance
  - iii) section factor
- c) Explain velocity distribution in open channel flow. [6]
- Q7)** a) Explain M1, M2, and M3 profiles of GVF. Give their practical example. [9]
- b) A flat plate 1 m × 1 m moves through air of density 1.2 kg/m<sup>3</sup> at 30 kmph. Determine: [9]
- i) drag force
  - ii) lift force
  - iii) resultant force
  - iv) power required to maintain the plate in motion.
- Take  $C_D = 0.18, C_L = 0.70$ .

OR

- Q8)** a) In a wide rectangular channel of 100 m wide and 3 m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 1.5 m. Take Manning's  $n = 0.035$ . Use direct step method and take two steps only. Sketch the water surface profile. [10]
- b) Differentiate between bluff body and streamlined body with neat sketch. [5]
- c) Draw a neat sketch showing variation of drag coefficient with Reynolds Number for flow around circular cylinder. [3]



Total No. of Questions : 9]

SEAT No. :

[Total No. of Pages : 5

**P1477**

[6002]-104

**S.E. (Civil)**

**ENGINEERING MATHEMATICS-III**

**(2019 Pattern) (Semester-III) (207001)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Questions No. 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) *Non-programmable electronic packet calculator is allowed.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume Suitable data if necessary.*
- 6) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Attempt the following.

a) The first four moments of distribution about mean one 0, 16, -64 and 162, then standard deviation of a distribution is \_\_\_\_\_. [2]

- |         |        |
|---------|--------|
| i) 21   | ii) 12 |
| iii) 16 | iv) 4  |

b) The value of  $\nabla_r^2$  is \_\_\_\_\_ [2]

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

c) For  $\vec{F}=3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ , the value of  $\int \vec{F}.d\vec{r}$  along straight line joining points (0,0,0) and (2,1,3) is \_\_\_\_\_. [2]

- |         |        |
|---------|--------|
| i) 15   | ii) 14 |
| iii) 16 | iv) 8  |

**P.T.O.**

d) The most general solution of PDE  $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$  is \_\_\_\_\_. [2]

i)  $u(x,t) = (c_1 \cos mx + c_2 \sin mx) e^{-m^2 t}$

ii)  $u(x,t) = (c_1 \cos mx + c_2 \sin mx) (c_3 \cos mt + c_4 \sin mt)$

iii)  $u(x,y) = (c_1 \cos mx + c_2 \sin mx) (c_3 e^{my} + c_4 e^{-my})$

iv)  $u(x,y) = (c_1 e^{mx} + c_2 e^{-mx}) (c_3 \cos my + c_4 \sin my)$

e) A throw is made with two dice. The probability getting a score of 10 is \_\_\_\_\_. [1]

i)  $\frac{1}{12}$

ii)  $\frac{1}{6}$

iii)  $\frac{1}{5}$

iv)  $\frac{2}{3}$

f) The cross product of  $\vec{a}$  &  $\vec{b}$  is defined as  $\vec{a} \times \vec{b} =$  [1]

i)  $ab \cos \theta$

ii)  $ab \sin \theta \hat{n}$

iii)  $ab \sin \theta$

iv)  $ab \cos \theta \hat{b}$

Q2) a) Calculate the first four moments about mean of the given distribution also find  $\beta_1$  &  $\beta_2$ . [5]

$x$	2	2.5	3	3.5	4	4.5	5
$f$	5	38	65	92	70	40	10

b) Find coefficient of correlation from given data. [5]

$n = 25, \Sigma x = 75, \Sigma y = 100, \Sigma x^2 = 250, \Sigma y^2 = 500, \Sigma xy = 325.$

c) An unbiased coin is thrown 10 times. Find probability of getting. [5]

i) Exactly 6 heads

ii) At least 6 heads

OR

Q3) a) Find lines of regression for the following data. [5]

$x$	10	14	19	26	30	34	39
$y$	12	16	18	26	29	35	38

- b) One percent of articles from a certain machine are defective. What is the probability of [5]
- No defective
  - One defective
- c) Assuming that the diameter of 1000 brass plugs taken consecutively from machine form a normal distribution with mean 0.7515 cm and standard deviation 0.0020 cm. How many of the plugs are likely to be approved if the acceptable diameter is  $0.752 \pm 0.004$  cm. [5]

[Given  $A(2.25) = 0.4878$ ,  $A(+1.75) = 0.4599$ ]

**Q4) a)** Find the angle between velocity and acceleration vectors

$$\text{at } t=0 \text{ for } \vec{r} = e^{-t}\hat{i} + \log(t^2 + 1)\hat{j} - \tan t\hat{k}. \quad [5]$$

- b) In what direction from the point (1, 0, 1) is the directional derivative of  $\phi = x^2y z^3$  a maximum? What is the magnitude of this maximum? [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 scalar  $\phi$  such that  $\vec{F} = \nabla\phi$ . [5]

OR

**Q5) a)** If directional derivative of  $\phi = ax^2y + by^2z + cz^2x$  at (1,1,1) has maximum magnitude 15 in the direction parallel to  $\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}$ . Hence find the values of  $a, b, c$ . [5]

b) Attempt any one [5]

$$\text{i) } \nabla^2 \left( \frac{\vec{r}}{r^2} \right) = \frac{2}{r^4}$$

$$\text{ii) } \nabla^2 \left( \frac{\vec{a} \cdot \vec{b}}{r} \right) = 0$$

c) Show that  $\vec{F} = \frac{1}{r} [r^2\vec{a} + (\vec{a} \cdot \vec{r})\vec{r}]$  is irrotational. [5]

**Q6) a)** Evaluate  $\oint_C \bar{F} \cdot d\bar{r}$  where  $\bar{F} = (x^2 + xy)\hat{i} + (x^2 + y^2)\hat{j}$  where C is the square formed by  $y = \pm 1$  and  $x = \pm 1$ .  $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$ . [5]

b) Evaluate  $\iint_S \bar{f} \cdot \hat{n} ds$  where  $\bar{f} = yz\hat{i} + zx\hat{j} + xy\hat{k}$  and S is the sphere  $x^2 + y^2 + z^2 = 1$  in the first octant. [5]

c) Apply Gauss divergence theorem to evaluate  $\iint_S \bar{f} \cdot \hat{n} ds$  where  $\bar{f} = 4xz\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ , S being the closed cylinder  $x^2 + y^2 = 4$  bounded by  $z = 0$  and  $z = 3$ . [5]

OR

**Q7) a)** Using Green's lemma for  $\bar{F} = (3x^2 - 8y^2)\hat{i} + (4y - xy)\hat{j}$  and the curve C bounding the region R formed by  $x = 0$ ,  $y = 0$  and  $x + y = 1$ , evaluate  $\iint_R (\nabla \times \bar{F}) \cdot \hat{k} dx dy$ . [5]

b) Using Gauss divergence theorem evaluate  $\iint_S (\bar{F} \cdot \bar{n}) ds$  where  $\bar{F} = x^2z\hat{i} + y\hat{j} - xz^2\hat{k}$  where S is the boundary of the region bounded by the surfaces  $z = x^2 + y^2$  and  $z = 4y$ . [5]

c) A liquid mass is rotating with a constant angular velocity  $\omega$  about a vertical axis (positive z-axis) under the action of gravity. Find the pressure at any point of the liquid, if the motion is steady. Use the equation  $\frac{\partial \bar{q}}{\partial t} + (\bar{q} \cdot \nabla) \bar{q} = \bar{F} - \frac{1}{\rho} \nabla p$  assigning the symbols appropriate meanings. [5]

**Q8) a)** If  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  represents the vibrations of the string of length fixed at both ends. Find the solution it. [8]

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

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

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

iv)  $y(x, 0) = lx - x^2 \quad 0 < x < l$

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

- i)  $u(0, t) = 0, \forall t$
- ii)  $u(l, t) = 0 \forall t$
- iii)  $u(x, 0) = x \quad 0 < x < l$
- iv)  $u(x, t)$  is bounded.

OR

Q9) a) If the wave equation of vibration of string is given by,  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ . Find the solution  $y(x, t)$ , if, [8]

- i)  $y(0, t) = 0 \forall t$
- ii)  $y(l, t) = 0 \forall t$
- iii)  $y(x, 0) = 0 \forall x$

$$\text{iv) } \left. \frac{\partial y}{\partial t} \right|_{t=0} = \begin{cases} ax & 0 < x < l/2 \\ a(l-x) & l/2 < x < l \end{cases}$$

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

- i)  $u$  is finite for all  $t$
- ii)  $u(0, t) = 0$
- iii)  $u(\pi, t) = 0,$
- iv)  $u(x, 0) = \pi x - x^2 \quad 0 \leq x \leq \pi$



Total No. of Questions : 8]

SEAT No. :

P-1478

[Total No. of Pages : 2

[6002]-105

S.E. (Civil Engineering)

ENGINEERING GEOLOGY

(2019 Pattern) (Semester - III) (207009)

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) What is unconformity and Describe various types of unconformities. [6]
- b) Define fault and explain the significance of fault in Civil Engineering. [6]
- c) What is plate tectonics? Explain divergent and convergent plates. [5]

OR

- Q2)** a) Define fold and explain any three types of folds. [6]
- b) What is mountain building process? Describe types of mountains. [6]
- c) Write short notes on : [5]
- i) Inlier and Outlier
  - ii) Strike and Dip of rocks.

- Q3)** a) Explain importance of preliminary geological exploration in civil engineering. [6]
- b) Explain applications of remote sensing in civil engineering. [6]
- c) Compare direct and indirect methods of subsurface geological investigations. [6]

OR

*P.T.O.*

- Q4)** a) Describe in detail core drilling method of subsurface geological exploration with its significance. [6]  
b) What will be the effects of faulting on civil engineering structures? [6]  
c) Explain how GIS is an important tool for civil engineers. [6]

- Q5)** a) Discuss on tunnel excavated through faulted area. [6]  
b) Discuss on unfavorable geological conditions for reservoir area of dam. [6]  
c) A site is proposed for excavation of tunnel along A-B and M-N, passing through axial and limb region of fold respectively. Justify the suitability of tunnel in such conditions. [5]

OR

- Q6)** a) Explain Preliminary Geological Investigations carried out for Tunneling. [6]  
b) Explain influence of geological conditions on the choice and type of dam. [6]  
c) Explain significance of dipping strata in site selection for construction of dam. [5]

- Q7)** a) What is landslide? Describe preventive measures against landslides. [6]  
b) Explain various types of aquifers. [6]  
c) Describe requirements of good building stone. [6]

OR

- Q8)** a) What is earthquake? Explain causes of earthquake. [6]  
b) What is groundwater? Describe methods of artificial recharge of groundwater. [6]  
c) Describe suitability of basalt, granite and limestone as a building stone. [6]





Total No. of Questions : 8]

SEAT No. :

P-1479

[Total No. of Pages : 3

[6002]-106

S.E. (Civil)

**GEOTECHNICAL ENGINEERING**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Calculate the zero-air-void density for a soil with  $G_s = 2.70$  at moisture contents of 5, 10, 15, 20, and 25%. Plot a graph of ZAV versus moisture content. **[6]**
- b) A ring foundation is of 3.60 m external diameter and 2.40 m internal diameter. It transmits a uniform pressure of  $135 \text{ kN/m}^2$ . Calculate the vertical stress at a depth of 1.80 m directly beneath the centre of the loaded area. **[6]**
- c) Explain the field application of compaction test result and how to control Field compaction. **[5]**

OR

- Q2)** a) List the factors affecting compaction and explain the effect of compaction on any four soil properties. **[6]**
- b) A raft of size  $4 \text{ m} \times 4 \text{ m}$  carries a uniform load of  $200 \text{ kN/m}^2$ . Using the point load approximation with equivalent point loads for four equal squares, calculate the stress increment at a point in the soil which is 4 m below the centre of the loaded area. **[6]**
- c) What is Isobar and Pressure bulb? Explain its significance. **[5]**

**P.T.O.**

**Q3) a)** Comment on Unconfined Compression test is special case of Triaxial Compression test. Explain Unconfined Compression test with respect drainage, soil suitability and time requirement. [6]

b) The following table gives data obtained from triaxial compression test conducted under undrained conditions on two specimens of same soil sample. The diameter and height are 40 mm and 80 mm respectively for both samples. Determine shear strength parameters analytically. [6]

Specimen	i	ii
Cell pressure (kN/m <sup>2</sup> )	100	200
Deviator load at failure (N)	637	881
Increase in volume at failure (ml)	1.1	1.5
Axial Compression (mm)	5	7

c) Draw shear strength envelopes for c-soils,  $\phi$ -soils and c- $\phi$  soils. Explain Terzaghi's effective stress principle. [5]

OR

**Q4) a)** Explain Thixotropy, Sensitivity and Activity of clayey soils. [6]

b) From a direct shear test on an undisturbed soil, evaluate the undrained shear strength parameters. Determine shear strength, major and minor principal stresses and their planes in the case of specimen of same soil sample subjected to a normal stress of 100 kN/m<sup>2</sup>. [6]

Normal stress (kN/m <sup>2</sup> )	70	96	114
Shear stress at failure (kN/m <sup>2</sup> )	138	156	170

c) Explain with neat sketch the Peak and Residual shear strengths of soils. [5]

**Q5) a)** Compare between assumptions and principle of Rankine's and Coulomb's theory of Earth pressure. [6]

b) For the retaining wall of 6 m height with vertical back, the top 3 m of the sand fill has unit weight of 16 kN/m<sup>3</sup> and  $\phi = 30^\circ$  and the rest sand fill have saturated unit weight of 18 kN/m<sup>3</sup> and  $\phi = 35^\circ$  with Groundwater table at 3m from bottom. Determine the force per unit length of the wall for Rankine's active state. Also find the location of the resultant. [6]

c) Explain with neat sketch Culmann's graphical method of determination of earth pressure. [6]

OR

- Q6)** a) Explain with neat sketches at rest, active and passive earth pressure with respect to wall movements. [6]
- b) A retaining wall with a smooth vertical back retains a purely cohesive fill. Height of wall is 12 m. Unit weight of fill is  $20 \text{ kN/m}^3$ . Cohesion is  $10 \text{ kN/m}^2$ . Show pressure distribution, at what depth is the intensity of pressure zero. What is the total active Rankine thrust on the wall? where does the resultant thrust act? [6]
- c) Explain with neat sketch Rebhann's graphical method of determination of earth pressure. [6]

- Q7)** a) Explain with neat sketch stability analysis of Infinite Slopes in  $c-\phi$  soil. [6]
- b) An embankment 10 m high is inclined at an angle of  $36^\circ$  to the horizontal. A stability analysis by the method of slices gives the forces per running meter:  $\Sigma$  Shearing forces = 450 kN,  $\Sigma$  Normal forces = 900 kN,  $\Sigma$  Neutral forces = 216 kN. The length of the failure arc is 27 m. The soil has the effective values  $c' = 20 \text{ kN/m}^2$  and  $\phi = 18^\circ$ . respectively. Determine the factor of safety of the slope with respect to (a) shearing strength and (b) cohesion. [6]
- c) Explain Friction Circle Method with neat sketch. [6]

OR

- Q8)** a) Explain Landslides causes and remedial measures. [6]
- b) An embankment is inclined at an angle of  $35^\circ$  and its height is 15 m. The angle of shearing resistance is  $15^\circ$  and the cohesion intercept is  $200 \text{ kN/m}^2$ . The unit weight of soil is  $18 \text{ kN/m}^3$ . If Taylor's stability number is 0.06, find the factor of safety with respect to cohesion. [6]
- c) Explain Bishop's method of stability analysis with neat sketch. [6]



Total No. of Questions : 8]

SEAT No. :

P-1480

[Total No. of Pages : 3

[6002]-107

S.E. (Civil)

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 downward (depression) and staff is held vertical? [6]

b) State the different applications 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 position : [7]

Staff Station	Instrument Station	Vertical angle	Staff reading
A	Intermediate between A & B	+ 4°30'	1.605, 2.400, 3.195
B		+ 2°45'	0.805, 1.345, 1.885

Compute the length AB and RL of point B, if that of A is 395.400m. The instrument and staff are in one line. (take multiplying constant as 100 and Additive constant as 0)

OR

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. [8]

Instrument station	H.I. (m)	Vertical Angle	Staff at	Staff Reading
P	1.8	+ 2°40'	M	1.25, 1.93, 2.56
P	1.8	- 4°40'	Q	1.45, 1.85, 2.30

R.L of station M is 50.00 m Calculate the R.L. of P & Q, distance PQ and gradient of PQ line?

P.T.O.

- b) State the different patterns of contour showing natural features. [4]
- c) Explain the procedure for finding out tachometric constant. [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]
    - i) Chainage of intersection point 1580 m
    - ii) Angle of intersection =  $145^\circ$
    - iii) Radius of curve = 380 m
    - iv) Peg Interval = 30 m
  - c) Draw neat sketch of combined curve with its notations. [4]

OR

- Q4)**
- a) Two tangents intersect at a chain age of 1320.5 m the deflection angle  $24^\circ$  calculate the following quantities for setting out all curves of radius 275 m. [8]
 

Calculate :

    - i) Tangent length
    - ii) Length of long chord
    - iii) Length of the curve
    - iv) Apex Distance
    - v) Chainage of Curve point & tangency point
    - vi) Versed sine
  - b) Enlist various linear methods of setting out curves and explain any one with sketch. [5]
  - c) Enlist different linear and angular methods of setting out of curves. [4]

- Q5)**
- a) Enlist the limitations of the prevalent survey techniques and also give advantages of Space Based Positioning System. [6]
  - b) Write a note on setting out alignment of road. [6]
  - c) Explain necessity horizontal and vertical controls in construction activity. [5]

OR

- Q6)** a) State Different names of satellites and Write a note on GLONASS (Global Navigation and Surveying System). [6]  
b) Write a short note on survey for drainage line work. [6]  
c) Write a short note on checking verticality of tall building. [5]

- Q7)** a) Describe the objective and classification of triangulation 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) Explain sounding methods and sounding equipment of hydrographic survey. [6]  
b) State the working and uses of Electronic Total Station. [6]  
c) Define geodetic survey and state its objectives of study. [6]



Total No. of Questions : 8]

SEAT No. :

**P-1481**

[Total No. of Pages : 5

**[6002]-108**

**S.E. (Civil)**

**CONCRETE TECHNOLOGY**

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

*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) *Bold 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)** Calculate the compressive strength of following specimen, of concrete. **[6]**

Sr. No.	Specimen and size	Crushing load in kN
i)	Cube 1 : 150 mm × 150 mm × 150mm	600
ii)	Cube 2 : 150 mm × 150 mm × 150mm	630
iii)	Cube 3 : 150 mm × 150 mm × 150mm	625

**b)** Calculate the split tensile strength of following specimen of concrete. **[6]**

Sr. No.	Specimen and size	Crushing load in kN
i	Cylinder 1 : 150mm diameter × 300 mm height	130
ii	Cylinder 2 : 150mm diameter × 300 mm height	140
iii	Cylinder 3 : 150mm diameter × 300 mm height	150

**c)** Write short note on :

**[6]**

- i) Shrinkage of concrete.
- ii) Creep of Concrete.

OR

**P.T.O.**

- Q2)** a) Enlist non destructive tests for concrete. Explain core test along with its advantages and limitations. [6]  
 b) Explain the principal of rebound hammer with neat sketch. Enlist the limitations of rebound hammer test. [6]  
 c) Explain the stress-strain relationship of concrete with neat sketch. [6]
- Q3)** a) Define concrete mix design and state objectives in mix design? [4]  
 b) Enlist the factors influencing concrete mix design and explain any one of them. [5]  
 c) Enlist various methods available for concrete mix design and explain the step by step procedure for concrete mix design IS 10262 method. [8]

OR

- Q4)** a) Design a concrete for grade M30 using IS code method for following data: [13]

<b>Parameter</b>	<b>:</b>	<b>Details</b>
Grade designation	:	M30
Standard deviations	:	5.00
Factor based on the grade of concrete, X	:	6.50
Type of cement	:	OPC 53 grade conforming to IS 12269
Workability	:	75 mm (slump)
Exposure conditions	:	Moderate (for plain concrete)
Degree of supervision	:	Good
Maximum cement content	:	450 kg/m <sup>3</sup>
Type of aggregate	:	Angular coarse aggregate
Specific gravity of cement	:	3.00
Specific, gravity of coarse aggregate and fine aggregate	:	2.65
Water absorption of coarse aggregate	:	0.50%
Water absorption of fine aggregate	:	1.00%
Free surface moisture for coarse aggregate	:	Nil
Free surface moisture for fine aggregate	:	Nil



## Sieve Analysis

### Course 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

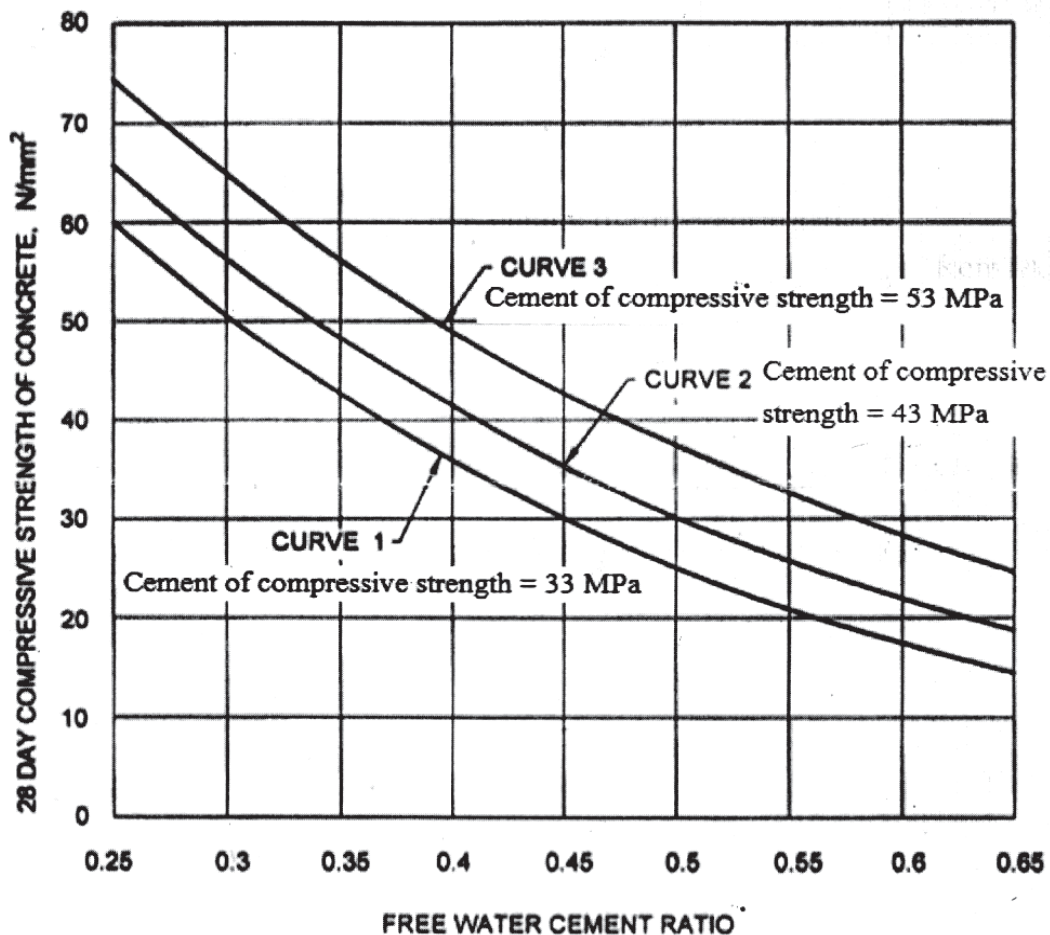


Figure: Relationship between free water cement ratio and 28 days compressive strengths of concrete

**Water content per m<sup>3</sup> of concrete for 50mm slump :**

Sr.	Nominal maximum size of aggregate (mm)	Maximum water content (kg/m <sup>3</sup> )
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.	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.	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 20mm nominal maximum size :**

Sr.	Exposure	Minimum cement content (kg/m <sup>3</sup> )	Maximum W/C	Minimum grade of concrete
i)	Mild	300	0.55	M20
ii)	Moderate	300	0.50	M25
iii)	Severe	320	0.45	M30
iv)	Very severe	340	0.45	M35
v)	Extreme	360	0.40	M40
b)	What do you mean by :			[4]

- i) Mean strength
- ii) Variance
- iii) Standard deviation
- iv) Coefficient of variation

- Q5) a)** Write short note on [6]
- i) Ready mix concrete (RMC)
  - ii) Under water concreting
- b) What do you mean by roller compacted concrete. Give real life examples/application of roller compacted concrete. [6]
- c) Discuss concrete vibrators and compaction equipments. [6]

OR

- Q6) a)** Define lightweight concrete? Classify the various types of lightweight concrete by their method of production. [6]
- b) Discuss the self compacting concrete (SCC) with its advantages, material and examples of SCC mixes. [6]
- c) Write short note on: [6]
- i) Fiber reinforced concrete
  - ii) Geo-polymer concrete

- Q7) a)** Discuss factors affecting the durability of concrete. [6]
- b) Discuss ingredients/factors influencing the permeability of concrete. [5]
- c) Write short note on : [6]
- i) Attack by sea water on concrete
  - ii) Carbonation of concrete

OR

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

**x x x**

**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 sketches must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume Suitable data if necessary.
- 5) Use of electronic pocket calculator allowed.
- 6) Use of cell phone is prohibited in the examination hall.

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

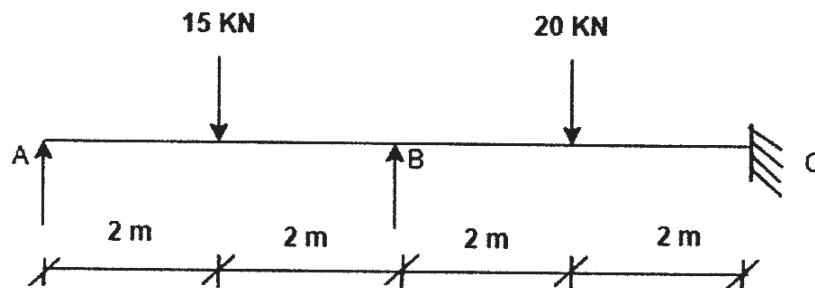


Figure 1

**b)** Find the rotation B ( $\theta_B$ ) for the beam with uniform flexural rigidity as show in figure 2. **[6]**

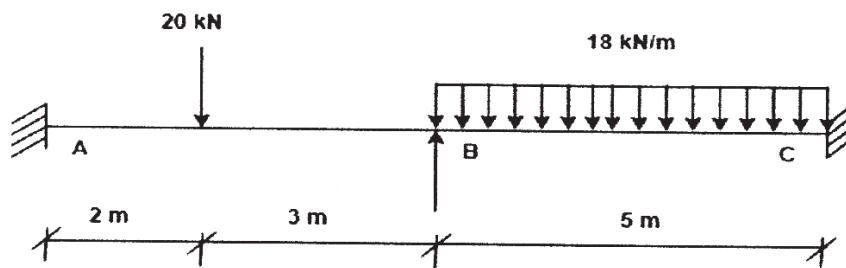


Figure 2

OR

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

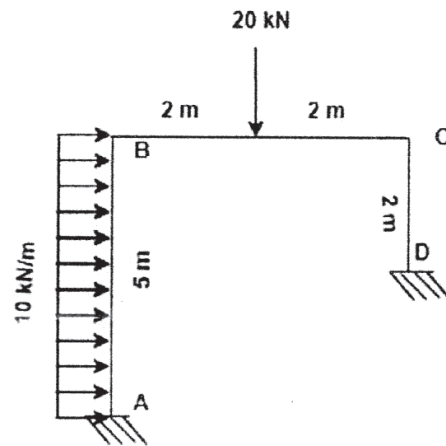


Figure 3

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

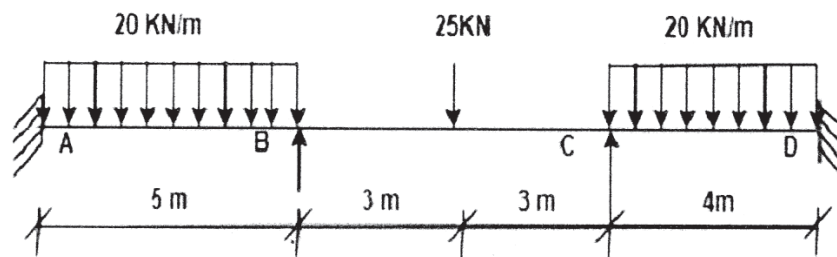


Figure 4

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

OR

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

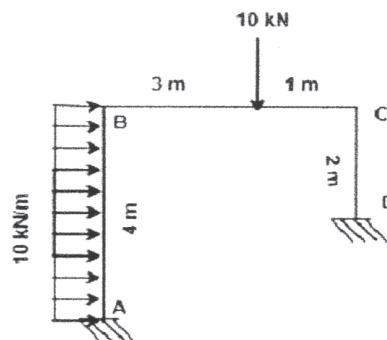


Figure 5

- Q5) a) Analyze the beam ABC shown in figure 6 by stiffness method and draw BMD. [11]

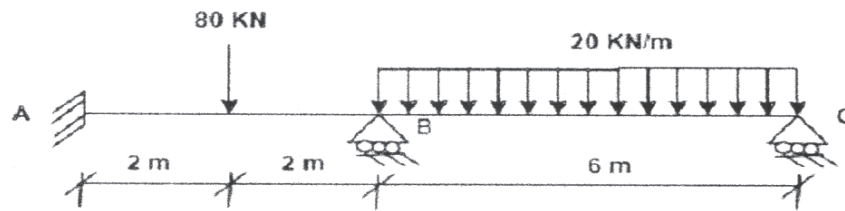


Figure 6

- b) Explain stiffness and flexibility and write elements of displacement matrix for the frame shown in figure 7. [6]

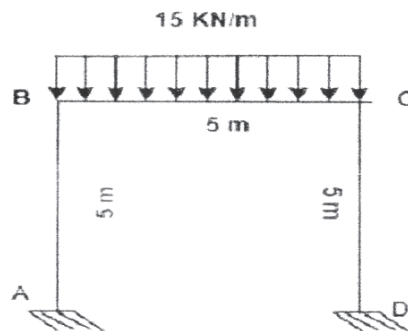


Figure 7

OR

- Q6) Analyse the bent shown in figure 8 by stiffness method. [17]

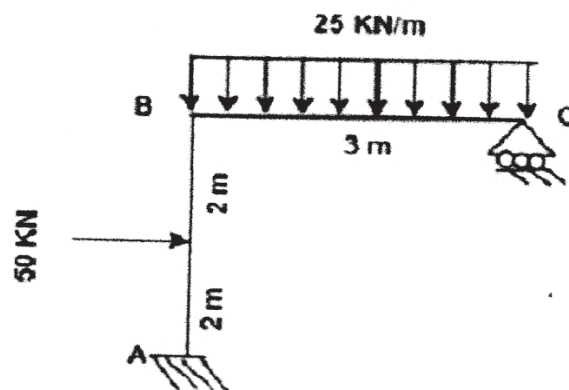
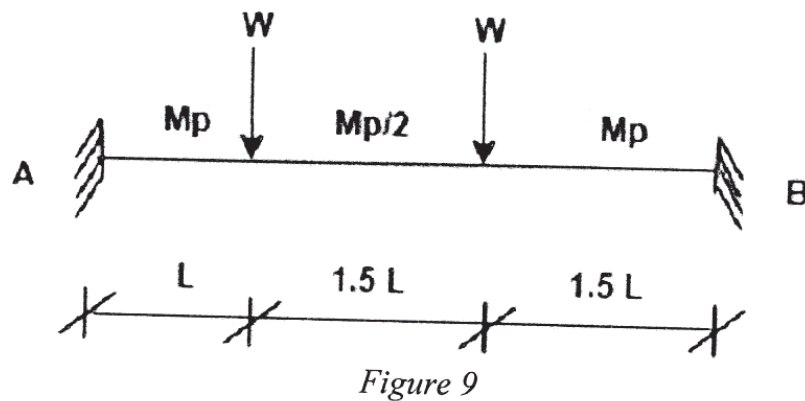


Figure 8

- Q7) a) Determine collapse load for the beam shown in figure 9 with variable moment or resistance. [12]



- b) Explain idealized stress strain curve for plastic analysis. [5]

OR

- Q8) a) Calculate plastic section modulus, shape factor and plastic moment for the figure 10. [13]

Properties of ISMB 200 section ;  $I_{xx} = 2235.4 \text{ cm}^4$ ,  $Z_{xx} = 223.5 \text{ cm}^3$ ,  $A = 32.33 \text{ cm}^2$ .

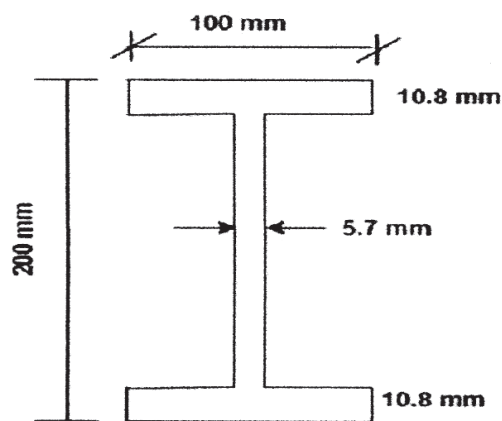


Figure 10

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



Total No. of Questions : 8]

SEAT No. :

**P1483**

**[6002]-110**

[Total No. of Pages : 3

**S.E. (Civil)**

**PROJECT MANAGEMENT**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** State the primary and secondary objectives of material management.[3+3]

b) Explain the process of material procurement in construction project.[2+4]

c) The monthly requirement of a sand for a particular firm is 849 cubic meter. The cost of one cubic meter of sand is 25000. Ordering cost is Rs. 200 per order and annual inventory carrying cost is 20% of average inventory. [3+3]

Determine

- i) EOQ
- ii) No. of orders per annum

OR

**Q2) a)** Explain in brief the following: [3+3]

- i) Raising of Indents
- ii) Delivery of Material

b) How do you inspect quality of material like sand and aggregate on your site? [3+3]

c) Explain why safety program have to be implemented at work site. What points should be considered while making a safety program for the following projects. [2+2+2]

- i) Highway construction
- ii) Building construction

**P.T.O.**



**Q3) a)** Explain resource allocation methods and their significance in manpower planning. [5]

b) What do you mean by network crashing? Write down the step by step procedure of network crashing? [6]

c) State the various methods of Project Monitoring. Explain any one in brief. [6]

OR

**Q4) a)** What do you mean by EVA? Explain any one method in detail. [6]

b) Discuss in brief direct cost and indirect cost. [6]

c) Enlist the various benefits of EVA to any project. [5]

**Q5) a)** Explain Demand and supply curve. [3+3]

b) Define the following terms :

i) Cost, Price and Value.

ii) Equilibrium price, Equilibrium quantity. [3+3]

c) Illustrate with example “Law of Diminishing Marginal Utility” [2+4]

OR

**Q6) a)** Explain Concept of Cost of Capital & Time Value of Money. [3+3]

b) Mr. Uttam brought an air - conditioner for Rs. 20,000; he paid tax of Rs. 2,000 and Rs.200 for transport. If he sold it to a customer for Rs. 22,500, what is the percentage profit or loss? [6]

c) Explain the following laws with suitable diagram. [3+3]

i) Law of demand and supply.

ii) Law of substitution.

**Q7) a)** What are the different types of appraisals required to undertake any Project? Explain any one in detail. [2+4]

- b) Write a short note on: [3+3]
- i) Break even analysis,
  - ii) Detailed project report (DPR).
- c) Compare the project by NPV and B/C ratio method and state its feasibility if project cost is Rs. 2,80,000 and it has net cash flow of Rs. 90,000 for a period 4 years. Firm expect returns 10% per annum. [5]

OR

- Q8) a) Following are the details of Project A and B. Using NPV ( $i = 8\%$ ), comment on the following statements: [6]
- i) Whether both projects are feasible?
  - ii) Whether both projects are not feasible?
  - iii) Either of the A or B is feasible?

Years	Project A	Project B
Initial Investment	4,00,000	4,50,000
1	1,20,000	1,40,000
2	1,25,000	1,45,000
3	78,000	76,000
4	80,000	65,000
5	75,000	60,000
6	-	90,000

- b) Explain the contents of project Feasibility report with example. [5]
- c) Explain the role of Project management Consultant in Pre - tender and Post - tender of a Project. [3+3]

\* \* \*

Total No. of Questions : 9]

SEAT No. :

**P1484**

[Total No. of Pages : 4

[6002]-111

**S.E. (Electronics/E&Tc/Electronics & Computer)**

**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. **[10]**

a) For  $\vec{F} = x^2\vec{i} + xy\vec{j}$ , the value of  $\int_c \vec{F} \cdot d\vec{r}$  for the curve  $y=x$  joining the points

(0,0) and (1,1) is .

- |                    |                   |
|--------------------|-------------------|
| i) 1               | ii) $\frac{1}{3}$ |
| iii) $\frac{3}{2}$ | iv) $\frac{2}{3}$ |

b) The curl of vector field  $\vec{F} = x^2\vec{y}\vec{i} + xyz\vec{j} + z^2\vec{y}\vec{k}$  at the point (0,1,2) is

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| i) $4\vec{i} - 2\vec{j} + 2\vec{k}$ | ii) $4\vec{i} + 2\vec{j} + 2\vec{k}$ |
| iii) $4\vec{i} + 2\vec{k}$          | iv) $2\vec{i} + 4\vec{k}$            |

c) The poles of  $\frac{1}{z^2+1}$  are

- |             |             |
|-------------|-------------|
| i) $i, -i$  | ii) $1, -1$ |
| iii) $1, i$ | iv) $1, -i$ |

d) Given  $\frac{dy}{dx} = x+y^2$ ,  $x = 0$ ,  $y = 1$ ,  $h = 0.2$   $k_1$  as defined in Runge-Kutta

method is given by

- |          |         |
|----------|---------|
| i) 0.1   | ii) 0.4 |
| iii) 0.3 | iv) 0.2 |

**P.T.O.**

- e) if  $\nabla$  is the backward difference operator the  $\nabla f(x)$  is equal to  
 i)  $f(x) - f(x-h)$     ii)  $f(x+h) - f(x)$   
 iii)  $f(x+h)$     iv)  $f(x-h)$
- f) If  $f(z)$  is analytic on and within the closed contour  $C$  then  $\oint_C f(z) dz =$   
 [Given  $r_1, \dots, r_n$  are residues at poles]  
 i)  $2\pi i$     ii)  $r_1 + r_2 + \dots + r_n$   
 iii)  $0$     iv)  $2\pi i(r_1 + r_2 + \dots + r_n)$

**Q2) a)** Find Lagrange's interpolation polynomial passing through the following set of points. [5]

$x$	0	1	2
$y$	4	3	$\sigma$

- b) By Trapezoidal Rule, find the value of  $\int_0^1 \frac{1}{1+x^2} dx$  by taking  $h=0.25$ . [5]
- c) Use Runge-kutta method of fourth order to obtain the numerical solution of  $\frac{dy}{dx} = x^2 + y^2$ ,  $y(1) = 1.5$  in the interval  $(1, 1.1)$  with  $h=0.1$ . [5]

OR

**Q3) a)** Find value of  $y$  for  $x=0.5$  using Newton's forward difference formula for following data [5]

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

- b) Use Simpson's  $\left(\frac{1}{3}\right)^{rd}$  rule with four intervals to find value of  $\int_1^2 \frac{1}{x} dx$ . [5]
- c) Use modified Euler's method to find the value of  $y$  satisfying the equation  $\frac{dy}{dx} = \log_e(x+y)$ ,  $y(1) = 2$  for  $x=1.2$  correct upto four decimal places by taking  $h=0.2$ . [5]

- Q4)** a) Find the directional derivative of the function  $\phi = xy^2 + yz^3$  at  $(1, -1, 1)$  towards the point  $(2, 1, -1)$ . [5]
- b) Show that the vector field  $\vec{F} = (y \sin z - \sin x)\vec{i} + (x \sin z + 2yz)\vec{j} + (xy \cos z + y^2)\vec{k}$  is irrotational & find scalar function  $\phi$  such that  $\vec{F} = \nabla \phi$  [5]
- c) If  $\vec{r} \cdot \frac{d\vec{r}}{dt} = 0$  then show that  $\vec{r}$  has constant magnitude. [5]

OR

- Q5)** a) Find the directional derivative of the function  $\phi = e^{2x-y-z}$  at  $(1, 1, 1)$  in the direction of vector  $-\vec{i} + 2\vec{j} + \vec{k}$ . [5]
- b) If  $\rho \vec{E} = \nabla \phi$  then prove that  $\vec{E} \cdot \text{curl} \vec{E} = 0$  [5]
- c) Prove that  $\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r} \frac{df}{dr}$  [5]

- Q6)** a) Use Green's theorem to evaluate  $\int_C \vec{F} \cdot d\vec{r}$  [5]

where

$$\vec{F} = (2x - \cos y)\vec{i} + x(4 + \sin y)\vec{j}, \text{ C is the ellipse } \frac{x^2}{9} + \frac{y^2}{25} = 1, z = 0$$

- b) Verify stoke's theorem for  $\vec{F} = xy^2\vec{i} + yj + xz^2\vec{k}$  for the surface of rectangular lamina bounded by  $x = 0, y = 0, x = 1, y = 1, z = 0$ . [5]
- c) Evaluate  $\iint_S \vec{r} \cdot \hat{n} ds$  over the surface of a sphere of radius 1 with centre at origin. [5]

OR

- Q7)** a) Using Green's theorem, show that the area bounded by a simple closed curve C is given by  $\frac{1}{2} \int [x dy - y dx]$ . Hence find area of the ellipse  $x = 2 \cos \theta, y = 3 \sin \theta$ . [5]

b) Using divergence theorem, show that  $\iiint_v \frac{1}{r^2} dv = \iint_s \frac{1}{r^2} \bar{r} \cdot d\bar{s}$  [5]

c) Verify stokes theorem for  $\bar{F} = -y^3 i$  and the closed curve  $c$  is the boundary of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  [5]

**Q8)** a) If  $f(z) = u + iv$  is analytic, find  $f(z)$  if  $u-v = (x-y)(x^2 + 4xy + y^2)$  [5]

b) Evaluate  $\oint_c \frac{4z^2 + z}{(z-1)^2} dz$  where  $c$  is the contour  $|z-1|=2$  by using cauchy integral formula. [5]

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

OR

**Q9)** a) If  $u = 3x^2 - 3y^2 + 2y$  find  $v$  such that  $f(z)=u+iv$  is analytic. Determine  $f(z)$  in terms of  $z$ . [5]

b) Evaluate  $\oint_c \frac{z + 2}{z^2 + 1} dz$  where  $c$  is  $|z - 1| = \frac{1}{2}$  by Residue theorem. [5]

c) Show that the image of line parallel to  $x$ -axis are mapped onto hyperbola in  $w$ -plane under the transformation  $w = \sin hz$ . [5]



Total No. of Questions : 8]

SEAT No. :

**P1485**

[Total No. of Pages : 2

[6002]-112

**S.E. (Electronics/ E&T.C)**

**ELECTRONIC CIRCUITS.**

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

*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) Figure 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 block diagram of regulated power supply and explain the function of each block? [6]  
b) With the help of neat diagram explain buck-boost converter? [6]  
c) Draw and explain low dropout regulator? [6]

OR

- Q2)** a) Design a regulated power supply using LM 317 for output voltage  $g_v$  and  $15v$   $I_{Adj}=100 \mu A$ . [6]  
b) Explain the working of SMPS with neat diagram? [6]  
c) Compare regulated and unregulated power supply? [6]

- Q3)** a) List all parameter's of op-amp. Explain any four in brief ? [6]  
b) Explain significance of negative feed back, in op-amp amplifier? [5]  
c) A dualt input balanced output differential amplifier has following specification  $R_c=2.7K\Omega$ ,  $R_E=4.5k\Omega$ ,  $\pm V_{CC}=\pm 10v$ ,  $\beta=100$ ;  $V_{BE}=0.7V$ ;  $r_e=26.34\Omega$  calculate [6]  
i) Voltage gain ( $A_d$ )  
ii)  $R_{in}$   
iii)  $R_o$

OR

- Q4)** a) Draw block diagram of op-amp and explain each block? [6]  
b) Compare inverting and non-inverting configuration of op-amp with following parameters:  
i) Feedback Type  
ii)  $R_i$   
iii) Gain  
iv) Bandwith [5]

*P.T.O.*

- c) Determine the Q point for dual input and balanced output differential amplifier with  $R_C=R_E=65K\Omega$  and supply voltage  $\pm 15V$  assume suitable data. [6]

- Q5)** a) Draw an inverting summing amplifier with three input and derive expression for the output voltage  $V_o = -(V_a+V_b+V_c)$  [6]  
b) Design a practical Integrator with input Signal of 1.5 vpp and cut off frequency of 3KHz for DC voltage gain of 10. [6]  
c) Draw circuit diagram of 30p-amp Instrumentation amplifier and write its o/p equation? [6]

OR

- Q6)** a) With the help of neat diagram explain working of symmetrical schmitt trigger? [6]  
b) Design a square wave generator using op-amp for frequency 1KHz to 10 KHz with 50 % duty cycle. draw diagram with component value. [6]  
c) Explain practical differentiator circuit with neat diagram? list limitations of ideal differentiator? [6]

- Q7)** a) Explain voltage to current converter with floating load? [6]  
b) Determine the output voltage produced by 4 bit R-2R ladder DAC with  $V_{ref}=5v$  for bit sequence i) 0110 ii) 1101 [5]  
c) Explain working of flash ADC in details. [6]

OR

- Q8)** a) Define terms. [6]  
i) Lock range  
ii) Capture range.  
iii) Pull in time  
iv) Free running frequency.  
b) With the neat diagram explain working of weighted resistor DAC? [6]  
c) Find the digital output of an ADC having  $t_1=83.33$  Msec and  $V_R=100$  mv for an input voltage. of +100mV. The clock frequency is kHz [5]





Time : 2½Hours]

[Max. Marks : 70

Instructions to the candidates:

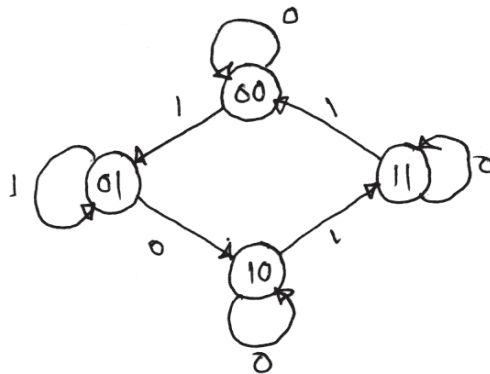
- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.

- Q1)** a) Explain the working of a half-adder? Draw its logic diagram. [7]  
 b) Implement the full subtractor using a 1 : 8 demultiplexer. [5]  
 c) Implement the following function using multiplexer  
 $f(A,B,C) = \sum m(0, 2, 4, 6)$ . [5]

OR

- Q2)** a) Draw the logic diagram of full-adder and its truth table. [7]  
 b) Implement a full-adder using Demultiplexer. [5]  
 c) Implement the given logic function using a 4 : 1 multiplexer.  
 $f(A,B,C) = \sum m(0, 2, 4, 6)$ . [5]

- Q3)** a) For the state diagram shown in figure, obtain the state table and design the circuit using minimum number of J = K flip - flops. [8]



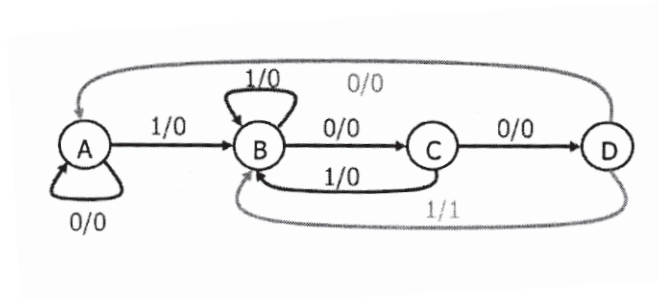
- b) Explain the function of a shift register. Give its application. [5]  
 c) Explain with truth table the working of clocked RS flip-flop. [5]

OR

- Q4)** a) Design a sequence generator using T FFs  $0 \rightarrow 1 \rightarrow 7 \rightarrow 4 \rightarrow 2$ . [8]  
 b) Explain the types of shift register. [5]  
 c) Explain with diagram the working of D type Flip-flop. Give its truth table. [5]

P.T.O.

- Q5) a)** Design the clocked sequential circuit for the state diagram using JK flip flop. [9]



- b) Draw ASM chart for a 2 bit up-down counter having mode control input M.  
M=1 Up counter.  
M = 0 Down Counter. [8]

OR

- Q6) a)** Design a sequential circuit using Mealy machine for detecting the sequence.....1001.....Use Jk Flip-flop. [9]
- b) Explain in short: [8]
- State Diagram.
  - ASM chart.

- Q7) a)** Explain the classification of memories based on their principle of operation. [8]
- b) Write a short note on concept of PLA and PAL. [10]

OR

- Q8) a)** Explain with circuit diagram the dynamic MOS memory. [8]
- b) A combinational circuit defined by the function. [10]  
 $F_1(A, B, C) = \sum (3, 5, 6, 7)$  and  $F_2(A, B, C) = \sum (0, 2, 4, 7)$   
 Implement the circuit with PLA having 3 inputs, 3 products terms and 2 outputs.

★ ★ ★

Total No. of Questions : 8]

SEAT No. :

P1487

[Total No. of Pages : 3

[6002]-114

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

ELECTRICAL CIRCUITS

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer 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 a two port network? Mention the application of two port network parameters [6]
- b) Determine the z parameters for the circuit shown in Fig. 1. [6]

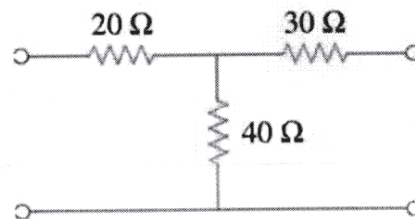


Fig. 1

- c) Find the condition for symmetry and reciprocity of Z parameter. [6]

OR

- Q2) a) Explain the pole-zeros of network function. Also state its significance. [6]
- b) Find h-parameters for the network shown in Fig.2. [6]

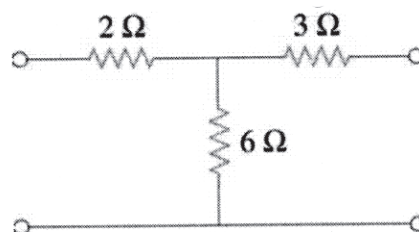


Fig. 2

P.T.O.

- c) Determine  $Z(s)$  in the network shown in Fig.3. Find poles and zeros of  $Z(s)$  and plot them on s-plane. [6]

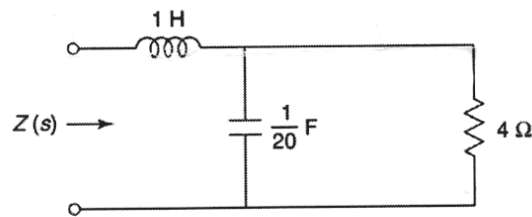


Fig. 3

- Q3)** a) What are the types of DC motor? A series motor should not be started on no load. Why? [5]
- b) Draw a neat sketch of a DC generator. State the functions of each part. [6]
- c) A 200 V lap wound DC shunt motor has 800 conductors on its armature. The resistance of the armature winding is  $0.5 \Omega$  and that of field winding is  $200 \Omega$ . The motor takes a current of 21 A, the flux per pole is 30 m Wb. Find the speed and torque developed in the motor. [6]

OR

- Q4)** a) Explain significance of back e.m.f. in a DC motor. [5]
- b) A 4 pole DC shunt generator with lap connected armature has field and armature resistances as  $50 \Omega$  and  $0.1 \Omega$  respectively. If the generator has to supply 60 lamps, with rating 100V/40 W each. Calculate [6]
- Total armature current
  - Current in each armature conductor
  - Generated EMF
- Take 1V per brush as contact drop.
- c) Why starter is required in a DC motor? Under what condition the mechanical power developed in a dc motor will be maximum? [6]

- Q5)** a) Explain the effect of loading on induction motor. [6]
- b) What are different methods of speed control for three phase induction motor. Explain any one. [6]

- c) The power input to a 500V, 50Hz, 6 pole, 3 phase induction motor running at 975 rpm is 40kW. The stator losses are 1kW and the friction and windage losses total 2 kW. Calculate: [6]
- i) slip
  - ii) rotor copper loss
  - iii) shaft power
  - iv) efficiency

OR

- Q6)** a) State any 4 use of single phase induction motor? Differentiate between “capacitor start” & “Capacitor start capacitor run” Single phase induction motor? [6]
- b) What are types of 3-phase induction motor? Explain any one in detail.[6]
- c) The power input to the rotor of a 440V, 50 hz, 6 pole, 3 phase induction motor is 100kW. The rotor electromotive force is observed to make 120 cycles per minute. Calculate: Rotor speed. [6]
- i) Mechanical power developed
  - ii) Rotor copper loss per phase

- Q7)** a) Give types and applications of stepper motor. [5]
- b) What is Brushless DC motor? Explain working and construction of any one type of BLDC motor. [6]
- c) What is the need of electric vehicle? Also give the advantages and disadvantage of electric vehicle. [6]

OR

- Q8)** a) Compare Brushless DC motor with conventinal DC motor. [5]
- b) Explain the construction and operation of permanent magnet stepper motor. [6]
- c) Draw the block diagram and explain components of electric vehicle. [6]



Total No. of Questions : 8]

SEAT No. :

P-1488

[Total No. of Pages : 4

[6002]-115

S.E. (E & TC/Electronics)

DATA STRUCTURES

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

Time : 2½ Hours]

[Max. Marks : 70

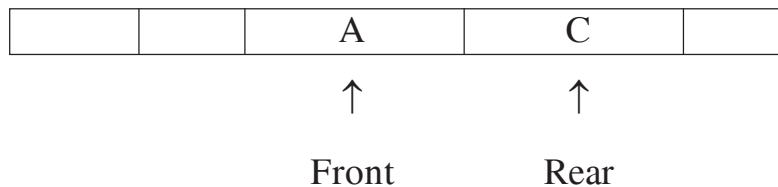
Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

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

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

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



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

- i) F is added to the queue.
- ii) Two letters are deleted.
- iii) K, L, M are added to the queue
- iv) Two letters are deleted.
- v) R is added to the queue.
- vi) Two letters are deleted.

OR

P.T.O.

- Q2)** a) Compare Stack and Queue. [4]  
b) What are the applications of Stack.  
Represent stack for decimal to binary conversion:  $(56)_{10}$  to  $(---)_2$  [3]  
c) Define Queue. What are conditions for 'Queue empty' and 'Queue full' when queue is implemented using Array? Explain. [6]  
d) Write a 'C' function for deletion in a queue using an array. [4]

- Q3)** a) Compare circular linked list with singly linked list in terms of pros and cons. [6]  
b) What is a singly linked list? Write C function for inserting a node at a given location into a singly linked list. [6]  
c) Explain the disadvantages of polynomial representation using an array. Represent the following polynomial using a singly linked list. [6]  
 $23x^9 + 18x^7 + 41x^6 + 16x^4 + 3$

OR

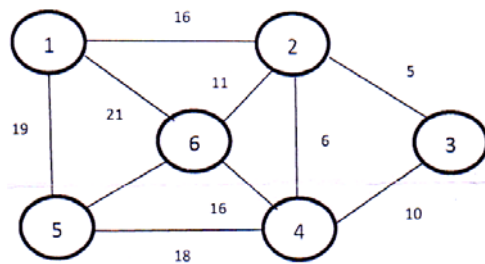
- Q4)** a) What is a doubly linked list? Write a 'C' function for Inserting a number at the end of the doubly linked list. [6]  
b) Write a 'C' function for Inserting a number at the front of the circular linked list. [5]  
c) Compare linked representation and array representation with reference to the following aspects : [3]  
i) Accessing any element randomly  
ii) Insertion & deletion of an element  
iii) Utilization of memory  
d) Write a short note on the Circular Linked list. [4]

- Q5)** a) Define the following terms with respect to Trees : [5]  
i) Root  
ii) Subtree  
iii) Level of node  
iv) Depth of Tree  
v) Siblings  
b) Write a recursive 'C' function for inorder, preorder, postorder tree traversal? [6]  
c) Construct the Binary Search Tree (BST) from the following data : [6]  
5, 2, 8, 4, 1, 9, 7  
Also show preorder, postorder and inorder traversal for the same.

OR

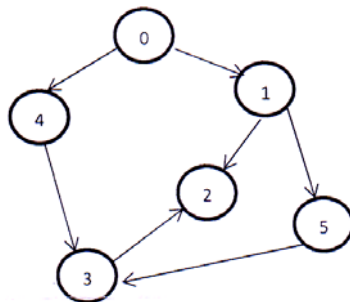
- Q6)** a) Define a tree. Explain with a suitable example how a binary tree can be represented using an array. [5]  
b) Write an algorithm to implement non-recursive in-order traversal of a binary search tree. [6]  
c) The postorder and inorder traversals of a binary tree are given below. Is it possible to obtain a unique binary tree from these traversals? If yes, obtain the tree, if not give justification. [6]  
Inorder Traversal : D B F E G A H I C  
Postorder Traversal : D F G E B I H C A

- Q7)** a) Define Graph. Explain types of Graph. [6]  
b) Compare DFS and BPS. [6]  
c) Find the minimal spanning tree of the following graph using Prim's algorithm. Show all the steps. [6]



**Fig : 1**

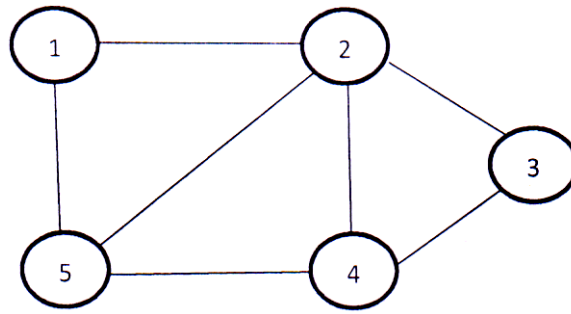
- Q8)** a) Define with an example : [6]  
i) Path  
ii) Cycle  
iii) Connected graph  
b) Define indegree and outdegree of a vertex in graph. Find the indegree and outdegree of following graph. [6]



**Fig : 2**



- c) Represent the following graph using the adjacency matrix and adjacency list. [6]



**Fig : 3**

**□□□**

[6002]-116

S.E. (Electronics/E&amp;TC/Electronics &amp; Computer)

SIGNALS &amp; SYSTEMS

(2019 Pattern) (Semester - IV) (204191)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) All questions are compulsory.
- 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 logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.

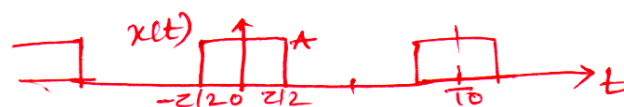
- Q1) a) State the Dirichlet conditions for the existence of Fourier Series. [4]
- b) Find the Trigonometric Fourier Series for the periodic bidirectional symmetric square waveform below. Plot phase and magnitude response. [8]



- c) State and explain the physical significance for following properties for CT signals. [6]
- i) Time Differentiation
  - ii) Convolution
  - iii) Modulation

OR

- Q2) a) Define Fourier series, write equations for Fourier series representation. Compare it. [6]
- b) Determine the complex exponential Fourier Series for periodic Rectangular pulse train shown below. Plot its magnitude and phase spectrum. [8]



- c) State and explain Gibb's Phenomenon. [4]

P.T.O.

- Q3)** a) What are the limitations of Fourier series. Compare it with Fourier Transform. Write the expression for Fourier Transform for CT Signals. [5]
- b) Find the Fourier transform of the signal  $x(t) = e^{-3t}u(t)$ . Also sketch magnitude and phase response. [6]
- c) State the following properties of CTFT. [6]
- Linearity
  - Convolution
  - Time Reversal

OR

- Q4)** a) Find the Fourier Transform of sine wave signal and sketch magnitude response and phase response. [6]
- b) Find the Inverse Fourier Transform using partial fraction expansion. [6]

$$X(j\omega) = \frac{1}{(j\omega)^2 + 5j\omega + 6}$$

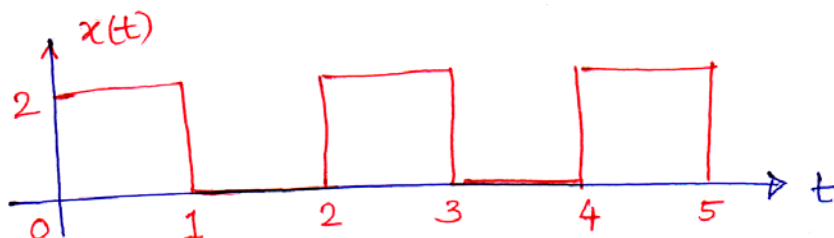
- c) Find the Fourier Transform of  $x(t) = \cos(\omega_0 t)u(t)$  using the property. [5]

- Q5)** a) Define convolution property of Laplace Transform and using same property, determine Laplace Transform of following  $y(t)$ . [6]
- $y(t) = x_1(t) * x_2(t)$  where
- $x_1(t) = e^{-2t} \cdot u(t)$
- $x_2(t) = e^{-3t} \cdot u(t)$
- b) State the limitations of Fourier Transform and need of Laplace transform. Compare both. [6]
- c) Find the initial and final value of given function [6]

$$X(S) = \frac{S + 4}{S^2 + 3S + 2}$$

OR

- Q6)** a) Find Laplace Transform of following signal. [6]



- b) Find the inverse Laplace Transform [6]

$$X(S) = \frac{S}{S^2 + 5S + 6}$$

- c) A signal has Laplace transform [6]

$$X(S) = \frac{S+2}{S^2 + 4S + 5}$$

Find Laplace transform  $Y(S)$  if

- i)  $y(t) = t \cdot x(t)$
- ii)  $y(t) = e^{-t} \cdot x(t)$

- Q7)** a) Write short note on the following : [6]

- i) Random experiment
- ii) Random event
- iii) Sample space
- iv) Random variable
- v) Probability of certain event is \_\_\_\_\_
- vi) If A and B are mutually exclusive events then  $P(A + B) =$  \_\_\_\_\_

- b) A certain computer becomes in operative, if two components A and B both are fails. The probability that A fails is 0.01 and the probability that B fails is 0.05. However the probability B fails increase by factor 4, if A has failed. Calculate the probability that the computer becomes inoperable. Also find the probability that A will fail if B has failed. [5]

- c) Define CDF and state any four properties of CDF. [6]

OR

- Q8)** a) Define PDF and state four properties of PDF. [6]

- b) Find mean, second moment and standard deviation of  $x$  [6]

$$f_x(x) = A \cdot e^{-Ax} u(x)$$

- c) In a random experiment of rolling a dice Find the probability of [5]

- i) Getting a number 3 or 4
- ii) Getting a number less than 5
- iii) Getting a number between 3 and 6



Total No. of Questions : 8]

SEAT No. :

P-1490

[Total No. of Pages : 3

**[6002]-117**  
**S.E. (E & TC)**  
**CONTROL SYSTEM**  
**(2019 Pattern) (Semester - IV) (204192)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

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

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

OR

**Q2) a)** A feedback control system has open loop gain

$G(s)H(s) = \frac{k(s+2)}{s(s+1)(s^2+2s+5)}$ . Determine the value of 'k' for which the system is stable as well as critically stable. [8]

b) A unity feedback system has the loop transfer function,

$G(s) = \frac{k}{s(s+1)(s+3)(s+4)}$  Determine : Breakaway points, intersection with imaginary axis. Plot root locus. [10]

**P.T.O.**

**Q3) a)** For a unity feedback System with open loop transfer function  

$$G(s) = \frac{4}{s(s+2)}$$
 Determine Damping factor, Undamped natural frequency, reason peak, resonant frequency. [9]

b) The open loop transfer function of a unity feedback system is given by  

$$G(s) = \frac{1}{s(s+1)(s+2)}$$
 Sketch the polar plot and determine the gain margin. Also comment on the stability. [8]

OR

**Q4) a)** Draw Bode plot of the system with open loop transfer function :  

$$G(s) = \frac{10}{s(s+2)(s+5)}$$
 and determine gain margin, Phase margin. Gain crossover frequency, Phase crossover frequency. Also comment on Stability. [9]

b) Derive the expression for resonant peak ( $M_r$ ) and resonant frequency ( $\omega_r$ ). [8]

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

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

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

OR

**Q6) a)** Obtain the state model for the system with transfer function  

$$\frac{Y(s)}{U(s)} = \frac{3S+4}{S^2+5S+6}$$
 [9]

b) Determine the transition matrix of state equation [9]

$$X = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix} x(t)$$

- Q7)** a) Explain Proportional mode, Integral Mode and Derivative Mode. [9]  
b) What do you mean by Industrial Automation? What are its types? Explain the architecture of an automation. [8]

OR

- Q8)** a) Explain the Ziegler-Nichols tuning method of a PID controller. [9]  
b) Draw and explain the block diagram of digital control system. [8]



Total No. of Questions : 8]

SEAT No. :

P-1491

[Total No. of Pages : 2

[6002]-118

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

PRINCIPLES OF COMMUNICATION (2019

Pattern) (Semester - IV) (204193)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

Q1) a) Classify FM generation methods & with suitable diagram explain FM generation by Armstrong's Indirect method. [6]

b) A frequency modulated signal is represented by voltage equation  $e_{FM} = 10 \sin[6 \times 10^8 t + 5 \sin 1250 t]$  calculate [6]

i) Carrier frequency  $f_c$                       ii) Modulating frequency  $f_{(FM)}$

iii) Max<sup>m</sup> deviation  $\delta$

iv) What power will this FM wave dissipates in  $20\Omega$  resistor?

c) Give comparison between pre-emphasis & De-emphasis in FM. [6]

OR

Q2) a) State the types of FM detector & with neat diagram explain Balanced slope detector. [6]

b) Compare frequency modulation & phase modulation. [6]

c) Sketch PM waveform for sinusoidal input signal. Enlist advantages & disadvantages of phase modulation. [6]

Q3) a) Describe Band limited & time limited signal with suitable example. [6]

b) Draw & explain spectrum showing aliasing effect & Guard band. [6]

c) Consider the signal  $\{3 \cos(200\pi t) + (5 \sin 6000\pi t) + 10 \cos 1200\pi t\}$  what is Nyquist rate for this signal? [5]

OR

P.T.O.



- Q4)** a) Describe with the help of neat sketches of wave forms methods of generation of PWM. [6]
- b) Illustrate the classification of multiplexing & with suitable diagram explain time division multiplexing. [6]
- c) The signal  $g(t)=10 \cos (40\pi t) \cos (400\pi t)$  is sampled at a rate of 500 samples/sec. [5]
- i) Determine the Nyquist rate
- ii) Calculate the cut-off frequency of ideal reconstruction filter.
- iii) Draw the spectrum of resulting sampled signal.

- Q5)** a) Draw block diagram of Digital communication system & explain function of each block. [6]
- b) State types of quantization & explain uniform quantization in detail with characteristics. [6]
- c) Compare A-law &  $\mu$ -law compander. [6]

OR

- Q6)** a) Draw & explain Delta modulation waveform with slope overload & granular noise. [6]
- b) With neat block diagram explain PCM transmitter. [6]
- c) Describe Adaptive Delta modulation with neat diagram. [6]

- Q7)** a) Define synchronization & with block diagram explain bit synchronization. [6]
- b) Explain the properties of line codes. [5]
- c) Draw AT&T hierarchy multiplexing system & explain it in detail. [6]

OR

- Q8)** a) Explain working principle of scrambling & unscrambling with example. [6]
- b) Describe with block diagram digital signal hierarchy using  $T_1$  carrier system. [6]
- c) Draw the line codes - unipolar R<sub>z</sub>, polar R<sub>z</sub>, AMI & split phase manchester for the bit stream 10110010. [5]



Total No. of Questions : 8]

SEAT No. :

P-3665

[Total No. of Pages : 2

[6002]-119

**S.E. (E & TC/Electronics & Computer)**  
**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 side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) What is a friend function? What are the merits and demerits of using the friend function? [6]
- b) What are the rules for overloading operators? [6]
- c) Which is operator overloading? Write steps to overload << & >> operators. [6]

OR

- Q2)** a) What is operator overloading? Why it is necessary to overload an operator? [6]
- b) Write a program to demonstrate friend function in C++. [6]
- c) Give a programming example that overloads == operator with its use. [6]

- Q3)** a) What is inheritance? How to inherit a base class as protected? Explain it in Multiple base classes. [6]
- b) What is containment? Explain with the help of String, Date and Employee class. Objects of Date and String classes are data members of Employee Class. [6]
- c) What does inheritance mean in C++? What are different forms of inheritance? Give an example of each. [5]

OR

**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 divide by zero exception? [6]
- b) Explain class template using multiple parameters. Write a program in C++ [6]
- c) What is stream? Explain types of streams available in C++? [6]

OR

- Q6)** a) Explain Namespace in C++ with example. [6]
- b) Write a C++ program using function template to find the product of two integer or floating-point type of data. [6]
- c) What is a user defined exception? Write down the scenario where we require user defined exceptions. [6]

- Q7)** a) Write a program using the open() , eof(), and getline() member function to open and read a file content line by line. [6]
- b) Explain the role of seekg(), seekp(), tellg(), tellp(), function in the process of random access in a file. [5]
- c) What is file mode? Explain any four file modes supported by C++. [6]

OR

- Q8)** a) Write a program using put() to write characters to a file until user enters a dollar sign. [6]
- b) What is the difference between opening a file with constructor function and opening a file with open () function. [5]
- c) Explain error handling during file operation. [6]



Total No. of Questions : 8]

SEAT No. :

P1492

[6002]-120

[Total No. of Pages : 2

S.E. (Electronics & Computer Engineering)

ELECTRONIC CIRCUITS

(2019 Pattern) (Semester - III) (204202)

Time : 2½ Hours]

[Max. Marks : 70

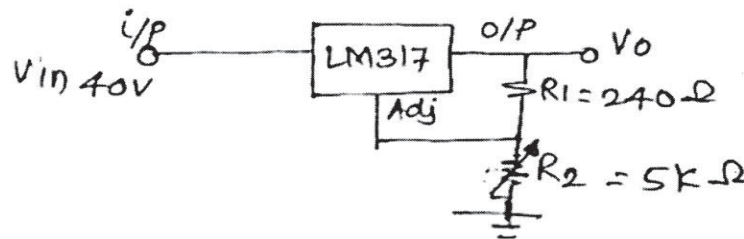
Instructions to the candidates:

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

- Q1) a) Write short note on current boosting regulator. [6]  
b) Draw the detailed block diagram of SMPS and explain its operation. [6]  
c) Design an adjustable voltage regulator using LM 317 for output voltage from 10 to 20 V and draw the typical connection diagram. Assume:  $R_1 = 240\Omega$  and  $I_{adj} = 100 \mu A$ . [6]

OR

- Q2) a) Compare Linear Voltage regulators with SMPS. [6]  
b) Write a short note on Low Dropout Regulator (LDO). [6]  
c) For the circuit diagram as shown in the Fig. (3) calculate range of O/P voltage. (Assume  $I_{adj} = 50 \mu A$ ). [6]



- Q3) a) Explain the following Op Amp parameters and state their ideal value [6]  
i) In put offset Voltage  
ii) Slew rate  
b) Draw circuit diagram of current mirror circuit and explain in detail. [5]  
c) Draw the circuit diagram of Dual input balanced output differential amplifier and write down the expressions for [6]  
i) Voltage Gain ( $A_d$ )  
ii) Input Resistance ( $R_i$ )  
iii) Output Resistance ( $R_o$ )

OR

P.T.O.

- Q4)** a) Draw the block diagram of Op Amp and explain in detail. [6]  
 b) Write a short note on Level Shifter circuits. [5]  
 c) A Dual input balanced output differential amplifier has the following specifications : [6]  
 $V_{CC} = \pm 10 \text{ V}$ ,  $R_{C1} = R_{C2} = 3.7 \text{ k}\Omega$  and  $R_E = 4.2 \text{ k}\Omega$ ,  $\beta_{ac} = \beta_{dc} = 100$  &  $V_{BE} = 0.7\text{V}$ .  $r'_e = 25.3\Omega$   
 Calculate :  
 i) Voltage Gain ( $A_d$ )  
 ii) Input Resistance ( $R_i$ )  
 iii) Output Resistance ( $R_o$ )

- Q5)** a) Draw circuit diagram of practical integrator and explain its frequency response in detail. [6]  
 b) Draw neat circuit diagram of :  
 i) Non-inverting amplifier  
 ii) Inverting summing amplifier [6]  
 c) Draw circuit diagram of precision full wave rectifier with showing input and output waveform. [6]

OR

- Q6)** a) Explain in detail working of square wave generator with neat circuit diagram. Draw waveform of output voltage and capacitor voltage. [6]  
 b) Draw neat circuit diagram of three Op-amp Instrumentation amplifier. Enlist the advantages of Instrumentation amplifier. [6]  
 c) Draw circuit diagram of inverting symmetrical Schmitt trigger and plot hysteresis and explain in short. [6]

- Q7)** a) Draw and explain successive approximation A/D converter. [5]  
 b) Explain PLL with its block diagram. [6]  
 c) Calculate output frequency 'f<sub>0</sub>', Lock range ' $\Delta f_L$ ', Capture range ' $\Delta f_C$ ' of a PLL, If  $R_T = 1 \text{ k}\Omega$ ,  $C_T = 0.1 \mu\text{f}$ , filter capacitor  $C = 10 \mu\text{f}$  and internal resistance =  $36 \text{ k}\Omega$ . Assume  $\pm V = 10\text{V}$ . [6]

OR

- Q8)** a) Draw the circuit diagram of R-2R ladder DAC. State the advantages over binary weighted DAC. [5]  
 b) Define the term Free running frequency, Lock range and Capture range in PLL. [6]  
 c) Draw circuit diagram of frequency multiplier using PLL and explain in detail. [6]



Total No. of Questions : 8]

SEAT No. :

**P1493**

[Total No. of Pages : 3

[6002]-121

**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, Q.7 or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Assume Suitable data if necessary.
- 4) Use of non-programmable scientific calculator is allowed.

**Q1) a)** What is queue? Explain insertion and deletion operation in queue with suitable example. [6]

b) Write an algorithm for evaluating a postfix expression using stack. [6]

c) Evaluate following postfix expression with the help of stack. [5]

$53 + 62/*35*+$

OR

**Q2) a)** Write necessary C functions, PUSH and POP, to implement STACK of integers using array. [6]

b) Compare stacks and queues. [6]

c) Explain the concept of circular queue with an example. [5]

**Q3) a)** Compare SLL with DLL? [6]

b) Write a C function to insert a node into a singly linked list. [6]

c) Differentiate between static and dynamic memory allocation. Name and explain in brief dynamic memory allocation functions. [6]

OR

**Q4) a)** Compare array and linked list. Declare node structure for doubly linked list. [6]

b) Write a function in C to delete a node in SLL. [6]

c) Represent the following polynomials using linked list. [6]

i)  $25x^5 + 15x^4 + 5x^3 + 2x^2 + 100$

ii)  $16x^8 + 9x^4 + 5x^2 + 2x$

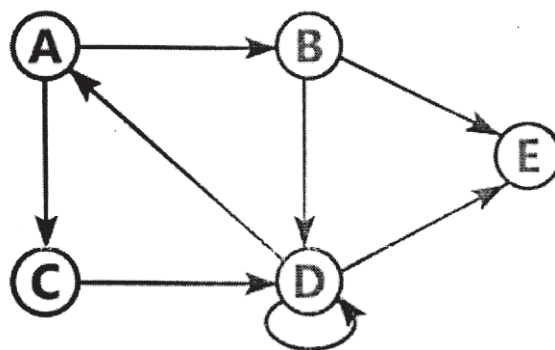
*P.T.O.*

- Q5) a)** Define the following terms with suitable example. [6]
- i) Strictly binary tree
  - ii) AVL tree
  - iii) Skewed binary tree
- b) Construct a binary search tree for the following set of elements. [6]  
5, 2, 8, 4, 1, 9, 7  
Traverse the resulting binary search tree in post-order manner.
- c) What is threaded binary search tree. Explain with suitable example. [5]

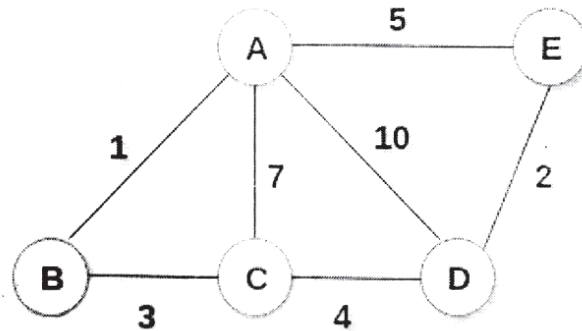
OR

- Q6) a)** From the given traversal construct the binary tree. [6]  
Inorder : D B F E A G C L J H K  
Postorder : D F E B G L J K H C A
- b) Explain with suitable example how binary tree can be represented using. [6]
- i) Array
  - ii) Linked List
- c) Construct a binary search tree for the for following data. [5]  
CAR, BAG, MAN, ADD, SAD, FAN, TAN

- Q7) a)** What do you mean by adjacency matrix and adjacency list. Give the adjacency matrix and adjacency list of the following graph. [6]



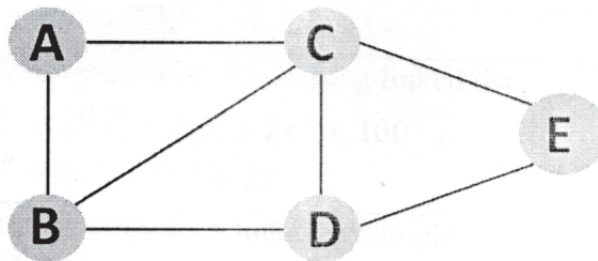
- b) Construct a minimum spanning tree for the following graph using Kruskal's Algorithm. [6]



- c) Explain Dijkstra's shortest path algorithm with suitable example. [6]

OR

- Q8) a) Write an algorithm for depth first search technique. [6]  
 b) Perform depth first search algorithm on the following graph. [6]



- c) Define with example. [6]  
 i) Connected Graph  
 ii) Path





Total No. of Questions : 8]

SEAT No. :

P-1494

[Total No. of Pages : 2

[6002]-122

**S.E. (Electronics & Computer Engineering)**

**COMPUTER ORGANIZATION**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

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

**Q1) a)** Differentiate between programmed I/O and interrupt driven I/O. [4]

b) Explain any two DMA data transfer modes. [6]

c) Explain functions of following blocks of 8237: [8]

- Priority encoder
- Program command control

OR

**Q2) a)** Write short note on programmed I/O. [4]

b) Explain different methods to handle multiple interrupt request. [6]

c) What is DMA ? Explain DMA cycle stealing. [8]

**Q3) a)** What is machine instruction? Explain types of instructions. [8]

b) Explain addressing modes of 8086. [9]

OR

**Q4) a)** Explain the following addressing modes with one example each : [9]

- i) Immediate
- ii) Register Indirect
- iii) Direct Addressing

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

*P.T.O.*

- Q5)** a) Explain in detail pipeline performance. [9]  
b) Depict the concept of Instruction level parallelism. [9]

OR

- Q6)** a) Discuss the architecture of Pentium 4 processor. [9]  
b) Explain Design issues of Super scalar processor. [9]

- 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. :

P-1495

[Total No. of Pages : 2

[6002]-123

**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 question 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) Explain in detail about separate and independent compilation. [8]  
b) Explain in detail about language features for programming in the large for Ada programming. [10]

OR

- Q2)** a) Explain the key features of object oriented programming language. [8]  
b) Explain concept of Interface and implementation in detail with example. [10]

- Q3)** a) Explain Java history in detail. [8]  
b) Explain the use of for loop with syntax and suitable programming example in Java. [9]

OR

- Q4)** a) Explain the terms i) JDK ii) JVM iii) JRE with block diagram. [8]  
b) Explain about following Jump statement in Java i) break statement ii) continue statement. [9]

- Q5)** a) Explain concept of constructors in Java with suitable example. [8]  
b) Write a Java program for class Rectangle to calculate area for Rectangle. [10]

OR

*P.T.O.*

- Q6)** a) What is garbage collection in Java? Explain use of finalize ( ) method in Java. [8]  
b) Explain about abstract class in Java with suitable example. [10]

- Q7)** a) Explain about predefined streams in Java. [8]  
b) Explain about requesting repainting in Java. [9]

OR

- Q8)** a) Explain in detail about writing console output in Java with suitable example. [8]  
b) Explain concept of exception handling in Java with suitable example. [9]



Total No. of Questions : 8]

SEAT No. :

**P1496**

**[6002]-124**

[Total No. of Pages : 3

**S.E. (Electronics and Computer Engineering)**  
**SYSTEM PROGRAMMING AND OPERATING SYSTEMS**  
**(2019 Pattern) (Semester - IV) (204207)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Differentiate between pre - emptivel & non - pre - emptive scheduling. **[6]**

b) Consider the following processes arrival time and burst time are as shown. Calculate average waiting time and average turnaround time using FCFS scheduling algorithm. **[6]**

Process	Arrival time	Burst time
P1	02	02
P2	05	06
P3	00	04
P4	00	07
P5	07	04

c) What is Real Time Operating Systems? Explain different types of Real Time operating systems with suitable examples. **[8]**

OR

**Q2) a)** What is meant by system calls in operating system? Why system calls are necessary in OS? Explain the working of System Calls in OS. **[6]**

b) In the following example, there are five processes named as P1 ,P2, P3, P4, and P5. Their arrival time and burst time are given below in the table. If the CPU scheduling policy is Round Robin with time quantum = 2 unit, calculate the average waiting time and average turnaround time. **[6]**

*P.T.O.*

Process	Arrival time	Burst time
P1	00	05
P2	01	03
P3	02	01
P4	03	02
P5	04	03

- c) Draw and explain Microkernel kernel Operating System. Differentiate between Microkernel and Monolithic Kernel. [8]

**Q3)** a) What is Inter Process Communication (IPC)? Explain the terms Shared Memory and message passing for IPC. [8]

- b) What is Mutual Exclusion? Explain any three mutual exclusion techniques in detail. [8]

OR

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

- i) Dining philosopher problem
- ii) Producer consumer problem

[8]

- b) Find out the safe sequence for the execution of the following processes using banker's algorithm. [8]

Maximum resources R1 =13, R2= 7, R3=10

Allocation Matrix

Maximum Required

Process	R1	R2	R3	Process	R1	R2	R3
P1	02	01	01	P1	04	03	03
P2	07	02	03	P2	07	02	04
P3	03	02	02	P3	04	02	05
P4	01	01	03	P4	05	03	03

**Q5)** a) What is page replacement in operating systems? What is meant by page fault? List the page replacement algorithm and explain LRU in detail. [8]

- b) Explain Fixed Partitioning and Dynamic Partitioning memory management Schemes. Also state their advantages and disadvantages. [8]

OR

**Q6) a)** What is Memory Segmentation? What is need of Memory Segmentation? How Does Memory Segmentation Work? What are the advantages and disadvantages of Memory Segmentation. [8]

- b) i) Explain concept of paging with suitable diagram. [8]  
ii) Calculate the number of page faults and page hits for the page replacement policies LRU for the given reference string 7,1,0,2,0,3,0,4,2,1,0 with 4 frames.

**Q7) a)** Explain I/O software layer. [6]

- b) What is I/O buffering? Explain double I/O buffering and state its advantages and disadvantages. [6]  
c) What is Redundant Array of Independent Disks (RAID)? Write advantages and disadvantages of RAID. [6]

OR

**Q8) a)** Explain Direct Memory Access (DMA) I/O data transfer technique with suitable block diagram. [6]

- b) Explain the following file organization techniques. [6]  
i) Serial file organization  
ii) Indexed - Sequential file organization  
c) List and explain operating system design issues. [6]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1497**

[Total No. of Pages : 2

[6002]-125

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

*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) How are hydroelectric power plants classified? [5]  
b) Explain the importance of hydrograph for the installation of hydroelectric power plant. [5]  
c) Draw layout of hydroelectric power plant and explain functions of different components. [8]

OR

- Q2)** a) Discuss the various factors which affect the location of site of a hydro-power station. [5]  
b) Compare between Kaplan turbine and francis turbine. [5]  
c) Explain the phenomenon 'water hammer' in hydroelectric power station. State the procedure to overcome this problem. [8]

- Q3)** a) Compare vertical axis and horizontal axis wind turbine. [4]  
b) Explain historical development of wind power. [6]  
c) Derive the relation of power in wind and explain impact of tower height on power generation in wind energy system. [7]

OR

- Q4)** a) Write in brief advantages and disadvantages of wind energy. [4]  
b) Explain any two speed control techniques used in wind turbine to extract maximum power. [6]  
c) With neat diagram explain different components and their functions in horizontal axis wind turbine. [7]

*P.T.O.*



- Q5)** a) Explain the terms. [4]  
i) Concentration ratio  
ii) Cloudy index  
b) Explain the methods of measurements of solar radiations. [6]  
c) Explain the working of PV cell and simplest Equivalent Circuit for a photovoltaic Cell. [8]

OR

- Q6)** a) Explain the terms. [4]  
i) Solar radiations  
ii) Solar constant  
b) Explain the impact of shading on PV systems I-V curve. [6]  
c) With the help of diagram explain the main concept of solar thermal power plant? [8]

- Q7)** a) What is a grid connected renewable system, explain with neat sketch. [4]  
b) Explain the process of municipal solid waste to energy conversion. [6]  
c) Write a short note on [7]  
i) Biomass energy  
ii) Fuel cell energy

OR

- Q8)** a) Explain standalone renewable system with neat diagram. [4]  
b) Describe the fuel cell. How they are used for energy storage requirement? [6]  
c) Write a short note on. [7]  
i) Geothermal energy  
ii) Ocean energy



Total No. of Questions : 8]

SEAT No. :

**P1498**

[Total No. of Pages : 2

**[6002]-126**

**S.E. (Electrical)**

**MATERIAL SCIENCE**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain various factors which affects breakdown of solid insulating material. [6]
- b) Discuss insulating materials used for transmission line. [6]
- c) State the properties and application of [5]
- i) Mica
  - ii) SF<sub>6</sub>

OR

- Q2)** a) Classify insulating materials and hence write properties and applications of any two materials from Class C type. [6]
- b) Explain properties of insulating materials which are used in line insulator. [6]
- c) Give properties and application of PVC and polyethylene. [5]
- Q3)** a) What do you mean by spontaneous magnetization? And derive curie-Weiss law for ferromagnetic material. [6]
- b) Define the following terms. [6]
- i) Magnetic dipole moment
  - ii) Magnetization
  - iii) Magnetic susceptibility

**P.T.O.**

- c) A magnetic field strength of a material is  $10^6 A/m$ . Given that magnetic susceptibility of material at room temperature is  $1.25 \times 10^{-3}$ . Calculate [6]
- i) Induced magnetization.
  - ii) Flux density
  - iii) Permeability

OR

- Q4)** a) Compare paramagnetic and ferromagnetic material. [6]  
b) Explain ferromagnetic and ferrimagnetic material and their application. [6]  
c) Differentiate between soft and hard magnetic material. [6]

- Q5)** a) Give the properties and application of  
i) Copper  
ii) Aluminium. [6]  
b) What is thermal bimetal? Which materials are used for this, give any three application. [6]  
c) Write a short note on thermocouple. [5]

OR

- Q6)** a) Describe properties and application of [6]  
i) Nicrome  
ii) Tungsten  
b) Give the properties and application of Manganin. [5]  
c) Explain Soft and hard solder. [6]

- Q7)** a) Explain energy bands with neat sketch. [6]  
b) Give any three nano molecular machines [6]  
c) Explain SET(Single Electron Transistor). [6]

OR

- Q8)** a) Explain [6]  
i) Nano wires  
ii) Nano carbon tubes  
b) Explain Carbon cluster. [6]  
c) Describe with neat diagram molecular machines. [6]



Total No. of Questions : 8]

SEAT No. :

**P1499**

[Total No. of Pages : 2

[6002]-127

**S.E. (Electrical)**

**ANALOG AND DIGITAL ELECTRONICS**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) What is PAL? Explain in detail with suitable diagram. [6]  
b) Write a short note on FPGA. [6]  
c) What is RAM? Explain SRAM & DRAM in detail. [5]

OR

- Q2)** a) Write a short note on PLA. [6]  
b) Explain CPLD with the help of neat logic diagram. [6]  
c) What is ROM? Explain PROM and EPROM in detail. [5]

- Q3)** a) Explain the working of OP-AMP as zero-crossing detector with circuit diagram and waveforms. [6]  
b) Write a short note on V to I converter with grounded type load. [6]  
c) Explain working of OP-AMP as instrumentation amplifier. [6]

OR

- Q4)** a) Explain operation of OP-AMP as peak detector. Draw circuit diagram and waveforms. [6]  
b) Explain sine wave generator with neat circuit diagram and waveforms. [6]  
c) With the help of circuit diagram and waveforms explain application of OP-AMP as comparator. [6]

*P.T.O.*

- Q5)** a) Draw and explain frequency response characteristics of low pass & high pass filters. [6]  
b) Explain working of IC 555 as astable multivibrator. [6]  
c) Draw a neat circuit diagram of LM-317 and derive formula for variable voltage available at the output in terms of circuit parameters. [5]

OR

- Q6)** a) Explain high pass filter using OP-AMP with its frequency response. [6]  
b) Explain working of IC 555 as monostable multivibrator. [6]  
c) Explain the function of 78XX and 79XX voltage regulator. [5]

- Q7)** a) Draw neat diagram and waveforms of single phase half wave rectifier with resistive load. Define: [6]  
i) Efficiency.  
ii) Form factor.  
iii) Ripple factor.  
iv) Peak inverse voltage.  
b) Explain full wave centre tapped rectifier supplying resistive load with circuit diagram and waveforms. [6]  
c) Draw and explain the operation of single phase bridge rectifier supplying RL load. [6]

OR

- Q8)** a) Explain the working of single phase full wave bridge rectifier with RL load. [6]  
b) A voltage of  $200 \sin(100\pi t)$  is applied to a half wave rectifier with a load resistance of  $10 \text{ k}\Omega$ . Calculate the maximum current, RMS current, average current, AC input power and ripple factor. [6]  
c) Draw neat diagram of three phase full wave bridge rectifier with R load and explain its working. [6]



Total No. of Questions : 8]

SEAT No. :

**P1500**

[Total No. of Pages : 3

[6002]-128

**S.E. (Electrical Engineering)**

**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right side indicate total 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 two possible connections of wattmeter for power measurement in single phase circuit. State clearly which connection should be used for respective conditions. [6]
- b) Two wattmeters are connected in a balanced star-connected load. The circuit is supplied from a 3-phase, 440 V, 50 Hz supply system. The current in each phase is 20 amperes and lags behind its phase voltage by 40 degrees. Calculate. [6]
- i) Phase voltage
  - ii) Load impedance
  - iii) Readings of the two wattmeters
- c) Give any 3 points of comparison between 1 wattmeter method and 2 Wattmeter method for measurement of active power in a 3 phase circuit. [6]

OR

- Q2)** a) Draw circuit diagram and phasor diagram for one wattmeter method for reactive power measurement in a 3 phase star connected (R+L) load. Explain this method in brief. [6]

*P.T.O.*

- b) When two wattmeter method is used for measurement of power in a three phase balanced circuit, comment upon the readings of the two wattmeter under following conditions. [6]
- i) when the power factor is unity
  - ii) when the power factor is zero
  - iii) when the power factor is 0.5 lagging
- c) Power input to a 150 kW, 440 V, 3-phase induction motor is measured by two wattmeter method. The wattmeter readings are 115 kW and 50 kW. Calculate. [6]
- i) The input to the motor
  - ii) Power factor of the motor
  - iii) Line current drawn by the motor

- Q3)** a) With suitable block diagram explain working of static energy meter. [6]
- b) A 230 V, 1 phase energy meter has a constant load of 4A passing through it for 6 hours at unity power factor. If the meter disc makes 2208 revolutions during this period what is the meter constant in revolutions per kWh? Calculate the power factor of the load if the number of revolutions made by the meter is 1472 when operating at 230 V, 5A for 4 hours. [6]
- c) Explain working of TOD meter with a suitable diagram. [5]

OR

- Q4)** a) With suitable labelled diagram explain constructional details of single phase induction type energy meter. [6]
- b) What is lag adjustment in case of energy meter? Explain it in detail with suitable diagrams. [6]
- c) Derive torque equation of induction type energy meter with usual notations. [5]

- Q5)** a) Explain any two types of resistive transducers. [6]  
b) Explain Phase angle measurement by Lissajous pattern. [6]  
c) With suitable diagram explain construction and working of McLeod gauge. [5]

OR

- Q6)** a) State detail classification of transducers. [6]  
b) With suitable diagram explain constructional details and working of pirani gauge. [6]  
c) With suitable diagram, explain current and frequency measurement by CRO. [5]

- Q7)** a) State 3 advantages and 3 disadvantages of LVDT. [6]  
b) With suitable diagram explain nucleonic method of level measurement. [6]  
c) With suitable diagram explain construction and working of semiconductor type strain gauge. [6]

OR

- Q8)** a) With suitable diagram explain construction and working of foil type strain gauge. [6]  
b) With suitable diagram explain construction and working of LVDT. [6]  
c) With suitable diagram explain hydraulic method of level measurement. [6]





Total No. of Questions : 9]

SEAT No. :

P-1501

[Total No. of Pages : 5

[6002]-129

S.E. (Electrical)

**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, Q.8 or Q.9.*
- 3) *Assume suitable data if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right side indicate full marks.*
- 6) *Use of electronic pocket calculator is allowed.*

**Q1) a)** The standard deviation of binomial probability distribution is, [1]

- |                |                  |
|----------------|------------------|
| i) $\sqrt{pq}$ | ii) $\sqrt{np}$  |
| iii) $np$      | iv) $\sqrt{npq}$ |

**b)** The poles of  $f(z) = \frac{e^z}{(z-1)(z-3/2)}$  are [1]

- |                    |                  |
|--------------------|------------------|
| i) $z = 1, 2$      | ii) $z = 3, -1$  |
| iii) $z = 3/2, -1$ | iv) $z = 1, 3/2$ |

**c)** In a poisson probability distribution if  $n = 100, p = 0.01$   $p(r = 0)$  is given by, [2]

- |            |           |
|------------|-----------|
| i) $2/e$   | ii) $4/e$ |
| iii) $1/e$ | iv) $3/e$ |

**d)** If  $\phi = 2x^2 - 3y^2 + 4z^2$ , then curl (grad  $\phi$ ) is, [2]

- |        |   |
|--------|---|
| i) 3   | ii) $4x\hat{i} - 6y\hat{j} + 8z\hat{k}$ |
| iii) 0 | iv) $4x - 6y + 2z$                      |

**P.T.O.**

e) Residue of  $f(z) = \frac{z+1}{z^2+1}$  at a pole  $z = i$  is, [2]

i)  $\frac{i+1}{2i}$                       ii)  $\frac{1-i}{2}$

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

f) z-transform of  $f(k) = \frac{2^k}{k!}$   $k \geq 0$  is given by [2]

i)  $e^{z/2}$                       ii)  $e^{2z}$

iii)  $e^z$                       iv)  $e^{2/z}$

**Q2)** a) Find the fourier sine transform of  $\frac{e^{-ax}}{x}$ . [5]

b) Attempt any one : [5]

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

ii) Find the inverse z-transform of  $f(z) = \frac{z}{(z-2)(z-3)}$ ;  $|z| > 3$

c) Solve  $f(k+2) - 5f(k+1) + 6f(k) = 36$ ,  $f(0) = f(1) = 0$ . [5]

OR

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

i) Find z-transform of  $f(k) = \frac{2^k}{k}$ ,  $k \geq 1$

ii) Find inverse z-transform of

$$f(z) = \frac{z^2}{(z-1)\left(z-\frac{1}{2}\right)} ; \frac{1}{2} < |z| < 1$$

- b) Solve the integral equation : [5]

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

- c) Find the fourier transform of [5]

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

Hence, find the value of  $\int_0^{\infty} \frac{\sin^2 x}{x^2} dx$

- Q4)** a) First four moments about the value 4 are 1, 4, 10 and 45. Find first four moments about mean, coefficient of skewness and kurtosis. [5]
- b) Find correlation coefficient for following distribution, [5]

$$\begin{array}{c|cccc} x & 5 & 9 & 15 & 19 \\ \hline y & 7 & 9 & 14 & 21 \end{array}$$

- c) The mean and variance of Binomial distribution are 4 and 2 respectively, Find  $P(r \leq 2)$ . [5]

OR

- Q5)** a) Given the information,  $n = 5$ ,  $\Sigma x = 30$ ,  $\Sigma y = 40$ ,  $\Sigma x^2 = 220$ ,  $\Sigma y^2 = 340$ ,  $\Sigma xy = 214$ . Find regression line of  $y$  on  $x$  and estimate  $y$  for  $x = 10$ . [5]
- b) The mean number of defectives in a sample of 20 is 2 Out of 2000 such samples, how many would be expected to contain, i) No defective sample ii) At most 3 defective, samples. [5]
- c) A fair coin is tossed 64 times. Using normal distribution with mean 32, standard deviation 4 find the probability of getting i) number of heads between 28 to 40 and ii) number of heads less than 28. [5]

[Given :  $A(1) = 0.3413$ ,  $A(2) = 0.4772$ ]

**Q6) a)** Find directional derivative of  $\phi = xy^2 + yz^3$  at  $(1, -1, 1)$  along the direction normal to the surface  $x^2 + y^2 + z^2 = 9$  at  $(1, 2, 2)$  [5]

b) Show that the vector Field. [5]

$\vec{F} = (y \sin z - \sin x)\hat{i} + (x \sin z + 2yz)\hat{j} + (xy \cos z + y^2)\hat{k}$  is irrotational, and find scalar potential  $\phi$  such that  $\vec{F} = \nabla \phi$ .

c) Find the work done in moving a particle once round the ellipse

$$\frac{x^2}{25} + \frac{y^2}{16} = 1, z = 0 \text{ under the force field.} \quad [5]$$

$$\vec{F} = (2x - y + z)\hat{i} + (x + y - z^2)\hat{j} + (3x - 2y + 4z)\hat{k}$$

OR

**Q7) a)** Find directional derivative of  $\phi = 4y^2z - 2xz^3$  at  $(1, 2, -1)$  along the line  $x - 1 = 2(y + 1) = z - 2$  [5]

b) Show that (any one) : [5]

i)  $\nabla \cdot \left[ r \nabla \left( \frac{1}{r^3} \right) \right] = 3 / r^4$

ii)  $\nabla \times \left[ \frac{\vec{a} \times \vec{r}}{r^3} \right] = -\frac{\vec{a}}{r^3} + \frac{3(\vec{a} \cdot \vec{r})}{r^5} \vec{r}$

c) Using Green's theorem for  $\vec{F} = xy\hat{i} + y^2\hat{j}$  over region R enclosed by parabola  $y = x^2$  and line  $y = x$  in the first quadrant evaluate

$$\oint_C (xydx + y^2dy) \quad [5]$$

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

b) Use Cauchy's integral formula to evaluate  $\oint_C \frac{4z^2 + z}{(z-1)(z+1)} dz$  where C is

the circle  $|z-1| = \frac{1}{2}$  [5]

c) Find a bilinear transformation which maps the points  $-i, 0, 2 + i$  of the  $z$ -plane onto the points  $0, -2i, 4$  of the  $w$ -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  $\oint_C \frac{e^z}{(z+1)(z+2)} dz$ , where  $C$  is the circle  $|z+1| = \frac{1}{2}$  using Cauchy's Integral formula. [5]

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



Total No. of Questions : 8]

SEAT No. :

P-1502

[Total No. of Pages : 3

**[6002]-130**  
**S.E. (Electrical)**  
**POWER SYSTEM - I**  
**(2019 Pattern) (Semester - IV) (203145)**

*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 indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Make suitable assumption whenever necessary.*

- Q1)** a) Define term 'Sag' and explain factors affecting sag of transmission line. [5]  
b) With neat diagram, explain construction and application of any two of the following type of insulators. i) Pin Type Insulator ii) Strain type insulator. Write application of each type of insulator. [8]  
c) The weight of the overhead line conductor is 600 kg/km. The ultimate strength is 3000 kg. If the safety factor is 2. Find i) Sag ii) Height above which conductor should be supported if ground clearance required is 6 meters. [5]

OR

- Q2)** a) Derive an expression for sag in case of overhead transmission line when the supports are at unequal level. Explain the meaning of every term in derivation. Draw a neat diagram. [6]  
b) How wind and ice loading affect the presence of sag. [6]  
c) A string of suspension insulators consists of four units. The capacitance between each link and earth is one tenth of the self-capacitance of a unit. The voltage between line conductor and earth is 100 kV. Find i) Voltage distribution across each unit ii) String efficiency. [6]
- Q3)** a) Derive an expression for internal and external flux linkages of a conductor carrying current 'I' ampere. [8]  
b) Explain the concept of Geometric mean radius (GMR) or self GMR in case of transmission lines. [4]  
c) A 50 Hz, overhead transmission line consisting of three conductors each of diameter 1.24 centimeter and spaced 2 meters apart. Calculate the inductance per phase per kilometer when conductors are equilateral spacing. [5]

*P.T.O.*

OR

- Q4)** a) Derive an expression for inductance of three phase transmission line with symmetrical spacing. Draw a neat diagram. [7]
- b) Write a short note on proximity effect. [4]
- c) A three phase 50 Hz overhead transmission line consist of three conductors each of diameter 0.3 centimeter. The spacing between the conductors are as follows. Between A and B = 4 meter, B and C = 4.5 meter and between A and C = 5.2 meter. Find inductance and inductive reactance per phase per kilometer of line. [6]
- Q5)** a) Derive the expression for capacitance to neutral of a single-phase transmission line considering effect of earth. [8]
- b) A single-phase transmission line has two parallel conductors 3 meter apart, radius of each conductor is 1 centimeter. Calculate capacitance of line per kilometer. [5]
- c) What is the difference in calculation of self GMD or GMR of inductance and capacitance? [5]

OR

- Q6)** a) Derive an expression for line to neutral capacitance of three phase overhead line with unsymmetrical spacing of conductors. Assume complete transposition of conductors. Draw a neat transposition diagram. [8]
- b) A three phase, 110 kV, 50 Hz overhead line conductors are placed in a horizontal plane. The conductor diameter is 1.5 centimeter if line length is 120 kilometers, assume completer transposition of line. Calculate i) Capacitance per phase ii) Charging current. [8]
- c) Define term electric potential. [2]
- Q7)** a) Give classification of transmission line with voltage, length, and line parameters. [5]
- b) A balanced three phase load of 30 MW is supplied at 132 kV, 50 Hz and 0.85 power factor lagging by means of transmission line. The series impedance of single conductor is  $(20+j 52)$  ohm and total phase to neural admittance is  $315 \times 10^{-6}$  Siemens. Using nominal "T" method determine A, B, C and D constants of the line. Write units of each constant. [7]
- c) With a neat circuit diagram, derive an expression for A, B, C and D constants of short transmission line. Draw a neat phasor diagram. [5]

OR

- Q8)** a) 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. [7]
- b) A single-phase overhead transmission line delivers 2000 kW at 33 kV at 0.85 power factor lagging. The total resistance and inductive reactance of the line are 10 ohm and 15 ohms respectively. Determine i) Sending end voltage ii) Sending end power factor iii) Transmission efficiency. [6]
- c) Write a short note on Ferranti effect. [4]





Total No. of Questions : 8]

SEAT No. :

P-1503

[Total No. of Pages : 3

[6002]-131

S.E. (Electrical Engineering)

ELECTRICAL MACHINES - I

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

- Q1)** a) State four features of LAP winding of DC machine. [4]
- b) Draw the diagram showing constructional details of a DC motor, clearly mark all parts. State the details of any two parts (name of part, material used for it, its function). [6]
- c) Draw and explain power stage diagram (power flow diagram) of DC motor. [8]

OR

- Q2)** a) State any four applications of DC Series motor. [4]
- b) State the significance of back emf in dc motor. [6]
- c) Draw the connection diagram of shunt, series DC motors. Write their current & voltage distribution equations. [8]
- Q3)** a) Explain in detail what precaution is necessary to be taken while operating DC Series motor. [3]
- b) Sketch & explain the Torque-Armature current characteristics of DC shunt motor. [6]

P.T.O.

- c) A 250 V d.c. shunt motor has an armature circuit resistance of 0.5 Ohm and a field circuit resistance of 125 Ohm. It drives a load at 1000 r.p.m. and takes 25 A. The field circuit resistance is then slowly increased to 150 Ohm. If the load torque remains constant, calculate the new speed and armature current. [8]

OR

- Q4)** a) What is meant by reactance voltage in ease of commutation in DC machine? [3]
- b) Draw the circuit diagram & explain the speed control of DC shunt motor by flux control also draw the nature of graph (Field current Vs. Speed). [6]
- c) Draw the connection diagram of 3 point starter used for DC shunt motor & explain the function of (i) Hold on coil & (ii) Over load coil. [8]

- Q5)** a) Draw the power flow diagram of 3-ph Induction motor. [4]
- b) A 6 pole, 3 phase induction motor is connected to 400 volt, 50 Hz ac supply. Calculate- [6]
- i) the speed of rotating magnetic field of the motor
- ii) speed of motor at 2% slip
- iii) the rotor emf frequency at 2% slip
- c) Compare 3 phase slip-ring induction motor with Squirrel cage induction motor (Minimum 4 points of comparison expected) [8]

OR

- Q6)** a) Derive the condition for maximum torque under running of 3 phase induction motors with usual notations. [4]
- b) With suitable diagram explain constructional details of 3 phase slipring induction motor. [6]
- c) Explain concept of rotating magnetic field in ease of 3 phase induction motor.
- Draw respective phasor diagrams and write respective equations [8]

- Q7)** a) With a suitable diagram explain rotor resistance starter for three-phase induction motor. [7]
- b) With suitable circuit diagram explain no load and blocked rotor test on 3 phase induction motor. Also write respective formulae involved in calculation part for determining the respective parameters. [10]

OR

- Q8)** a) Obtain the approximate equivalent circuit diagrams of 3-ph induction motor step by step. Also draw the phasor diagram of 3 phase induction motor. [7]
- b) Using data from No load & Blocked rotor test on 3-ph induction motor, write down the calculations and draw circle diagram. Indicate different losses and point of maximum torque in the circle diagram. [10]



[6002]-132

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, Q.7 or Q.8.
- 2) Neat diagram 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) Obtain the expression for current flowing through Inductor in series RL circuit and voltage across capacitor in series RC circuit connected to a d. c. voltage V for  $t > 0$ . Assume initial current flowing through Inductor is zero. [10]

b) The switch is closed at  $t = 0$  for the network shown in Fig. No.1 Find  $i(t)$ ,  $\frac{di(t)}{dt}$  at  $t=0+$ , if inductor has zero current flowing through it initially is zero. [7]

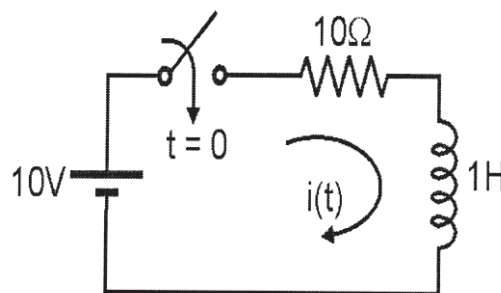


Fig. No.1

OR

P.T.O.

- Q2) a)** A series R-L-C circuit shown in fig. No.2, find current  $i(t)$  using conventional method. The switch is closed at  $t = 0$ . **[10]**

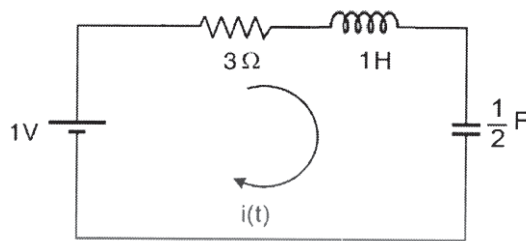


Fig. No.2

- b) What is time constant? Explain time constant in case of series R-C and series R-L circuit. **[7]**

- Q3) a)** State any six properties of Laplace Transform. **[6]**

- b) Find Laplace Transform of the following : **[6]**

i)  $e^{3t} \cosh 4t$  and ii)  $t \sin 5t$

- c) Using Laplace Transform solve differential equation **[6]**

$$2 \frac{d^2 i(t)}{dt^2} + 7 \frac{di(t)}{dt} + 6i(t) = 0 \text{ with } I(0^-) = 0 \text{ and } I'(0^-) = 1$$

OR

- Q4) a)** A series RL circuit in Fig No.3, the switch is closed at  $t=0$ . Find the expression for  $i(t)$  using Laplace Transform method. **[6]**

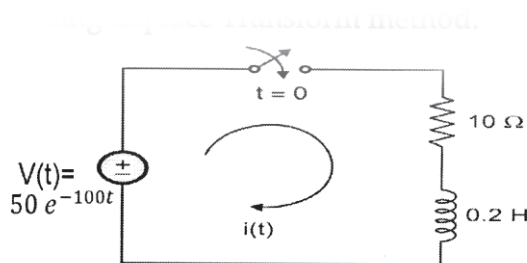


Fig. No.3

- b) Find Laplace Transform of the waveform given in Fig No.4. [6]

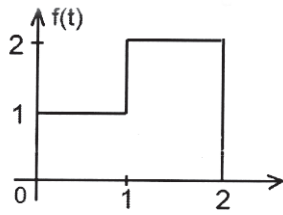


Fig. No.4

- c) Find the inverse Laplace of given. [6]

$$F(s) = \frac{(s+2)}{s(s+3)(s+4)}$$

- Q5) a) Design constant K high pass filter T and  $\pi$  section having  $f_c = 5\text{kHz}$  and nominal characteristic  $R_0 = 600\Omega$ . [9]

- b) What is Low pass filter? Derive the expression for the cut-off frequency of prototype High pass filter in terms of L and C. [8]

OR

- Q6) a) Find the transmission parameters of the network shown in Fig. No.5. [9]

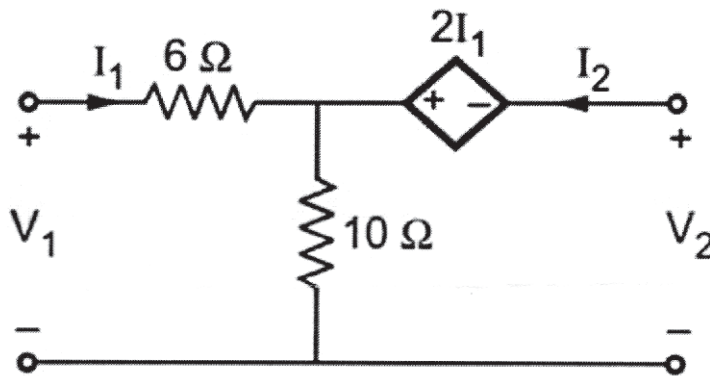


Fig. No.5

- b) Express Z-parameters in terms of ABCD parameters. [8]

Q7) a) Find Driving point Admittance  $Y(S)$  of given network Fig. No.6. [10]

$$\left[ Y(s) = \frac{1}{Z(s)} \right]$$

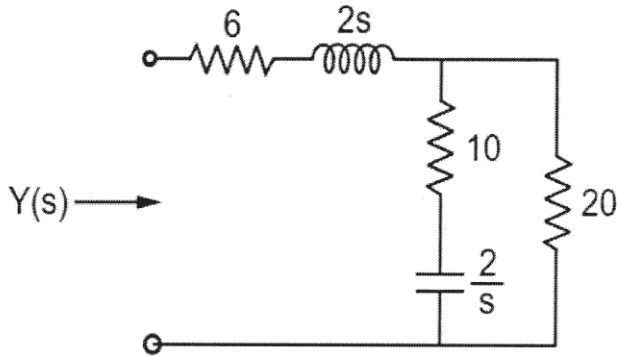


Fig. No.6

b) Define the following terms: [8]

- i) Driving point Impedance
- ii) Driving Point Admittance
- iii) Voltage Transfer function
- iv) Current transfer function

OR

Q8) a) Obtain the impedance function  $Z(s)$  for which pole-zero diagram is given in Fig. No.7  $Z(\infty) = 1$ . [10]

$$\left[ Z(s) = \frac{H(s - Z_1)(s - Z_2 \dots)}{(s - P_1)(s - P_2 \dots)} \right]$$

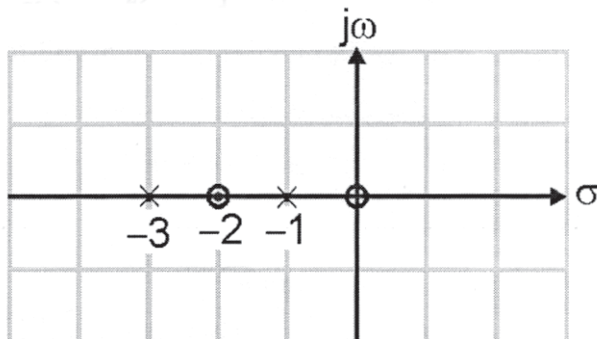


Fig. No.7

b) Define the following terms :

[8]

- i) Transfer impedance function
- ii) Transfer admittance function
- iii) Poles of system function
- iv) Zeros of system function





Total No. of Questions : 8]

SEAT No. :

**P1505**

[Total No. of Pages : 4

[6002]-133

**S.E. (Electrical Engineering)**

**NUMERICAL METHODS AND COMPUTER PROGRAMMING**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Derive the formula for Newton's divided difference for the interpolation when the data is unequally spaced. [6]

b) Construct the forward difference table and hence find the missing value corresponding to  $x = 20$ . [6]

$x$	0	10	20	30	40	50
$y = f(x)$	22	28	?	45	57	85

c) Use Sterling's interpolation formula and hence find the value of  $y$  when  $x = 28$  [6]

$x$	20	25	30	35	40
$y = f(x)$	49225	48316	47236	45926	44306

OR

**Q2) a)** The breakdown voltage of the gaseous insulating material experiment was carried out at the material science laboratory. The distance between two electrodes was increased from 0 to 3 cm and its corresponding breakdown voltage (kV) reading was recorded which is shown in the table below. [6]

Distance between two electrodes (cm)	0.5	1	1.5	2	2.5	3
Breakdown Voltage (kV)	4.5	9	15	25	32.5	48.7

Find the breakdown voltage in kV when the distance between the electrodes is 2.8 cm. Use Newton's backward interpolation formula.

**P.T.O.**

- b) Use Lagrange's interpolation formula and hence find the value of  $y$  when  $x = 0$ . [6]

$x$	-2	1	3	7
$y = f(x)$	5	7	11	34

- c) Construct the forward difference table for the following data. [6]

$x$	8	12	16	20	24
$f(x)$	48	54	60	74	98

Hence find the value of  $f(x)$  when  $x=10$  by using Newton's forward interpolation method.

- Q3)** a) Evaluate the integral using the trapezoidal rule. Take  $h = 0.5, k = 0.5$ . [6]

$$z = \int_0^1 \int_0^1 (x + 2y) dx dy$$

- b) Find the  $y(0)$  and  $y'(0)$  from the given table. Use Newton's forward interpolation formula. [6]

$x$	0	1	2	3	4
$f(x)$	3	7	15	6	2

- c) Evaluate by using Simpson's (3/8). Take  $h = 0.2$ . [5]

$$I = \int_4^{5.2} \log_e(x) dx$$

OR

- Q4)** a) Evaluate the integral using the Simpson's 1/3<sup>rd</sup> rule. Take  $h = k = \frac{\pi}{4}$  [6]

$$z = \int_0^{\pi/2} \int_{\pi/2}^{\pi} \cos(x + y) dx dy$$

- b) From the following table with the values of  $x$  and  $y$ , find the first and second derivatives when  $x=10$ . Use Newton's backward interpolation formula. [6]

$x$	2	4	6	8	10
$f(x)$	4.7183	5.0552	7.3891	9.4789	12.4132

- c) Apply Simpson's  $1/3^{\text{rd}}$  rule taking  $h = 0.25$  [5]

$$I = \int_0^1 \frac{dx}{2+x^2}$$

- Q5) a)** Apply Gauss Elimination Method to solve the following set of equations. [6]

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

$$x + y - 6z = -12$$

$$3x - y - z = 4$$

- b) Use the Jacobi's method to solve the following set of equations. Consider the initial approximation as  $x^{(0)} = y^{(0)} = z^{(0)} = 0$ . Solve only 5 iterations. [6]

$$15x + 4y - z = 17$$

$$3x + 15y - 6z = -18$$

$$2x - 3y + 15z = 25$$

- c) Use the Gauss Jordan method to find the inverse of the following matrix. [6]

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

OR

- Q6) a)** Apply the Gauss Jordan method to solve the following equations. [6]

$$x + y + z = 9$$

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

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

- b) Use the Seidel method to solve the following set of equations. Consider the initial approximation as  $x^{(0)} = y^{(0)} = z^{(0)} = 0$ . Solve only 4 iterations. [6]

$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

$$-2x + 3y + 10z = 22$$

- c) Explain the Gauss Elimination method used for the solution of the linear simultaneous equation. (Problem is not expected. Just write in detail steps). [6]

- Q7) a)** Use the Euler's method to solve the following ordinary differential equation and hence find the value of  $y(1.2)$  taking the step size as  $h = 0.4$ . [6]

$$\frac{dy}{dx} = x + y$$

$$y(0) = 1$$

- b)** Use the Runge-Kutta method of fourth order, Solve the following ODE and find the value of  $y(0.2)$  and  $y'(0.2)$ . Correct to four decimal places. [6]

$$y'' = y + xy'$$

The initial conditions given are  $x = 0, y = 1.5, y' = 0$

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

OR

- Q8) a)** Solve the following ordinary differential equation by using Runge-Kutta fourth order method. Find the value of  $y$  when  $x=0.2, x = 0.4$ . The initial approximation is  $y(0)=1$ . [6]

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

- b)** Find the  $y(0.1)$  and  $y(0.2)$  by using Taylor's series method. Consider the terms up to fourth derivative. Consider the initial value as  $y(0)=1$ . [6]

$$\frac{dy}{dx} = x^2 y - 1$$

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



Total No. of Questions : 8]

SEAT No. :

**P1506**

**[6002]-134**

[Total No. of Pages : 2

**S.E. ( Electrical)**

**FUNDAMENTALS OF MICROCONTROLLER AND  
APPLICATIONS**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Ques. 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.*

- Q1) a)** Write a program in C language to configure timer 0 of 8051 microcontroller in mode 2 use 8051 XTAL for clock source and start the timer 0. [5]
- b) Write a program in C to toggle all bits of Port 1. [5]
- c) Draw the TCON and TMOD register and explain use of individual bits of both the registers. [8]

OR

- Q2) a)** Write a short note on C Data types for 8051 microcontroller. [5]
- b) Write an 8051 C program to toggle only bit P2.4 continuously without disturbing any other bit of port 2. [5]
- c) Write a program in C language to toggle only bit P1.5 continuously every 50ms use timer 0 in mode 1 (16 bit) to create a delay. Assume crystal frequency = 12MHz. [8]
- Q3) a)** Write a program in C language assign highest priority to INT 1 interrupt. Discuss the sequence in which the interrupts are served if INT 1 is assigned the highest priority. [5]

*P.T.O.*

- b) Write down the steps in executing on an interrupt. [5]
- c) Explain the functions of following pins of ADC 0809. [7]
  - i) ADD A, ADD B, and ADD C.
  - ii) EOC
  - iii) START
  - iv) OUTPUT ENABLE

OR

- Q4)** a) Draw the IE register and explain the functions of bits EA, ET0 and EX0. [5]
- b) Write down the steps to program ADC 0809. [5]
- c) Draw interfacing diagram of ADC and draw a flow chart to read ADC. [7]
- Q5)** a) Explain how the BAUD rate is set for serial communication in 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 "A" serially at baud rate of 4800, Use serial port in Mode 1. Crystal frequency is 11.0592 MHz. [8]

OR

- Q6)** a) Draw the SCON register and explain use of individual bits of the register in detail. [5]
- b) Assuming crystal frequency of 11.0592 MHz, Find the value to be loaded in TH 1 to set up the following baud rates (i) 9600, (ii) 2400 and (iii) 1200 [5]
- c) Program the 8051 in C to receive bytes of data serially and put them in P2. Set the baud rate at 4800, 8 - bit data, and I stop bit. [8]

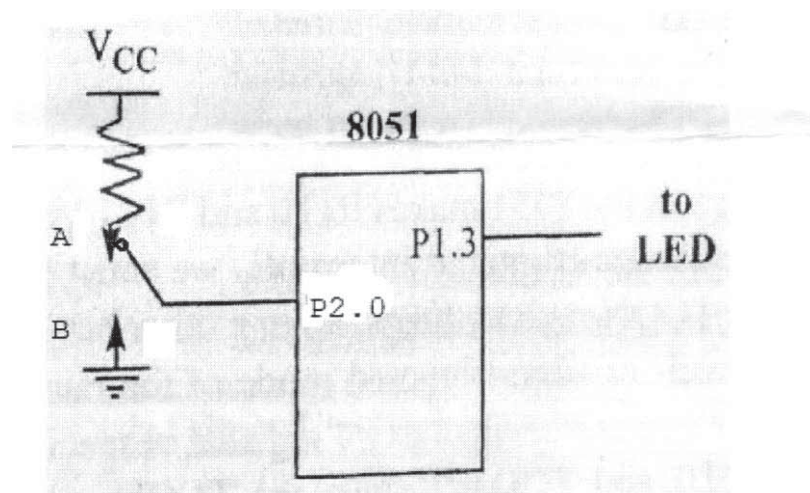
**Q7) a)** With a neat block diagram explain AC current measurement using 8051 microcontroller. [7]

b) Draw an interfacing diagram of stepper motor with 8051. Assuming the motor is controlled through least significant 4 bits of port 2, Assuming the step angle of motor as 1.8 degrees, Write a program in C language to run the stepper motor in anticlockwise direction through an angle of 7.2 degrees. 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 drive circuit.[7]

b) A switch and an LED is connected to 8051 as shown in diagram. The LED is connected in common cathode configuration. Write a program in C language to switch on the LED when Switch is in position A and switch it OFF when it is in position B. [10]



\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1507**

[Total No. of Pages : 2

[6002]-135

**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) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of calculator is allowed.*

- Q1)** a) Discuss any vacuum gauge tester in detail with a diagram. [8]  
b) Draw and discuss the dead weight tester with diagram. How will you calibrate bourdon tube pressure gauge with it? [9]

OR

- Q2)** a) Draw and discuss the motion balance system. Write the significance of it. [8]  
b) What are the various types of manometers? Discuss U-tube manometer in detail with diagram. [9]

- Q3)** a) Draw and discuss the bimetallic thermometer. Discuss in detail with one application. [9]  
b) What is RTD? How do you measure temperature with RTD. Discuss the signal conditioning circuitry for it. [9]

OR

- Q4)** a) What is lead wire compensations for RTD? Discuss 2-wire and 3-wire compensation techniques. [9]  
b) Discuss the working of thermocouples using seebeck effect with diagram. What are the various types of thermocouples? Discuss “J” and “k” type. [9]

- Q5)** a) How do anemometers measure fluid flow velocity, discuss with diagram. What are their limitations? [8]  
b) Discuss Doppler and transit-type flowmeters with diagram. [9]

OR

*P.T.O.*



**Q6) a)** Discuss Bernoulli's Principle. What are the head-type flowmeters? Explain one in detail with diagram. [8]

b) How do you measure flow using an electromagnetic flow meter? Discuss with diagram. [9]

**Q7) a)** How does the falling and rolling ball viscometer used to measure the viscosity? Discuss. [9]

b) How does a chain-balanced float-type density meter work? Discuss with diagram. [9]

OR

**Q8) a)** Briefly explain the function of pH sensors in measuring the acidity or alkalinity of a solution with diagram. [9]

b) Describe the working principle of capacitive humidity sensors with diagram. [9]



Total No. of Questions : 8]

SEAT No. :

**P1508**

**[6002]-136**

[Total No. of Pages : 2

**S.E. (Instrumentation and Control)  
LINEAR INTEGRATED CIRCUITS  
(2019 Pattern) (Semester - III) (206262)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain the working principle of practical integrator circuit with neat circuit diagram and derivation of output equation. [9]
- b) Write short note on. [8]
- i) Current booster
  - ii) Isolation amplifiers

OR

- Q2)** a) Explain the working principle of practical differentiator circuit with neat circuit diagram and derivation of output equation. [8]
- b) Design and implement the circuit using op-amp to get the output expression as  $V_o = 2V_1 - 4V_2 + 5V_3$  [9]
- Q3)** a) Explain working of Non-inverting comparator and state its characteristics. [9]
- b) Design a wein bridge oscillator to generate oscillations at 1 KHZ. Draw circuit diagram. [9]

OR

- Q4)** a) Explain the working of Half wave Precision Rectifier with appropriate equations. [9]
- b) Design a phase shift oscillator to oscillate at 200 Hz. [9]

*P.T.O.*

- Q5)** a) Describe working of astable multivibrator with necessary diagrams and derivations. [9]  
b) Explain with one application, the working of IC CD 4051 as analog multiplexer. [8]

OR

- Q6)** a) Draw pin diagram of IC 555 and explain working of each pin. [8]  
b) Describe working of monostable multivibrator with necessary diagrams and derivations. [9]

- Q7)** a) Define filter. Draw practical and ideal frequency response plots of low pass, high pass, band pass, band stop filter. [9]  
b) Design low pass first order Butterworth filter having cut off frequency 1 kHz with passband gain of 2. [9]

OR

- Q8)** a) Differentiate between active and passive filter. [3]  
b) Define line, load regulation, ripple rejection of voltage regulator. [6]  
c) Draw and explain circuit for generating 15V supply using IC7815. [9]



Total No. of Questions : 8]

SEAT No. :

**P1509**

[6002]-137

[Total No. of Pages : 2

**S.E. (Instrumentation and Control)**  
**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**  
**(2019 Pattern) (Semester - III) (206263)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Write any two differences between 1:1 oscilloscope probe and 10:1 oscilloscope probe. [4]
- b) What are the advantages of Digital Storage oscilloscope over Dual Trace oscilloscope. [4]
- c) What is Lissajous pattern? How it can be used to measure unknown frequency and phase difference between two sine waveforms. [9]

OR

- Q2)** a) With neat waveforms explain the measurement of frequency by sweep method and Lissajous pattern method in dual trace oscilloscope. [8]
- b) With neat waveforms explain the ALT and CHOP modes in dual trace oscilloscope. [6]
- c) One cycle of triangular waveform when applied to Y-channel of CRO occupies 7 horizontal divisions. The time per division setting is at 0.5 mS/div. Calculate the frequency of the signal. [3]

- Q3)** a) Differentiate between Maxwell Inductance-Capacitance bridge and Hay bridge. (any three points). [6]
- b) Describe with neat circuit diagram Schering bridge. [6]
- c) A Wheatstone bridge has arms as: AB = 102 ohms, BC = 1002 ohms, CD = 3955 ohms, DA = 4780 ohms. A voltmeter with internal impedance of  $1M\Omega$  is connected between B and D, while a battery of 9 V is connected between AC. Calculate the value of unbalanced emf. [6]

OR

*P.T.O.*

- Q4)** a) Enlist the various bridge circuits you have studied and mention the measurement carried out using these bridges. [6]
- b) In Wien bridge at balanced condition the values of components in bridge arms are as follows.  
 $R_1=1250\Omega$ ,  $R_2 = 820\Omega$ ,  $R_3 = 2200\Omega$ ,  $R_4 = 3300\Omega$  and  $C_1 = 6.8 \mu\text{f}$  &  $C_3 = 2.2 \mu\text{f}$  Calculate the value of bridge supply frequency. [6]
- c) Draw circuit diagram of general AC bridge and derive the equation for the balanced condition of the bridge. [6]

- Q5)** a) What are the advantages of digital instruments over analog instruments. [6]
- b) 8-bit SAR type ADC is used in a certain application with reference voltage of 5 V. The clock used has a frequency of 1 MHz. Determine the digital output and conversion time when the analog input voltage is 2.25 volts. [6]
- c) Describe any three specification of ADC. [6]

OR

- Q6)** a) Draw general block diagram of digital multimeter and explain its working. [9]
- b) An 8-bit ADC has input range of 5V. Determine resolution, digital output for input voltage of 1.55 V and quantization error. [6]
- c) For R-2R type DAC,  $R_f=1.5 \text{ Kohms}$ ,  $R = 1 \text{ Kohms}$  and reference voltage is 5 V. Calculate the analog output for digital input of  $(011011)_2$ . [3]
- Q7)** a) With the help of neat diagram, explain the galvanometric type recorder. [9]
- b) Classify recorders. List the different writing mechanisms. Explain ink filled system for generating record. [8]

OR

- Q8)** a) Differentiate between Virtual Instruments and traditional instruments. [8]
- b) Describe the working of strip chart recorder with reference to block diagram. What do you mean by multichannel recorder? [9]



Total No. of Questions : 8]

SEAT No. :

**P1510**

[Total No. of Pages : 2

[6002]-138

**S.E. (Instrumentation)**

**CONTROL SYSTEM COMPONENTS**

**(2019 Pattern) (Semester-III) (206264)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain the Pneumatic power supply with neat sketch. [6]  
b) Compare Pneumatic System with Electric System (any 4 important points.) [6]  
c) State the necessity of FRL unit in Pneumatic System. [5]

OR

- Q2)** a) List various types of direction control valve. Explain any one in details.[6]  
b) Compare pneumatic System with Hydraulic System (any 4 important points.) [6]  
c) What is cushioning of air cylinder. State its effect on the cylinder performance. [5]

- Q3)** a) Draw and Explain Meter-in control circuit in details. [6]  
b) Explain construction & working of any one type of Hydraulic pumps.[6]  
c) Draw and Explain Meter-out control circuit in details. [6]

OR

- Q4)** a) Draw hydraulic circuit for sequential operation of two cylinders. [6]  
b) Compare Hydraulic & Pneumatic system (Any 4 important points). [6]  
c) Draw and explain 5/3 way Hydraulic valve. [6]

*P.T.O.*

- Q5) a)** Draw and Explain working of SCR. Give its application. [10]  
b) Draw and Explain working of TRIAC. [7]

OR

- Q6) a)** List various commutation techniques. Explain any one in detail. Write its applications. [10]  
b) Draw and Explain circuit of an IGBT. Explain its various parts. [7]

- Q7) a)** Explain Construction, Working & applications of Alarm Annunciation system. Draw its block diagram. [10]  
b) Explain significance of square root extractor with reference to Differential Pressure Transmitter. [8]

OR

- Q8) a)** List different types of fuses and Explain working of any one in detail.[10]  
b) Explain how synchros can used as Error detectors. [8]



[6002]-139

**S.E. (Instrumentation Engineering)**  
**ENGINEERING MATHEMATICS - III**  
**(2019 Pattern) (Semester - III) (207008)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Question No. 1 is compulsory
- 2) Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
- 3) Assume suitable data, if necessary.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Figures to the right indicate full marks.
- 6) Use of electronic pocket calculator is allowed.

**Q1) a)** Range of correlation coefficient  $r(x, y)$  is, [1]

- |                                     |                        |
|-------------------------------------|------------------------|
| i) $-\infty < \frac{1}{r} < \infty$ | ii) $0 \leq r \leq 1$  |
| iii) $-\infty < r < \infty$         | iv) $-1 \leq r \leq 1$ |

**b)** Maximum directional derivative of scalar point function  $\phi(x, y, z)$  is in the direction of, [1]

- |                    |                                   |
|--------------------|-----------------------------------|
| i) tangent vector  | ii) $\hat{i} + \hat{j} + \hat{k}$ |
| iii) radius vector | iv) normal vector                 |

**c)** In a poisson probability distribution if  $n = 100, p = 0.01, p(r = 0)$  is given by, [2]

- |            |           |
|------------|-----------|
| i) $1/e$   | ii) $2/e$ |
| iii) $3/e$ | iv) $4/e$ |

**d)**  $\nabla^2 \left( \frac{1}{r^2} \right)$  is equal to, [2]

- |                               |                     |
|-------------------------------|---------------------|
| i) $\frac{1}{r^3}$            | ii) $\frac{2}{r^4}$ |
| iii) $\frac{-2}{r^4} \bar{r}$ | iv) $\frac{6}{r^4}$ |

P.T.O.



e) For  $f(z) = \frac{z}{(z-1)(z+2)}$  the residue of  $f(z)$  at the pole  $z = -2$  is, [2]

i)  $\frac{1}{3}$                                       ii)  $\frac{1}{2}$

iii)  $\frac{2}{3}$                                       iv)  $1$

f) The fourier sine transform  $f_s(\lambda)$  of [2]

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

i)  $\frac{1 - \cos 2\lambda}{\lambda}$                                       ii)  $\frac{\sin 2\lambda}{\lambda}$

iii)  $\frac{\cos 2\lambda - 1}{\lambda}$                                       iv)  $-\frac{\sin 2\lambda}{\lambda}$

**Q2)** a) Find the Fourier cosine integral representation for the function [5]

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

b) Find z transform of  $f(k) = 4^k \sin(2k + 3), k \geq 0$ . [5]

c) Solve the difference equation [5]

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

OR

**Q3)** a) Find the inverse Z-transform of  $F(Z) = \frac{Z^2}{Z^2 + 1}$  by inversion integral method. [5]

b) Solve the integral equation [5]

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

c) Find the Fourier transform of [5]

$$f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$$

**Q4) a)** Find the first four moments about A mean for following distribution,

$$\begin{array}{c|ccccc} x & 1 & 2 & 3 & 4 & 5 \\ \hline f_{req} & 9 & 11 & 5 & 8 & 7 \end{array} \quad [5]$$

- b) Calculate the coefficient of correlation from the following data,  $n = 10$   
 $\sum x = 40, \sum x^2 = 190, \sum y^2 = 200, \sum xy = 150, \sum y = 40$ . [5]
- c) Determine the probability of getting sum 10 exactly twice in three throws with a pair of fair dice. [5]

OR

**Q5) a)** Find arithmetic mean and standard deviation for the following distribution,

$$\begin{array}{c|cccc} x & 1 & 2 & 3 & 4 \\ \hline f & 6 & 4 & 10 & 4 \end{array} \quad [5]$$

- b) In a poisson distribution if  $p(r = 2) = 3 p(r = 3)$ , find  $p(r = 3)$ . [5]
- c) In a certain examination test, 2000 students appeared in a subject of statistics. Average marks obtained were 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks, supposing that marks are distributed normally? [ $A(2) = 0.4772$ ]. [5]

**Q6) a)** Find directional derivative of  $\phi = e^{2x-y-z}$  at  $(1, 1, 1)$  in the direction of tangent to the curve  $x = e^{-t}$ ;  $y = 2\sin t + 1$ ;  $z = t - \cos t$  at  $t = 0$ . [5]

b) Show that the vector field. [5]

$\vec{F} = (x^2 - yz)\hat{i} + (y^2 - xz)\hat{j} + (z^2 - xy)\hat{k}$  is irrotational and find the scalar field such that  $\vec{F} = \nabla\phi$ .

c) Evaluate  $\int_c \vec{F} \cdot d\vec{r}$ , where [5]

$\vec{F} = (2xy + 3z^2)\hat{i} + (x^2 + 4yz)\hat{j} + (2y^2 + 6xz)\hat{k}$  and  $c$  is the curve  $x = y = z$  from  $(0, 0, 0)$  to  $(1, 1, 1)$ .

OR

**Q7) a)** Find directional derivative of  $\phi = 4xz^3 - 3x^2y^2z$  at  $(2, -1, 2)$  to wards the point  $\hat{i} + \hat{j} - \hat{k}$ . [5]

b) Show that (any one) : [5]

i)  $\nabla^4(r^2 \log r) = 6 / r^2$

ii)  $\nabla_x \left( \frac{\bar{a} \times \bar{r}}{r^3} \right) = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$

c) Using Green's theorem evaluate  $\oint_c \bar{F} \cdot d\bar{r}$  where

$\bar{F} = (2x + y^2)\hat{i} + (3y - 4x)\hat{j}$  and 'c' is circle  $x^2 + y^2 = 9; z = 0$ . [5]

**Q8) a)** If  $v = -\frac{y}{x^2 + y^2}$ , find  $u$  such that  $f(z) = u + iv$  is analytic. determine  $f(z)$  in terms of  $z$ . [5]

b) Evaluate  $\oint_c \frac{z^2 - z + 1}{z - 1} dz$  where C is the circle  $|z| = \frac{1}{2}$ . [5]

c) Find the bilinear transformation which maps the points  $1, i, -1$  from Z-plane into the points  $i, o, -i$  of the W-plane. [5]

OR

**Q9) a)** Find 'k' such that the function [5]

$f(z) = r^3 \cos 3\theta + i r^3 \sin k\theta$  is analytic.

b) Use Residue theorem to evaluate [5]

$\oint_c \frac{[\sin \pi z^2] + 2z}{(z - 4)(z - 2)} dz$  where

C is the circle  $|z| = 3$ .

c) Show that, under the transformation [5]

$w = \frac{i - z}{i + z}$ , X-axis in Z-plane is

mapped outo the circle  $|w| = 1$ .



Total No. of Questions : 8]

SEAT No. :

P-1512

[Total No. of Pages : 4

[6002]-140

S.E. (Instrumentation & Control Engineering)

CONTROL SYSTEMS

(2019 Pattern) (Semester - IV) (206268)

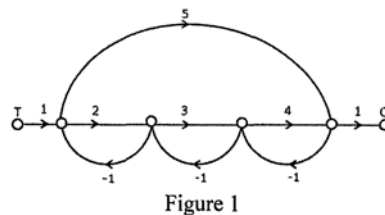
Time : 2½ Hours]

[Max. Marks : 70

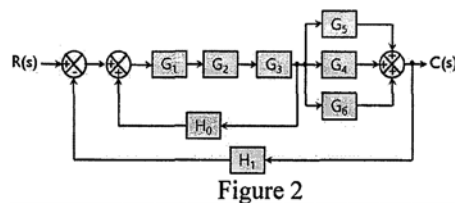
Instructions to the candidates:

- 1) Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data jf necessary.
- 5) Use of non-programmable calculators/Log table is allowed.

Q1) a) Apply the signal flow graph technique to determine the closed-loop gain of the system shown in Figure 1. [9]



b) Reduce the block diagram shown in Figure 2 into canonical form, also obtain its control ratio [9]



OR

P.T.O.

- Q2) a)** Use block diagram reduction rules for the system shown in Figure 3 to determine the transfer function  $C(s)/R(s)$  [9]

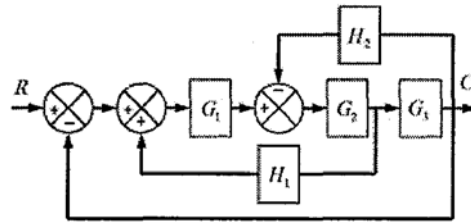


Figure 3

- b) Determine the transfer function  $\frac{C(s)}{R(s)}$  of the system shown in the Figure 4 [9]

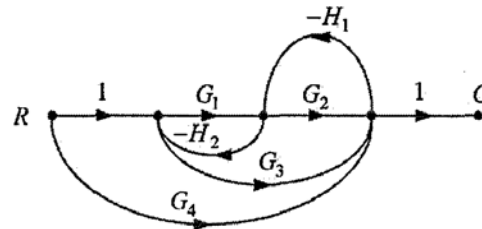


Figure 4

- Q3) a)** For the unity feedback system with open loop transfer function

$$G(s) = \frac{25}{s(s+6)}$$

determine rise time, peak time, peak overshoot and settling time. [9]

- b) A unity feedback control system is described by [8]

$$G(s) = \frac{K}{s^2(s+20)(s+30)}$$

Determine steady state error coefficients and also the value of K to limit error to 10 units due to input

$$r(t) = 1 + 10t + 20t^2$$

OR

**Q4) a)** The open loop transfer function of a feedback control system is given by

$$G(s)H(s) = \frac{K(s+1)}{s(1+Ts)(1+2s)}$$

Determine the error co-efficients and errors due to the unit positional input, unit velocity input and unit acceleration input : if  $K = 10$  and  $T = 4$ . [9]

**b)** Define the following [8]

- 1) Delay time
- 2) Rise time
- 3) Peak time
- 4) Settling time

**Q5) a)** Determine the stability of a system whose closed loop transfer function is given by

$$\frac{C(s)}{R(s)} = \frac{2s+5}{s^5 + 1.5s^4 + 2s^3 + 4s^2 + 5s + 10}$$

If the system is unstable, how many roots will have positive real part?[8]

**b)** Draw the root locus plot for a system having open-loop transfer function as [10]

$$G(s)H(s) = \frac{K}{s(s+1)(s+3)}$$

OR

**Q6) a)** Using Routh-Hurwitz criterion determine the relation between  $K$  and  $T$  so that unity feedback control system with open loop transfer function given below is stable [8]

$$G(s) = \frac{K}{s[s(s+10)+T]}$$

**b)** Draw the root locus plot for a system having open-loop transfer function as [10]

$$G(s)H(s) = \frac{K}{s(s+2)(s+4)}$$

Q7) a) Sketch the polar plots for  $\frac{1}{s}$  and  $\frac{1}{s^2}$  [7]

b) Draw the bode plot for a unity feedback system whose open-loop transfer function is given by [10]

$$G(s) = \frac{10}{s(s+1)(0.02s+1)}$$

From the bode plot determine

- i) Gain and Phase crossover frequencies
- ii) Gain and Phase margins
- iii) Stability of closed-loop system

OR

Q8) a) Sketch the polar plot for  $G(s) = \frac{sT}{1+sT}$ . [7]

b) Draw the bode plot for a unity feedback system whose open-loop transfer function is given by [10]

$$G(s) = \frac{10}{s(0.01s+1)(0.1s+1)}$$

Determine

- i) The gain crossover frequency and corresponding phase margin.
- ii) The phase crossover frequency and corresponding gain margin.
- iii) Stability of closed-loop system.

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-1513

[Total No. of Pages : 2

[6002]-141

S.E. (Instrumentation & Control)

Digital Electronics

(2019 Pattern) (Semester - IV) (206269)

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.

**Q1)** a) Design and explain full subtractor circuit with logic table, k-map, logic equation and logic diagram. [9]

b) Design and explain 1:4 DEMUX with block diagram, truth-table, equation and logic diagram. [9]

OR

**Q2)** a) Design and explain full adder circuit with logic table, k-map, logic equation and logic diagram. [9]

b) Design and explain BCD to 7-segment decoder driver IC 7447 along with display. [9]

**Q3)** a) Draw and explain SR flip-flop along with logic diagram, truth table. [9]

b) Discuss volatile and non-volatile, flash and bubble memories. [8]

OR

**Q4)** a) Design the Conversion of D flip-flop into T-type flip-flop with excitation table, k- map and logic diagram. [9]

b) What is limitation of SR flip-flop? Describe how this limitation is overcome in JK Flipflop. [8]

P.T.O.



- Q5)** a) What is buffer register? Discuss working of shift registers along with logic diagram, timing diagram and function-table. [9]
- b) What is Pre-settable counter? Design and discuss 3-bit asynchronous counter with logic diagram, function table. [9]

OR

- Q6)** a) What is modulus of counter? Design and discuss MOD 10 synchronous up-counter using logic diagram. [9]
- b) Design and explain 6 to 15 UP counter using IC 74193. [9]
- Q7)** a) What is PLD? Discuss PLA with neat diagram. [9]
- b) Describe the operation of TTL logic circuit working as NAND gate.[8]

OR

- Q8)** a) Classify logic families. Compare in details TTL with CMOS. [9]
- b) Implement Digital clock by using counter ICs. [8]



Total No. of Questions : 8]

SEAT No. :

P-1514

[Total No. of Pages : 2

[6002]-142

**S.E. (Instrumentation & Control Engineering)**

**PROCESS LOOP ELEMENTS**

**(2019 Pattern) (Semester - IV) (206270)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer 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) *Neat Diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data if necessary.*

**Q1)** a) Illustrate two position and floating control mode in brief with neat sketch. [9]

b) Enlist 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) Illustrate P, I and PID controller in brief with suitable examples. [9]

**Q3)** a) Illustrate Ziegler Nichols close loop tuning method in detail. [8]

b) Derive an expression for digital PID velocity algorithm and state the merit of velocity algorithm. [9]

OR

**Q4)** a) Illustrate process reaction curve tuning method in detail. [8]

b) Derive an expression for digital PID position algorithm and state the limitation of position algorithm. [9]

*P.T.O.*

- Q5) a)** Comment on cavitation in brief and suggest the method to reduce it. [9]
- b) State 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)** Comment on flashing in brief and suggest the suitable method used to reduce it. [9]
- b) Specify the need of final control element in process and explain globe and butterfly control valve in detail with neat sketch. [9]
- Q7) a)** List types of actuators, explain any one with neat sketch and state its advantages, disadvantages and applications. [8]
- b) What is the significance of pressure boosters and elaborate pressure booster in brief. [9]

OR

- Q8) a)** State the significance of volume boosters and explain volume booster in brief. [8]
- b) Specify the need of positioners, state its application, types and discuss effect of positioner on performance of control valve. [9]



[6002]-143

**S.E. (Instrumentation and Control)**  
**SIGNALS AND SYSTEMS**  
**(2019 Pattern) (Semester-IV) (206271)**

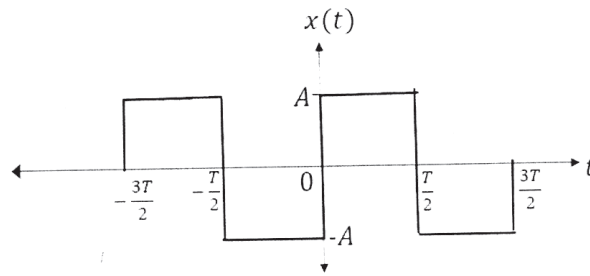
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a)** Obtain the Fourier series of the periodic signal  $x(t)$  shown in following figure. [10]



- b) Find the Fourier Series Coefficients of signal  $x(t)=1+2 \sin (\omega_0 t)+2 \cos (2 \omega_0 t)$ . [8]

OR

- Q2) a)** List out the properties of continuous time Fourier Series. Prove the linearity property. [10]
- b) Give the Dirichlet conditions for continuous time Fourier series. Find the Fourier Series Coefficients of signal  $x(t)=\cos (\omega_0 t)$ . [8]

- Q3) a)** Impulse response of system is  $h(t)=e^{-3t}u(t)$ . Find the system output using Fourier Transform if input to the system is  $x(t)=e^{-2t}u(t)$ . [10]
- b) Define continuous time Fourier Transform. State the condition for existence of Fourier integral. [7]

OR

P.T.O.

- Q4) a)** Determine the Fourier transform of the following continuous time signals. [10]
- $x(t) = \delta(t - t_0)$
  - $x(t) = \cos(\omega_0 t)$
- b)** List out the properties of continuous time Fourier Transform. Prove the Time Shifting property. [7]

- Q5) a)** Determine  $x(t)$  if  $X(s) = \frac{1}{(s+1)(s+2)}$  with [10]
- $\text{Re}(s) > -1$
  - $\text{Re}(s) < -2$
- b)** List out the properties of Laplace Transform. State and Prove the convolution property of Laplace Transform. [8]

OR

- Q6) a)** Find the Laplace Transform of following signals. [10]
- $x(t) = (2e^{-t} - e^{-2t}) u(t)$
  - $x(t) = e^{-t} \sin(2t)$
- b)** Define the region of convergence (RoC) of Laplace Transform. If Laplace Transform of a signal  $x(t)$  is  $X(s) = \frac{1}{(s+1)}$ , draw a sketch of RoC when  $x(t)$  is left handed and when  $x(t)$  is Right handed. [8]

- Q7) a)** Define the following terms. [10]
- Statistical average.
  - Mean
  - Standard Deviation
  - Variance
  - Moment about origin
- b)** In a fair-die experiment, determine the probability of the event  $\{f_2\}$ , assuming that the event occurred are even. [7]

OR

- Q8) a)** Find the mean, variance and standard deviation of the random variable. [10]

$$f(x) = \begin{cases} \frac{x}{2} & ; 0 < x < 2 \\ 0 & ; \text{otherwise} \end{cases}$$

- b)** List the properties of distribution function. [7]



Total No. of Questions : 8]

SEAT No. :

**P1516**

**[6002]-144**

[Total No. of Pages : 3

**S.E. ( Instrumentation and Control)**

**DATA STRUCTURES**

**(2019 Pattern) (Semester - IV) (206272)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Illustrate negative indexing in list with an example. Also describe list slicing with examples. **[6]**
- b) Develop a program to create one - dimensional array having. **[12]**
- i) 5 Integers
  - ii) 4 floating numbers
  - iii) 3 boolean values
  - iv) 5 8 - bit integers.

OR

- Q2)** a) Write a python program to store student's marks into an array and finding total marks and percentage of marks. **[8]**
- b) Write a python program to explain following operation on matrix. **[6]**
- i) to get diagonal elements
  - ii) finding maximum and minimum
  - iii) sorting of elements.
- c) Write a python program to insert a new item before the second element in an existing array. **[4]**

**P.T.O.**

- Q3) a)** Illustrate the following Map methods with an example. [12]
- i) Length ()
  - ii) Contains (key)
  - iii) Add (key, value)
  - iv) Remove (key)
  - v) Value of (key)
  - vi) Iterator()
- b) Elaborate set ADT and it's operations in python programming. [5]

OR

- Q4) a)** Design and implement a multidimensional array to do the following operations: [9]
- i) Constructor
  - ii) Dimensionality and Length
  - iii) Element access
- b) Write a python program to add and remove items from a given set. [8]

- Q5) a)** Write a program to implement the Linked list operations. [8]
- b) Consider the following unsorted list : [24,44,11,92,45,58]. Write the passes of selection sort for sorting the list in ascending order till the 3<sup>rd</sup> iteration. [10]

OR

- Q6) a)** Write a python program to create a linked list and perform operations on the list. Following are the operations. [12]
- i) Add element
  - ii) Remove element
  - iii) Replace element
  - iv) Search for element.
- b) Write a program of an iterator, for the Bag ADT implemented using a linked list. [6]

- Q7)** a) Illustrate the enqueue and dequeue operations of queue. [8]
- b) Develop a python program to add city and remove city considering them to act as insert and delete operations of the data structure queue.[9]

OR

- Q8)** a) Develop a function to push student's information to stack. Write the push operation of stack containing names using class. [12]
- b) Write a python program to create a queue class using list methods. [5]

\* \* \*



Total No. of Questions : 9]

SEAT No. :

**P1517**

[Total No. of Pages : 5

[6002]-145

**S.E. (Chem/Petro/Printing/Polymer/Bio-Tech)**

**ENGINEERING MATHEMATICS-III**

**(2019 Pattern) (Semester-III) (207004)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Q.1 is compulsory.*
- 2) *Answer Q2 or Q3, Q4 or Q5, Q6 or Q7, and Q8 or Q9.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** Attempt the following:

a) The Fourier transform  $F(\lambda)$  of  $f(x) = \begin{cases} 1, & x > 0 \\ 0 & x < 0 \end{cases}$  is \_\_\_\_\_ [2]

- |                          |                          |
|--------------------------|--------------------------|
| i) $i\lambda$            | ii) $\frac{1}{i\lambda}$ |
| iii) $\frac{1}{\lambda}$ | iv) $\lambda$            |

b) The first three moments of distribution about mean are 0, 16 and -64, then standard deviation of a distribution is \_\_\_\_\_ [2]

- |         |        |
|---------|--------|
| i) 1    | ii) 12 |
| iii) 16 | iv) 4  |

c) If  $\vec{a} = 2\hat{i} + 2\hat{j} + \hat{k}$  and  $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$  then angle between  $\vec{a}$  &  $\vec{b}$  is \_\_\_\_\_ [2]

- |  |  |
|--|--|
| i) $\cos\left(\frac{2}{\sqrt{6}}\right)$         | ii) $\cos^{-1}\left(\frac{2}{3}\right)$        |
| iii) $\cos^{-1}\left(\frac{2}{3\sqrt{6}}\right)$ | iv) $\cos^{-1}\left(\frac{1}{\sqrt{6}}\right)$ |

**P.T.O.**

d) The general sol<sup>n</sup> of PDE  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 y}{\partial x^2}$  is \_\_\_\_\_ [2]

i)  $u(x, t) = (c_1 \cos mx + c_2 \sin mx)e^{-c^2 m^2 t}$

ii)  $u(x, t) = (c_1 \cos t + c_2 \sin t)e^{-c^2 m^2 x}$

iii)  $u(x, y) = (c_1 \cos mx + c_2 \sin mx)e^{-c^2 m^2 y}$

iv)  $u(x, y) = (c_1 \cos y + c_2 \sin y)e^{c^2 x}$

e) The inverse Fourier sine transform  $f(x)$  of  $F_s(\lambda)$  is given by \_\_\_\_\_ [1]

i)  $\frac{2}{\pi} \int_0^\theta F_s(\lambda) \sin \lambda x d\lambda$

ii)  $\frac{2}{\pi} \int_0^\theta F_s(\lambda) \cos \lambda x d\lambda$

iii)  $\frac{2}{\pi} \int_0^\theta F_s(\lambda) \cot \lambda x d\lambda$

iv)  $\frac{2}{\pi} \int_0^\theta F_s(\lambda) \tan \lambda x d\lambda$

f) The coefficient of skewness  $\beta_1$  of distribution is \_\_\_\_\_ [1]

i)  $\frac{\mu_3}{\mu_2}$

ii)  $\frac{\mu_3^2}{\mu_2^3}$

iii)  $\frac{\mu_2}{\mu_3}$

iv)  $\frac{\mu_4}{\mu_2}$

Q2) a) Find the Fourier cosine integral representation for the function. [5]

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

b) Using Fourier integral representation show that [5]

$$\int_0^\infty \frac{\lambda \sin \lambda x}{\lambda^4 + 4} d\lambda = \frac{\pi}{2} e^{-x} \cos x, \text{ where } x > 0.$$

c) Solve the following integral equations. [5]

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

OR

**Q3) a)** Find the Fourier integral representation of the function  $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$

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

b) By considering fourier sine & cosine integrals of  $e^{-mx}$  ( $m > 0$ ), prove that

$$\int_0^{\infty} \frac{\lambda \sin \lambda x}{\lambda^2 + m^2} d\lambda = \frac{\pi}{2} e^{-mx}, m > 0, x > 0$$
 [5]

c) Solve the following integral equations. [5]

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

**Q4) a)** The first four moments of a distribution about value 5 are 2,20,40 and 50. From given information find first four central moments. Also find coefficient of skewness and kurtosis. [5]

b) Find coefficient of correlation from given data  
 $n=25, \Sigma x=75, \Sigma y = 100, \Sigma x^2=250, \Sigma y^2=500, \Sigma xy=325$  [5]

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

OR

**Q5) a)** Given the following information;

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

Coefficient of correlation between  $x$  &  $y$  is 0.9 find the linear regression estimate of  $x$ , given  $y=10$ . [5]

- b) Find probability that almost 5 defective fuses will be found in a box of 200 fuses if 2% of such fuses are defective? [5]
- c) In a sample of 1000 cases a mean of certain test is 14 and standard deviation is 2.5. Assuming that the distribution is normal find [5]
- i) How many students score between 12 and 15?
- ii) How many score above 18?

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

- Q6)** a) Find the angle between tangents to the curve  $x=t^2+1$ ,  $y=t^2-1$ ,  $z=t$  at the  $t=1$ ,  $t=2$ . [5]
- b) Find the function  $f(r)$  so that  $f(r)\vec{r}$  is solenoidal [5]
- c) Find the work done in moving a particle once round the circle  $x^2+y^2=9$  in  $xy$  plane. If the field of force is

$$\vec{F} = (2x - y + z)\vec{i} + (x + y - z^2)\vec{j} + (3x - 2y + 4z)\vec{k}. \quad [5]$$

OR

- Q7)** a) Find the directional derivative of  $\phi = xy^2 + yz^3$  at  $(2, -1, 1)$  in the direction of normal to the surface  $x \log z - y^2 + 4 = 0$  at  $(-1, 2, 1)$ . [5]
- b) Solve any one : [5]

i) Show that  $\nabla^2 \left[ \nabla \cdot \left( \frac{\vec{r}}{r^2} \right) \right] = \frac{2}{r^4}$

ii) if  $\rho \vec{E} = \nabla \phi$  prove that  $\vec{E} \cdot \text{curl } \vec{E} = 0$

- c) Evaluate  $\oint_C \vec{F} \cdot d\vec{r}$  by stoke's theorem. where  $\vec{F} = y^2\vec{i} + x^2\vec{j} - (x+z)\vec{k}$  and C is boundary of the triangle with vertices at  $(0,0,0)$ ,  $(1,0,0)$ ,  $(1,1,0)$  [5]

**Q8) a)** Solve  $\frac{\partial u}{\partial t} = k^2 \frac{\partial^2 u}{\partial x^2}$  if [7]

- i)  $u$  is finite  $\forall t$
- ii)  $u(0, t) = 0,$
- iii)  $u(\pi, t) = 0$
- iv)  $u(x, 0) = 2, 0 \leq x \leq \pi$  when  $t = 0$

b) A string is stretched and fastened to two points  $L$  apart. Motion is started by displacing string in form  $u = 4 \sin \frac{2\pi x}{L}$  from which it is released at time  $t = 0$ . Find displacement  $u(x, t)$  from one end. [8]

OR

**Q9) a)** Solve the boundary value problem  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  subject the conditions. [7]

- i)  $u(0, t) = 0$
- ii)  $u(1, t) = 0$
- iii)  $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$
- iv)  $u(x, 0) = x, 0 < x < 1$

b) Solve the equation  $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$  with conditions.

- i)  $v = 0, y \rightarrow 0. \forall x$
- ii)  $v = 0, \text{ for } x = 0. \forall y$
- iii)  $v = 0, x = 1 \forall y$
- iv)  $v = x(1 - x), \text{ for } y = 0 \text{ and } 0 < x < 1$



Total No. of Questions : 8]

SEAT No. :

**P1518**

**[6002]-146**

[Total No. of Pages : 2

**S.E. (Chemical Engineering)  
INDUSTRIAL CHEMISTRY - I  
(2019 Pattern) (Semester - III) (209341)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain principle, technique and applications of HPLC. [6]  
b) Give the instrumentation in single beam UV-Visible spectrophotometer. [6]  
c) Give principle and instrumentation of flame photometry. [6]

OR

- Q2)** a) Explain principle, technique and applications of coloum chromatography. [6]  
b) State Lambert and Beer laws and derive the combined law equation. [6]  
c) What is gas chromatography? Give the operation of a gas chromatograph. [6]
- Q3)** a) Explain the terms  
i) Vapour pressure  
ii) Molal elevation constant  
iii) Vant Hoff factor (i) [6]  
b) Derive the thermodynamic equation for Depreession in frizzing point of solution. [6]  
c) The vapour pressure of aqueous solution of glucose at 373 k is 750 mmHg. Calculate molality of solution. ( $P^{\circ} = 760$  mmHg) [5]

OR

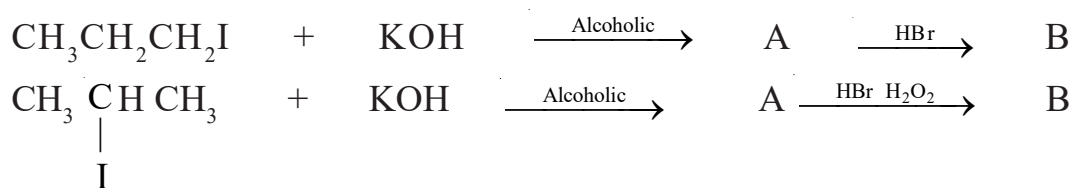
*P.T.O.*

- Q4)** a) State and explain Henry's law and give its applications. [6]  
 b) Explain Vant Hoff Boyle's law and Vant Hoff Charles law and combine form. [6]  
 c) A solution was prepared by dissolving certain amount of compound in 31.8g of  $\text{CCl}_4$  has a boiling point of 0.392 K higher than that of pure  $\text{CCl}_4$ . If the molar mass of compound is 128 g/mol, calculate the mass of the solute dissolved.  
 (Given  $K_b$  for  $\text{CCl}_4 = 5.02 \text{ K kg/mol}$ ) [5]

- Q5)** a) Explain the factors affecting rate of E1 and E2 reactions. [6]  
 b) Give the sulphonating agents and mechanism involve in sulfonation of benzene. [6]  
 c) Write a short note on Claisen rearrangement. [6]

OR

- Q6)** a) Nitrobenzene undergoes electrophilic substitution at meta only. While aminobenzene undergoes electrophilic substitution at ortho and para. [6]  
 b) Identify the compounds A and B in the following reactions. [6]



- c) Write a note on Beckman's rearrangement. [6]
- Q7)** a) How is pyridine synthesized? Explain Chichibabin reaction of pyridine. [6]  
 b) Discuss the methods of synthesis of furan and pyrrole. [6]  
 c) Give the steps involved in the preparation of Methyl Orange. [5]

OR

- Q8)** a) Describe the classification of dyes on the basis of chemical structure. [6]  
 b) Give the steps involved in the preparation of Crystal violet. [6]  
 c) Explain the following.  
 i) Pyridine is more basic than pyrrole.  
 ii) Phenolphthalein shows pink colour in basic medium. [5]



Total No. of Questions : 8]

SEAT No. :

**P1519**

[Total No. of Pages : 2

[6002]-147

**S.E. (Chemical)**

**FLUID MECHANICS**

**(2019 Pattern) (Semester - III) (209342)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat 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) Derive Euler's equation of motion. [6]  
b) Define Bernoulli's equation with assumptions. [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 horizontal venturimeter with inlet and throat diameter 30cm and 15cm resp is used to measure the flow rate of water. The reading of differential monometer Connected to the inlet and throat is 20 cm of mercury determine the rate of flow Take Cd=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 plates at a distance of 1.6mm apart. Determine. [6]  
i) Maximum velocity.  
ii) The pressure per unit length.  
iii) The shear stress at the wall of the plate if the average velocity is 0.2 m/s. The velocity of water at 15°C is given as 0.001 poise.

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 concept of boundary layer? [5]  
b) Explain the term dimensional homogeneous equation? With suitable example. [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 ‘ $\rho$ ’ and dynamic viscosity ‘ $\mu$ ’. [6]

OR

- Q6)** a) With suitable example, describe in detail the Rayleigh’s Method of dimensional analysis? [5]  
b) Explain Buckingham’s  $\pi$ -theorem in detail. [6]  
c) Efficiency ‘ $\eta$ ’ of a fan depends on density ‘ $\rho$ ’, dynamic viscosity ‘ $\mu$ ’ of the fluid, angular velocity ‘ $\omega$ ’ diameter ‘D’ of rotor and the discharge ‘Q’ Express ‘ $\eta$ ’ in term of dimensionless parameter. [6]

- Q7)** a) Explain value and its type with application? [5]  
b) Differentiate between particulate fluidization and aggregative fluidization. [6]  
c) What is fluidization? Write its importance in chemical process industries. [6]

OR

- Q8)** a) Explain fluidization with its type and application? [5]  
b) Explain operating characteristic of centrifugal pump? [6]  
c) Explain phenomenon of cavitation’s in centrifugal pumps. How it can be prevented? [6]



Total No. of Questions : 8]

SEAT No. :

P-2754

[Total No. of Pages : 2

**[6002]-148**  
**S.E. (Chemical)**  
**ENGINEERING MATERIALS**  
**(2019 Pattern) (Semester - III) (209343)**

*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) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 3) Assume suitable data, if necessary.*
- 4) Neat diagrams must be drawn wherever 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 and write down importance of polymers in various industries. **[10]**

b) Write note on High and low temperature materials with example. **[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 Nanotubes in detail and write down its applications in detail. **[9]**

b) Explain Top-down and Bottom-up approaches method for synthesis of nanomaterials. **[9]**

OR

*P.T.O.*

- Q6) a)** Explain 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 Seanning Transmission Microscope (SEM). [18]

OR

- Q8)** Explain principle and working of Transmission Electron Microscope (TEM). [18]



Total No. of Questions : 08]

SEAT No. :

P-1520

[Total No. of Pages : 4

[6002]-149

S.E. (Chemical)

PROCESS CALCULATIONS

(2019 Pattern) (Semester - III) (209344)

Time : 2½ Hours]

[Max. Marks : 70

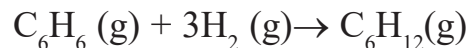
Instructions to the candidates :

- 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)** A coke is known to contain 90% carbon and 10% non-combustible ash (by weight): (a) find the moles of oxygen theoretically required to burn 100 kg of coke completely? (b) If 50 percent excess air is supplied, calculate the analysis of Gases at the end of combustion. [8]
- b) Ethylene Oxide is produce from oxidation of ethylene. 100 kmol of ethylene feed to reactor. The product stream contains 80 kmol ethylene oxide and 10 kmol of CO<sub>2</sub>. Calculate percentage conversion of ethylene and percentage yield of ethylene oxide. [8]

OR

- Q2) a)** Gaseous benzene reacts with hydrogen in the presence of Ni catalyst as per the reaction:



- 30% excess hydrogen is used above that required by the above reaction. Conversion is 50% and yield is 90%. Calculate the requirement of the benzene and hydrogen gas for 100 moles of cyclohexane produced. [8]
- b) A gas analyzing CO<sub>2</sub> =5.5 %, CO=25 %, H<sub>2</sub> = 14 %, CH<sub>4</sub>= 0.5 % and N<sub>2</sub> =55 % (by volume) is burnt in furnace with air which is 10 % excess over that required to burn CO, H<sub>2</sub>, CH<sub>4</sub> completely. Give the analysis of the product gas mixture, assuming all reactions proceed to completion.[8]

P.T.O.

- Q3) a)** A stream of carbon dioxide flowing at a rate of 100 kmol/min is heated from 298 K to 383 K. Calculate the heat that must be transferred using  $C_p$  data: [10]

$$C_p^0 = a + bT + cT^2 + dT^3, \text{kJ/kmol.K}$$

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
CO <sub>2</sub>	21.3655	64.2841	-41.0506	9.7999

- b)** Calculate the heat of formation of ethane gas at 298.15 K from its elements using Hess's law: [8]

Data:

$$\text{Heat of formation of CO}_2 \text{ (g)} = -393.51 \text{ kJ/mol}$$

$$\text{Heat of formation of H}_2\text{O (l)} = -285.83 \text{ kJ/mol}$$

$$\text{Heat of combustion of ethane gas at 298.15 K} = -1560.69 \text{ kJ/mol}$$

OR

- Q4) a)** A stream flowing at a rate of 15 kmol/hr. Containing 25 % N<sub>2</sub> and 75% H<sub>2</sub> by mole is heated from 298 K to 473 K. Calculate the heat that must be transfer using Cp data given as follows. [10]

Gas	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
N <sub>2</sub>	29.5909	-5.41	13.1829	-4.968
H <sub>2</sub>	28.6105	1.0194	-0.1476	0.769

- b)** Calculate the heat of reaction at 298.15 K of the following reaction: [8]



Data

Component	$\Delta H_c^0$ kJ/mol
C <sub>2</sub> H <sub>6</sub> (g)	-1560.69
C <sub>2</sub> H <sub>4</sub> (g)	-1411.2
H <sub>2</sub> (g)	-285.83

- Q5) a)** Define wet bulb temperature, dry bulb temperature, humid volume and humid heat. [8]

- b)  $\text{SO}_2$  is absorbed in water using a packed column operated at constant T and P. The gases entering the tower contain 14.8%  $\text{SO}_2$  by volume. Water is distributed from the top of the column at the rate of 16.5 l/s. The volume of the gas handled at 101.325 kPa at 303 K is 1425 m<sup>3</sup>/hr. The gases leaving the tower contain 1%  $\text{SO}_2$  by volume. Find the %  $\text{SO}_2$  in the outlet water (by weight). [10]

OR

- Q6) An absorption tower, packed with Telleratte packings, is used to absorb carbon dioxide in an aqueous monoethanol amine solution (MEA). The volumetric flow rate of incoming dry gas mixture is 1000 m<sup>3</sup>/h at 318 K and 101.3 kPa a. The  $\text{CO}_2$  content of the gas is 10.4 mole%, while the outgoing gas mixture contains 4.5 mole%  $\text{CO}_2$ . A 3.2 M monoethanol amine solution is introduced at the top of the tower at the rate of 0.625 L/s. Dissolved  $\text{CO}_2$  concentration of the entering solution is 0.166 kmol/kmol of MEA. Find the concentration of dissolved  $\text{CO}_2$  in the solution leaving the tower.

Data: Specific volume of the gas at 318 K and 101.3 kPa a,  $V = 26.107 \text{ m}^3/\text{kmol}$ . [18]

- Q7) a) Explain the following: [6]
- Classification of fuels
  - Calorific values of fuels
- b) Fuel gas has the following composition:  $\text{CO} = 27\%$ ,  $\text{CO}_2 = 4\%$ ,  $\text{O}_2 = 0.5\%$  and  $\text{N}_2 = 68.5\%$  by volume. Find the net theoretical oxygen required. find the analysis of flue gas if the fuel gas is burned with 80% excess air than the net requirement. [6]
- c) Define adiabatic flame temperature, HCV and NCV. Is the actual adiabatic flame temperature different than that calculated theoretically? [6]

OR

- Q8) Calculate the gross and net heating values of the natural gas at 298.15 K which has the following molar composition:

$\text{CH}_4 = 74.4\%$ ,  $\text{C}_2\text{H}_6 = 8.4\%$ ,  $\text{C}_3\text{H}_8 = 7.4\%$ ,  $\text{iso-C}_4\text{H}_{10} = 1.7\%$ ,  $\text{n-C}_4\text{H}_{10} = 2.0\%$ ,  $\text{iso-C}_5\text{H}_{12} = 0.5\%$ ,  $\text{n-C}_5\text{H}_{12} = 0.4\%$ ,  $\text{CO}_2 = 0.9\%$  and  $\text{N}_2 = 4.3\%$ .

Data:

Component	GCV kJ/mol	NCV kJ/mol
CH <sub>4</sub>	890.65	802.62
C <sub>2</sub> H <sub>6</sub>	1560.69	1428.64
C <sub>3</sub> H <sub>8</sub>	2219.17	2043.11
iso-C <sub>4</sub> H <sub>10</sub>	2868.20	2648.12
n-C <sub>4</sub> H <sub>10</sub>	2877.40	2657.32
iso-C <sub>5</sub> H <sub>12</sub>	3528.83	3264.73
n-C <sub>5</sub> H <sub>12</sub>	3535.77	3271.67

Specific volume of the natural gas at 298.15 K and 101.3 kPa = 24.465 m<sup>3</sup>/kmol. [18]



Total No. of Questions : 08]

SEAT No. :

P-1521

[Total No. of Pages : 2

[6002]-150

S.E. (Chemical Engineering)

INDUSTRIAL CHEMISTRY - II

(2019 Pattern) (Semester - IV) (209347)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) Explain complexometric titration and how it can be used for determination of hardness of water [6]
- b) Explain theory of indicators and also explain a difference of 2 PH is required for colour change. [6]
- c) 50 mL of 0.50M, barium hydroxide are required to fully titrate a 100 mL solution of sulfuric acid. What is the initial concentration of the acid? [6]

OR

- Q2)** a) What is precipitation titration? Explain it using Mohr's method. [6]
- b) Explain the strong acid strong base titration with the help of titration curve and indicators. [6]
- c) 30 ml of 0.1N HCl is added from burette into 20 ml of 0.11 N NaHCO<sub>3</sub> solutions in flask. Calculate pH of the titration mixture. [6]
- Q3)** a) What is adsorption isotherm? Describe Freundlich adsorption isotherm. [6]
- b) What are zeolites? Give applications of zeolites in chemical industry. [6]
- c) 3g of activated charcoal was added to 50 ml of acetic acid solution (0.06 M) in a flask. After an hour it was filtered and the strength of filtrate was found to be 0.042 M. What amount of acetic acid adsorbed per gram of charcoal. [5]

P.T.O.



- Q4)** a) What is adsorption isotherm? Deduce the Langmuir adsorption isotherm equation. [6]  
b) What are coordination catalyst explain with the help of wackers process.[6]  
c) Explain photolysis of water molecules using coordination catalysis. [5]

- Q5)** a) What is conformational isomerism? Give various conformation of propane. [6]  
b) Give brief description of optical isomerism. [6]  
c) Explain the terms enantiomers and diastereomers giving examples. [6]

OR

- Q6)** a) Explain various types of conformation in ethane molecule using P.E. diagram. [6]  
b) Explain geometrical isomerism in compound with one double bond. [6]  
c) Assign R and S conformation in 2- Chloro butane and lactic acid. [6]

- Q7)** a) What are heat capacities at constant volume and constant pressure? What is the relationship between them? [6]  
b) Explain the different conditions for spontaneity by using Gibbs free energy. [6]  
c) Calculate work done when 2 moles of an ideal gas expand reversibly and isothermally from a volume of 0.5 L to a volume of 2 L at 298°K and normal pressure. [5]

OR

- Q8)** a) State and explain Kirchoff's law and give its applications. [6]  
b) Derive the relation between heat of reaction at constant pressure and at constant volume mentioned the three case of it. [6]  
c) Calculate the heat of combustion of ethylene (gas) to form CO<sub>2</sub> (gas) and H<sub>2</sub>O (gas) at 298K and 1 atmospheric pressure. The heats of formation of CO<sub>2</sub>, H<sub>2</sub>O and C<sub>2</sub>H<sub>4</sub> are -393.7, -241.8,+52.3 kJ per mole respectively. [5]



Total No. of Questions : 8]

SEAT No. :

P-1522

[Total No. of Pages : 3

**[6002]-151**  
**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 sketches must be drawn wherever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** What are the different laws of Radiation? Explain Stefan Boltzmann's law. **[10]**

- b) A thermos flask with evacuated space to reduce the heat losses having surfaces facing each other of emissivity 0.02. If contents of the flask are at 380 K & the ambient temperature is 298 K. Compute the heat loss from the flask. If same effect is to be achieved by using insulating material of conductivity 0.04 w/m K. What would be the thickness required? **[8]**

OR

**Q2) a)** Explain : **[10]**

- i) Radiation Shape Factor
  - ii) Specular and Diffuse Reflection
  - iii) Black body
  - iv) Radiation Shield
- b) Two large parallel plates with emissivities 0.2 & 0.6 are maintained at 1000 K & 500 K 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)** Draw and describe Pool Boiling Curve. **[10]**

- b) Define Condensation? Differentiate filmwise and dropwise condensation. **[7]**

OR

**P.T.O.**

- Q4) a)** Define the terms in boiling phenomena : [7]
- i) Saturated Pool Boiling
  - ii) Subcooled boiling
  - iii) Peak heat flux
- b) Vertical plate of 30 cm × 30 cm is exposed to steam at atmospheric pressure. The plate is at 371K. Calculate the mean heat transfer coefficient rate of heat transfer and mass of steam condensed per hour. [10]  
 Data : Properties of condensate at mean film temperature are  
 Density = 960 kg/m<sup>3</sup> Dynamic Viscosity =  $2.82 \times 10^{-4}$  N s/m<sup>2</sup>, Thermal conductivity = 0.68 W/m.K, Latent heat of condensation = 2255kJ/kg. Saturation temperature of steam = 373K.
- Q5) a)** What is heat exchanger? Explain detail classification of Heat Exchanger? [10]
- b) It is required to cool 250 kg/hr of hot liquid with inlet temperature of 393°K using parallel flow arrangement 1000 kg/hr of cooling water is available for cooling purpose at a temperature of 283°K. Taking overall heat transfer coefficient of 1160 W/m<sup>2</sup>K and heat transfer surface area of 0.25 m<sup>2</sup>, calculate the outlet temperature of liquid and water and the effectiveness of heat exchanger. [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 1m<sup>2</sup> area of heat transfer.  
 Data : Specific heats of oil and water are 2000J/kg.K and 4187 J/kg.K Overall Heat transfer coefficient is 1075W/m<sup>2</sup>K. [8]
- Q7) a)** What is evaporation? Explain Calendria type evaporator with neat sketch. [7]
- b) A single effect evaporator is used to concentrate 20000kg/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 : 4.0 kJ/(kg.K)  
 Latent heat of condensation of steam at 399 K = 2185kJ/kg  
 Latent heat of vaporization of water at 373 K = 2257kJ/kg

OR

- Q8)** a) Draw and explain the Backward feed multiple effect evaporator. [10]
- b) An aqueous sodium chloride solution (10 wt %) is fed into a single effect evaporator at a rate of 10000 Kg/hr. It is concentrated to a 20 wt % sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 Kg/hr. Calculate Capacity (Kg/hr) & Economy of the evaporator. [7]



Total No. of Questions : 8]

SEAT No. :

P-1523

[Total No. of Pages : 4

[6002]-152

S.E. (Chemical Engineering)

PRINCIPLES OF DESIGN

(2019 Pattern) (Semester - IV) (209349)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt Q.No. 1 OR Q.No. 2; Q.No. 3 OR Q.No. 4; Q.No. 5 OR Q.No. 6; Q.No. 7 OR Q.No. 8.
- 2) Figures to the right indicate full marks.
- 3) Draw neat figures wherever necessary.
- 4) Use of scientific calculators is allowed.
- 5) Assume suitable data wherever necessary.

Q1) a) Prove that,

[8]

- i) For shaft subject to the twisting moment only :

$$T = \frac{\pi}{16} * f_s * d_s^3$$

- ii) For shaft subject to the bending moment only.

$$M = \frac{\pi}{32} * f_b * d_s^3$$

Were,

T- Twisting moment

M-Bending moment.

$f_s$  -Permissible shear stress,

$f_b$  -Permissible bending stress,

$d_s$  -Diameter of the shaft.

- b) Calculate the diameter of the shaft used in agitation system. Torque acting over the shaft is 120000 kg-cm while bending moment acting over the shaft is 35500 kg-cm. factor of safety = 6, ultimate tensile strength of material of shaft = 7000kg/cm<sup>2</sup>. Ultimate shear stress is 75% of UTS. [10]

P.T.O.

OR

**Q2) a)** Prove that the length of key, by considering the shearing strength of

$$\text{key, } L = \frac{\pi}{8} * \frac{f_{ss}}{f_{sk}} * \frac{d_s^2}{w}. \quad [6]$$

Were,

L - Length of key,

$f_{ss}$  - Permissible shear stress for shaft material,

$f_{sk}$  - Permissible shear stress for key material,

$d_s$  - Diameter of shaft.

w - Width of key.

- b) The 45 mm diameter of shaft is made of steel with the yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use the maximum shear stress theory and assume the FOS of 02. [12]

**Q3) a)** Find the efficiency of following riveted joints : [10]

- i) Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm.
- ii) Double riveted joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm.

Assume :

Permissible tensile stress in plate is 120 MPa.

Permissible shearing stress in rivets is 90 MPa,

Permissible crushing stress in rivets is 180 MPa.

- b) Explain different types of riveted joints. Define tearing, shearing & crushing strength of the riveted joints. Also define efficiency of joint. [7]

OR

- Q4) a)** Derive the equation, the condition for the maximum power transmission. [7]
- $$T = 3.T_c$$
- Where,
- T - Maximum-tension,
- T<sub>c</sub> - Centrifugal tension.
- b) The leather belt 9 mm \* 250 mm is used to drive a cast iron pulley 900 mm in diameter at 336 RPM. If the active arc on the smaller pulley is 120° and the stress in tight side is 2 MPa. Find the power capacity of belt (power transmitted through belt). The density of leather belt may be taken as 980 kg/m<sup>3</sup>, and coefficient of friction of leather on cast iron is 0.35. [10]
- Q5) a)** Define pressure vessels and explain design of pressure vessels subjected to external pressure. [6]
- b) A cylindrical pressure vessel 1.8 m in diameter and 5 m in height is subjected to an internal pressure of 8kg/cm<sup>2</sup>. The corrosion allowance is 2 mm.
- If the vessel is fabricated as :
- Class B vessel with J = 0.85
- Class C vessel with J = 0.5 and 0.7.
- What will be the minimum thickness of vessel?
- If a strip of suitable size is welded all along the longitudinal joint, (Joint efficient = J = 1.0). What will be the thickness of the vessel and how much percentage saving in the material can be achieved? [12]
- OR
- Q6) a)** Calculate the thickness of a torispherical heads (100-6) and (80-10) elliptical head (2:1) for a pressure vessel having 1.0 m diameter and having design pressure of 3.5 kg/cm<sup>2</sup>. Welded joint is fully tested so welded joint can be considered as 100%. The permissible stress for the material of contraction is 1250 kg/cm<sup>2</sup>. Also calculate the percentage reduction in thickness with reference to the thickness of the torispherical head (100-6). [12]
- b) Write a short note on purging of vessels. [6]

- Q7) a)** Proof that for cylindrical pressure vessel with flat head at the top and at the bottom, [7]

$$L = D \left[ 1 + \frac{3DP}{4CfJ} \right]$$
$$V = \frac{\pi}{4} D^2 L = \frac{\pi}{4} D^3 \left[ 1 + \frac{3DP}{4CfJ} \right]$$

Were,

L - Optimum length of pressure vessel.

V - Optimum volume of pressure vessel.

C - Corrosion allowance.

P - Pressure in the pressure vessel.

f - Allowable stress of material

J - Welded joint efficiency.

D - is diameter of pressure vessel.

- b) A pressure vessel is required to have a capacity of 20 m<sup>3</sup>. The vessel has an operating pressure of 6 kg/cm<sup>2</sup>. The material used for fabrication have an allowable stress of 1090 kg/cm<sup>2</sup>. Welded joint efficiency is 85%. The corrosion allowance is 2 mm. Estimate the optimum diameter and optimum length of pressure vessel. [10]

OR

- Q8) a)** Determine the optimum proportions of a cylindrical vessel with flat top and 60° conical bottoms. Due to space limitation, the diameter of the vessel should not be greater than 2.5m. The cost per unit area of the flat top and conical bottom is twice the cost of the shell capacity. [12]

- b) Differentiate between thick walled & thine walled pressure vessel. [5]





Total No. of Questions : 8]

SEAT No. :

**P1524**

[Total No. of Pages : 2

[6002]-153

**S.E. (Chemical Engineering)  
CHEMICAL TECHNOLOGY - I  
(2019 Pattern) (Semester - IV) (209350)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, and Q.No.7 or Q.No.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of cell phone/Mobile phone is prohibited in the examination hall.*

- CO  
(Course  
outcomes)
- Q1)** a) Explain necessity of nitrogenous fertilizers produced from Ammonia. [5] CO3
- b) Draw and explain process flow diagram (PFD) for manufacturing of Nitric acid by ammonia oxidation process. [10] CO2, CO5
- c) Explain in brief Autoclave variables as one of major engineering problems of urea production process. [3] CO3
- OR
- Q2)** a) Draw and explain in brief synthetic ammonia process with its process flow diagram (PFD). [8] CO2, CO5
- b) Explain in brief a manufacturing process of urea from ammonium carbamate. Draw its process flow diagram (PFD). [10] CO2, CO5
- Q3)** a) State classification of cleansing compounds. [5] CO1
- b) Explain in brief sulfation of fatty alcohols and sulfonates. [8] CO2, CO3
- c) State various methods of soap production & raw materials used. [4] CO2, CO4
- OR
- Q4)** a) Draw process flow diagram (PFD) of continuous process for fatty acids, soap and glycerine. [8] CO5
- b) Explain in brief reactions involved in manufacturing of detergent by sodium reduction of coconut oil. [5] CO2
- c) Explain Alkyl - Aryl sulfonates. [4] CO2

*P.T.O.*

- Q5)** a) Explain in brief condensation polymerization and Addition polymerization. [10] CO2  
b) State types of thermosetting resins. [4] CO4  
c) State various materials used in reinforcement of plastics. [4] CO4

OR

- Q6)** a) Describe in brief general polymerization process. [10] CO2  
b) Draw and explain in brief phenol from cumene production with a process flow diagram (PFD). [8] CO2, CO5

- Q7)** a) Explain in brief mechanisms of pyrolysis and cracking. [8] CO1  
b) Draw a neat diagram of fluidized bed type catalytic cracking process. [5] CO5  
c) State reactions take place in catalytic reforming process. [4] CO2

OR

- Q8)** a) State methods involved in production of crude petroleum. [4] CO2  
b) Describe in brief Butadiene - styrene copolymer. [5] CO2, CO6  
c) Describe in brief elastomer polymerization. [4] CO6  
d) Explain in brief rubbers based on silicon. [4] CO6



Total No. of Questions : 8]

SEAT No. :

**P1525**

[Total No. of Pages : 2

[6002]-154

**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 and explanatory note on [12]**

- i) Fabric Filter
- ii) Magnetic separator

b) Write notes on Terminal Settling, hindered settling and drag force on spherical particles. [6]

OR

**Q2) Derive the equation for minimum fluidization velocity and describe the equation for case of very small particles. [18]**

**Q3) Explain and derive the necessary equations for [17]**

- a) Flow number
- b) Power number

OR

**Q4) a) What are the various types of mixers used for paste and plastic materials? Explain any two in brief. [8]**

b) Write notes on [9]

- i) Flow pattern in baffled and un-baffled vessels
- ii) Ribbon Blender
- iii) Sigma Mixer

**P.T.O.**

- Q5) a)** Derive the rate filtration at **[10]**  
i) Constant rate  
ii) Constant pressure difference  
b) What is filter medium? State the various requirements of filter medium.**[8]**

OR

- Q6) a)** Explain with a neat sketch Sand filter. **[9]**  
b) Write an explanatory note on rotary drum filter. **[9]**

- Q7) a)** Explain with a neat sketch screw conveyor. **[9]**  
b) Write an explanatory note on Bucket Elevators. **[8]**

OR

- Q8) a)** Write an explanatory note on pneumatic conveyors. **[8]**  
b) Explain with a neat sketch following parts of belt conveyors. **[9]**  
i) Belts  
ii) Belt idlers  
iii) Belt arrangements



Total No. of Questions : 8]

SEAT No. :

**P1526**

[Total No. of Pages : 4

[6002]-155

**S.E. (Computer/A.I.& D.S./C.S & D.E.)**

**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 whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.

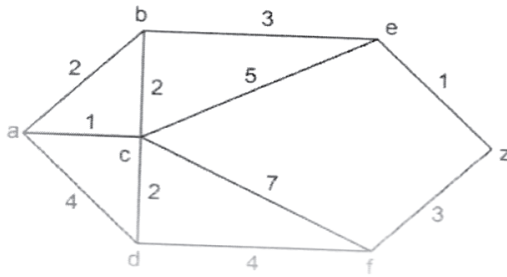
- Q1)** a) From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done? [6]
- b) Suppose repetitions are permitted: [6]
- i) How many ways three-digit no. can be formed from six digits 2,3,4,5,7 and 9?
  - ii) How many are multiple of 10?
  - iii) How many are even?
- c) What is the coefficient of  $x^{09}$  in the expansion of  $(2-x)^{19}$ ? [6]

OR

- Q2)** a) Five pencils and 5 pens are to be arranged in a row. In how many ways they can be arranged if [6]
- i) All pencils must be arranged together
  - ii) No two pencils should be kept together and
  - iii) One pen and one pencil must be arranged together?
- b) Find the number of permutations that can be made out of the letters [6]
- i) Mississippi
  - ii) Assassination
- c) How many automobile license plates can be made if each plate contains two different letters followed by three different digits. Solve the problem if the first digit can not be zero. [6]

*P.T.O.*

- Q3) a)** Find the shortest path between a - z for the given graph using Dijkstra's algorithm [6]



- b) Explain the terms adjacency matrix and incidence matrix. [5]
- c) Define the following terms with suitable example. [6]
- i) Factor of graph
  - ii) Weighted Graph
  - iii) Bipartite graph

OR

- Q4) a)** Draw all isomorphic graphs on vertices 2 and 3, also draw all non-isomorphic graphs on 2,3 and 4 vertices. [6]
- b) Explain Edge connectivity and Vertex Connectivity with suitable example. [5]
- c) Is it possible to construct a graph with 12 nodes such that 2 of the nodes have degree 3 and the remaining have degree 4. [6]

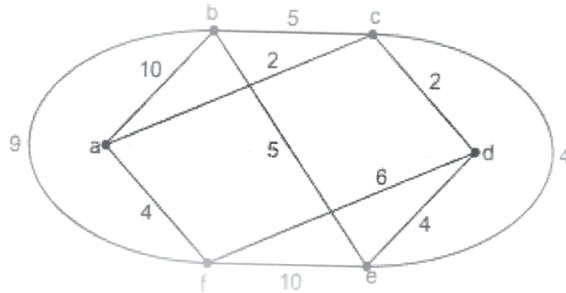
- Q5) a)** Construct a binary tree from given inorder and preorder traversals:

Inorder : b d f h k m p t v m

Preorder : b f d k h v w t m

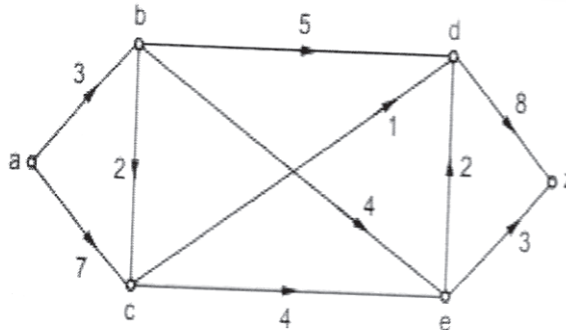
- b) Define following terms [6]
- i) Forest
  - ii) Fundamental cutsets
  - iii) Game tree

- c) Use Kruskal's algorithm to find the minimum spanning tree for the connected weighted graph G as shown in fig. below [6]



OR

- Q6) a) Find maximum flow in the transport network using labeling procedure. Determine the corresponding min-cut. [6]



- b) 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]
- c) What is Minimum Spanning tree? Explain briefly steps involved in finding MST in Prim's Algorithm? [6]

- Q7) a)** Define with examples: **[10]**
- i) Groupoid
  - ii) Semigroup
  - iii) Monoid
  - iv) Abelian group.
  - v) Subgroup
- b) Let  $(A, x)$  be monoid such that for every  $x \in A$ ,  $x * x = e$  where  $e$  is the identity element. Show that  $(A, *)$  is an abelian group. **[7]**

OR

- Q8) a)** Define with examples: **[10]**
- i) Properties of binary operation
  - ii) Ring with unity
  - iii) Fields.
  - iv) Integral Domain
- b) Find the number of codes generated by the given check matrix  $H$ . Also find all code words. **[7]**

1	1	0	1	0	0
0	1	1	0	1	0
1	0	1	0	0	1





Total No. of Questions : 8]

SEAT No. :

**P1527**

**[6002]-156**

[Total No. of Pages : 2

**S.E. ( Computer / AI & DS)  
FUNDAMENTALS OF DATA STRUCTURE  
(2019 Pattern) (Semester - III) (210242)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Make suitable assumption whenever necessary.*

**Q1) a)** Write a pseudo code for binary search apply you algorithm on the following no.s stored in an array to search no:23 & 100. **[9]**  
9,17,23,40,45,52,58,80,85,95,100

b) Explain the selection sort with algorithm sort the following no.s using selection sort & show the content of array after every pass. **[9]**  
27, 76, 17, 9, 45, 58, 90, 79, 100.

OR

**Q2) a)** Explain quick sort algorithm with suitable example. What is time complexity of quick sort algorithm. **[9]**

b) Write a short note on sentinel search & Index sequential search with suitable example. **[9]**

**Q3) a)** Write a pseudo code to insert new node in to singly link list. **[9]**

b) Explain the representation of polynomial using GLL. **[9]**

OR

**Q4) a)** What is doubly linkedlist. Explain the process of deletion of element from doubly linked list with example. **[9]**

b) What is dynamic data structure. Explain with circular linked list with it's basic operation. **[9]**

**Q5) a)** Write a pseudo code for basic operation of stack. **[8]**

**P.T.O.**

- b) What are the variants of recursion. Explain with example. [9]

OR

- Q6)** a) Write algorithm for postfix expression evaluation. Explain with suitable example. [8]

- b) Explain the linked implementation of stack with suitable example. [9]

- Q7)** a) Write pseudo code to implement circular queue using array. Explain its basic operation. [9]

- b) Explain array implementation of priority queue with all basic operation. [8]

OR

- Q8)** a) Explain linked implementation of queue with suitable example. [9]

- b) Write pseudo code for insertion operation of input restricted & output restricted double ended queue. [8]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1528**

[6002]-157

[Total No. of Pages : 2

**S.E. (Computer Engineering) (Artificial Intelligence & Data Science)  
(Computer Science & Design Engineering)  
OBJECT ORIENTED PROGRAMMING (OOP)  
(2019 Pattern) (Semester - III) (Theory) (210243)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Endsem exam based on 3, 4, 5, 6.*
- 2) *Draw Neat and clean Diagram.*
- 3) *Assume suitable data if necessary.*

- Q1)** a) What is runtime polymorphism? How it is achieved in C++. Explain it along with example. [5]  
b) Explain virtual base class and virtual function with example. [6]  
c) Explain need of operator overloading. Write C++ program to demonstrate use of unary operator overloading. [6]

OR

- Q2)** a) Explain polymorphism and types of polymorphism in C++. [5]  
b) Explain what is type casting, Explain Implicit and explicit type of conversion with example. [6]  
c) Write a program to overload insertion (<<) and extraction (>>) operator in C++. [6]

- Q3)** a) What are various functions which are used to manipulate file pointers? Explain using example. [7]  
b) Explain command line arguments in C++? Write program to explain the same. [7]  
c) What are different file opening mode? [4]

OR

- Q4)** a) Explain formatted and unformatted input and output functions used in C++ with example. [7]  
b) What are stream classes and their use? Provide the hierarchy of stream classes in C++. [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]

*P.T.O.*

- Q5)** a) What is the power of templates in C++? Explain along with one example. [5]  
b) Explain exception handling mechanism in C++? Write a program in C++ to handle “divide by zero” exception. [6]  
c) Write a short note on typename and export keyword in C++. [6]

OR

- Q6)** a) What is mean by user defined exception? Give one example. [5]  
b) Explain class template using multiple parameters. Write a program in C++. [6]  
c) How multiple catching is implemented in exception handling? [6]

- Q7)** a) Explain the concept of the Standard Template Library (STL) in C++. What are its key components? [7]  
b) Differentiate between sequence containers and associative containers in the STL. Provide examples of each. [7]  
c) Discuss the advantages of using container adapters in the STL. Provide examples of container adapters. [4]

OR

- Q8)** a) How can vectors and lists be used as sequence containers in the STL? Explain with a appropriate example. [7]  
b) Explain the concept of iterators in the STL. Differentiate between iterator and pointers. [7]  
c) Describe the process of using the STL algorithms for Quick sort. [4]



Total No. of Questions : 8]

SEAT No. :

**P1529**

[Total No. of Pages : 2

[6002]-158

**S.E. (Computer Engineering) (Artificial Intelligence &  
Data Science) (Computer Science & Design Engg.)**

**COMPUTER GRAPHICS**

**(2019 Pattern) (Semester-III) (210244)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Differentiate between Orthographic Projection and Isometric 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) Consider the square A (1, 0), B(0, 0), C(0, 1), D (1, 1). Rotate the square ABCD by 45° anticlockwise about point A (1,0) **[8]**

OR

**Q2) a)** What are the types of projection and write in brief about each type of projections. **[5]**

b) Derive 3D transformation matrix for rotation about a principal axis. **[5]**

c) A triangle is defined by  $\begin{bmatrix} 2 & 4 & 4 \\ 2 & 2 & 4 \end{bmatrix}$  Find transformed coordinates after the following transformation. **[8]**

i) 90° rotation about the origin.

ii) Reflection about line X=Y

**Q3) a)** What is Backface? Explain Backface Detection and removal. **[6]**

b) Explain and compare point source and diffuse illumination. **[5]**

c) Compare RGB and HSV color model **[6]**

OR

*P.T.O.*

- Q4)** a) Write short note on Painters Algorithm [6]  
b) Explain Halftone shading [5]  
c) Explain the following terms with examples. [6]  
i) Colour gamut  
ii) Specular Reflection  
iii) Diffuse reflection

- Q5)** a) Write a short note on interpolation and approximation. [4]  
b) Explain Blending function for B-spline curve. [7]  
c) What are fractals? Explain Triadic Koch in detail. [7]

OR

- Q6)** a) Explain the Bezier curve. Enlist its properties. [4]  
b) Draw and explain Hilbert's curve with an example [7]  
c) With suitable example write short note on the fractal lines. [7]

- Q7)** a) Explain deletion of segment with suitable example. [7]  
b) What is Morphing and write the applications of Morphing. [3]  
c) Draw block diagram of NVIDIA workstation and explain it in brief. [7]

OR

- Q8)** a) Write a short note on motion specification method based on. [7]  
i) Geometric and kinematics information.  
ii) Animation languages  
b) Write any three important features of NVIDIA gaming platform [3]  
c) Explain renaming of a segment with suitable example. [7]



Total No. of Questions : 8]

SEAT No. :

**P-1530**

[Total No. of Pages : 3

**[6002]-159**

**S.E. (Computer Engineering)**

**DIGITAL ELECTRONICS AND LOGIC DESIGN**

**(2019 Pattern) (Semester - III) (210245)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8,*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data jf necessary.*

- Q1)** a) Distinguish between combinational and sequential switching circuits also write examples of both. **[6]**
- b) Convert Following Flip flops: **[6]**
- i) SR to T
  - ii) JK to D
- c) What is MOD counter ? Design MOD 7 counter using IC 7490. **[6]**

OR

- Q2)** a) Draw and explain 3-bit asynchronous up-counter using JK flip flop. Also draw the necessary timing diagram. **[6]**
- b) What do you mean by excitation table of flip flop? Write the excitation table of **[6]**
- i) S-R flip flop
  - ii) J-K flip flop
- c) With neat diagrams explain the working of the following types of shift registers **[6]**
- i) Serial-in, serial-out
  - ii) Parallel-in, serial-out

**P.T.O.**

- Q3)** a) Draw the state diagram, state table, and ASM chart for a 2-bit binary counter having one enable line E such that E = 1 counting enabled, and E = 0 counting disabled. [6]
- b) Implement following Boolean function using PAL [6]  
 $F1 = \sum m (0,2,4,6,8,12)$   
 $F2 = \sum m (2,3,8,9,12,13)$   
 $F3 = \sum m (1,3,4,6,9,11,12,14,15)$
- c) Draw a block diagram of the PLA device and explain. [5]

OR

- Q4)** a) What is an ASM Chart? Name the elements of an ASM chart and define each of them. [6]
- b) Implement BCD to Excess-3 code converter using PAL. [6]
- c) What is the difference between PAL and PLA. [5]

- Q5)** a) With the help of a neat diagram, explain the working of two-input TTL NAND gate. [6]
- b) Draw and explain the circuit diagram of CMOS inverter. [6]
- c) Define the following terms and mention the standard values for TTL logic Family [6]
- i) Fan-out
  - ii) Power Dissipation
  - iii) Propagation Delay.

OR

- Q6)** a) What is the advantage of open collector output? Justify your answer with suitable circuit. [6]
- b) Compare TTL and CMOS logic family. [6]
- c) What is logic family? Give the classification of logic family and also write important characteristics of CMOS. [6]



- Q7)** a) Draw and explain the basic building of an ideal microprocessor based system with the help of neat diagram. [6]
- b) What is system bus? Draw microprocessor bus structure and explain in brief. [6]
- c) Write a short note on ALU IC 74181. [5]

OR

- Q8)** a) With the help of a block diagram explain the fundamental units of a microprocessor. [6]
- b) Explain the Memory organization of the microprocessor. [6]
- c) What is microprocessor? List different applications of microprocessor.[5]

**x x x**

Total No. of Questions : 9]

SEAT No. :

**P-1531**

[Total No. of Pages : 5

**[6002]-160**

**S.E. (Computer/I.T./A.I & M.L/C.S & D.E.)**

**ENGINEERING MATHEMATICS - III**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Q1 is compulsory.*
- 2) *Attempt Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.*
- 3) *Neat diagram 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 three decimal places.*

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

- a) If the two regression coefficients are  $\frac{-8}{15}$  and  $\frac{-5}{6}$  then the correlation coefficient is [2]

i)  $\frac{-2}{3}$

ii)  $\frac{2}{3}$

iii)  $-\frac{1}{2}$

iv)  $\frac{1}{2}$

- b) A and B are independent events such that  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{1}{3}$  then  $P(A \cup B)$ . [2]

i)  $\frac{3}{5}$

ii)  $\frac{2}{3}$

iii)  $\frac{1}{6}$

iv)  $\frac{1}{3}$

**P.T.O.**

c) Using Gauss elimination method the solution of system of equations  $x + 2y + z = 4$ ,  $-3y + 2z = -3$ ,  $-7y - 2z = -6$  is [2]

i)  $x = -\frac{43}{16}, y = \frac{-9}{8}, z = \frac{15}{16}$       ii)  $x = \frac{47}{20}, y = \frac{9}{10}, z = \frac{-3}{20}$

iii)  $x = \frac{4}{3}, y = \frac{3}{8}, z = \frac{-5}{6}$       iv)  $x = \frac{16}{43}, y = \frac{8}{9}, z = -5$

d) If a curve passing through (0,0), (2,4), (4,8) is given by  $y = y_0 + u \Delta y_0$  then y at  $x = 1$  is given by (Note :  $x = x_0 + uh$ ) [2]

i) 1      ii) 0

iii) -1      iv) 2

e) The range of correlation coefficient 'r' for a bivariate data is [1]

i)  $0 < r < \infty$       ii)  $-\infty < r < \infty$

iii)  $-1 \leq r \leq 1$       iv)  $0 \leq r \leq 1$

f) If  $x_0, x_1$  are two initial approximations to the root of  $f(x) = 0$ , by secant method next approximation  $x_2$  is given by [1]

i)  $x_2 = x_1 - \frac{(x_1 - x_0)}{(f_1 - f_0)} \times f_1$       ii)  $x_2 = \frac{x_0 + x_1}{2}$

iii)  $x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$       iv)  $x_2 = x_1 + \frac{(x_1 + x_0)}{(f_1 + f_0)} \times f_1$

Q2) a) The first four moments of distribution about the value 4 are -1.5, 17, -30 and 108 respectively. Obtain the first four central moments about mean,  $\beta_1$  and  $\beta_2$ . [5]

b) Firt a straight line of the form  $y = a + bx$  using least squares method to the following data. [5]

x	0	1	2	3	4
y	-2	1	4	7	10

c) The two regression lines of a bivariate data are  $3x + 2y = 26$  and  $6x + y = 31$ . Find the mean values of x and y.

Also, determine the correlation coefficient between x and y. [5]

OR

**Q3) a)** Calculate the coefficient of variation for the data given as follows. [5]  
36, 15, 25, 10 and 14.

b) Fit a second degree parabola of the form  $y = a + bx + cx^2$  using least squares method to the following data [5]

$x$	0	1	2	3
$y$	2	1	6	17

c) Find the correlation coefficient between the variables population density ( $x$ ) and death rates ( $y$ ) as given in the following data. [5]

$x$	200	400	500	700	300
$y$	12	18	16	21	10

**Q4) a)** Find the expected value of the sum of the faces obtained when two fair dice are tossed simultaneously. [5]

b) An unbiased coin is tossed five times. Find the probability of observing at least four heads. [5]

c) In a sample of 1,000 cases, the mean score in a certain examination is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find the expected number of students scoring between 12 and 15 (both inclusive). [5]

[Given :  $Z_1 = 0.4, A_1 = 0.1554; Z_2 = 0.8, A_2 = 0.2881$ ]

OR

**Q5) a)** A riddle is given to three students to solve independently. The individual probabilities of the riddle being solved by the three students are 0.3, 0.4 and 0.5 respectively. Find the probability that the riddle gets solved. [5]

b) On an average, there are two printing mistakes on a page of a book. Using Poisson distribution, find the probability that a randomly selected page from the book has at least one printing mistake. [5]

c) In a mouse breeding experiment, a geneticist has obtained 172 brown mice with pink eyes, 60 brown mice with brown eyes, 62 white mice with pink eyes and 26 white mice with brown eyes. Theory predicts that these types of mice should be obtained in the ratios 9 : 3 : 3 : 1. Test the compatibility of the data with theory, using 5% level of significance. [Given  $\chi_{\text{tab}}^2 = 7.815$ ] [5]

- Q6)** a) Find a root of the equation  $x^4 + 2x^3 - x - 1 = 0$ , lying in the interval  $[0, 1]$  using the bisection method at the end of fifth iteration. [5]
- b) Obtain the real root of the equation  $x^3 - 4x - 9 = 0$  by applying Newton-Raphson method at the end of third iteration. [5]
- c) Solve by Gauss - Seidel method, the system of equations : [5]
- $$10x_1 + x_2 + x_3 = 12$$
- $$2x_1 + 10x_2 + x_3 = 13$$
- $$2x_1 + 2x_2 + 10x_3 = 14$$

OR

- Q7)** a) Solve by Gauss elimination method, the system of equations : [5]
- $$2x_1 + x_2 + x_3 = 10$$
- $$3x_1 + 2x_2 + 3x_3 = 18$$
- $$x_1 + 4x_2 + 9x_3 = 16$$
- b) Solve by Jacobi's iteration method, the system of equations : [5]
- $$20x_1 + x_2 - 2x_3 = 17$$
- $$3x_1 + 20x_2 - x_3 = -18$$
- $$2x_1 - 3x_2 + 20x_3 = 25$$
- c) Find a real root of the equation  $x^3 - 2x - 5 = 0$  by the method of false position at the end of fourth iteration. [5]

- Q8)** a) Using Newton's forward interpolation formula, find  $y$  at  $x = 8$  from the data : [5]

$x$	0	5	10	15	20	25
$y$	7	11	14	18	24	32

- b) Evaluate  $\int_1^2 \frac{dx}{x^2}$  using Simpson's  $\frac{1}{3}$  rule, (Take  $h = 0.25$ ) [5]
- c) Use Euler's method to solve  $\frac{dy}{dx} = 1 + xy$ ,  
 $y(0) = 1$ . Tabulate values of  $y$  for  $x = 0$  to  $x = 0.3$  (Take  $h = 0.1$ ) [5]

OR

**Q9) a)** Use Runge-Kutta method of fourth order to solve  $\frac{dy}{dx} = x + y^2$ ,  $y(0) = 1$  at  $x = 0.1$  with  $h = 0.1$ . [5]

b) Use modified Euler's method to find  $y(0.1)$ , given  $\frac{dy}{dx} = 1 + xy$ ,  $y(0) = 1$  and  $h = 0.1$ . (up to two iterations) [5]

c) Using Newton's backward difference formula, find the value of  $\sqrt{155}$  from the data : [5]

$x$	150	152	154	156
$y = \sqrt{x}$	12.247	12.329	12.410	12.490

**x x x**

[6002]-161

S.E. (Computer/AI & DS)

DATA STRUCTURES AND ALGORITHMS

(2019 Pattern) (Semester - IV) (210252)

Time : 2½ Hours]

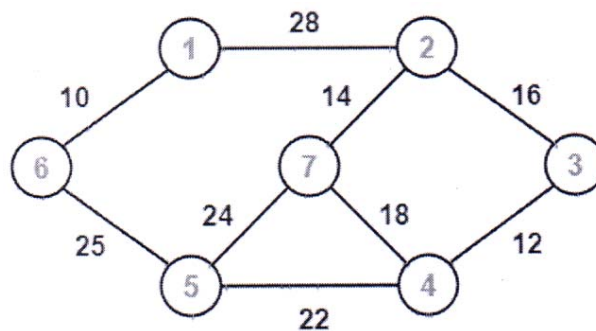
[Max. Marks : 70

Instructions to the candidates:

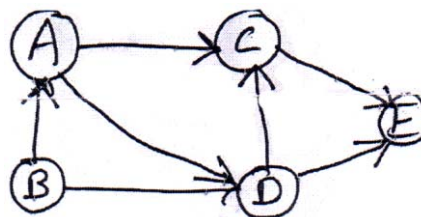
- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Assume suitable data, if necessary.
- 3) Draw neat labelled diagram wherever necessary.
- 4) Figures to the right indicate full marks.

Q1) a) Write an algorithm for depth first traversal of a graph. [6]

b) Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm starting from vertex 6. [6]

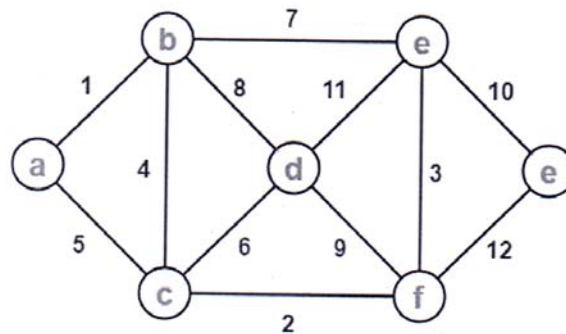


c) What is topological sorting? Find topological sorting of given graph. [6]



OR

- Q2)** a) Write an algorithm for breadth first traversal of a graph. [6]  
 b) Using Prim's Algorithm, find the cost of minimum spanning tree (MST) of the given graph starting from vertex 'a' - [6]



- c) Define the following terms : [6]  
 i) Complete Graph  
 ii) Connected Graph  
 iii) Subgraph

- Q3)** a) Construct an AVL Tree by inserting numbers from 1 to 8. [6]  
 b) Define Red Black tree. List its properties. Give example of it. [6]  
 c) Write functions for RR and RL rotation with respect to AVL tree. [6]

OR

- Q4)** a) Construct an AVL Tree for following data : [6]  
 50, 25, 10, 5, 7, 3, 30, 20, 8, 15  
 b) Explain with example K dimensional tree. [6]  
 c) Explain static and dynamic tree tables with suitable example. [6]

- Q5)** a) Construct a B-Tree of order 3 by inserting numbers from 1 to 10. [9]  
 b) Explain following primary index, Secondary index, Sparse index and Dense index with example. [8]

OR

- Q6)** a) Construct a B Tree of order 5 with the following data : [9]  
 D H Z K B P Q E A S W T C L N Y M  
 b) What is trie tree? Explain insert and search operation on it. [8]



- Q7)** a) Explain multilist files & coral rings. [9]  
b) What is Sequential and index sequential file organization? State its advantages and disadvantages. [8]

OR

- Q8)** a) Explain inverted file & cellular partitions. [9]  
b) Explain direct access file organization. State its advantages and disadvantages. [8]



Total No. of Questions : 8]

SEAT No. :

P-1533

[Total No. of Pages : 2

[6002]-162

S.E. (Computer/A.I.& D.S.)

SOFTWARE ENGINEERING

(2019 Pattern) (Semester - IV) (210253)

*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 any four design concepts with appropriate example. [9]

b) What is design pattern? How patterns can be used in design? [9]

OR

**Q2)** a) Explain the Data-flow architecture and Layered Architecture in detail. [9]

b) Explain the golden rules for User Interface Design. [9]

**Q3)** a) What question needs to be answered in order to develop a project plan according to W<sup>5</sup>HH principle? [9]

b) Explain the project management life cycle. [8]

OR

**Q4)** a) Explain with appropriate example how schedule can be prepare using PERT. [9]

b) List and explain the different metrics in the process and project domain. [8]

**Q5)** a) Describe the software quality dilemma in your own words. [9]

b) What are the objectives of testing? Explain the different types of testing. [9]

*P.T.O.*

OR

- Q6)** a) What is software quality? Write the different quality metrics. [9]  
b) What is test case design? Write the various approaches for test case design. [9]

- Q7)** a) What is SCM? Write short note on SCM Elements. [9]  
b) What is Risk? Explain the reactive and proactive risk strategies with appropriate examples. [8]

OR

- Q8)** a) Explain the repository features with respect to software configuration management. [9]  
b) Write short note on CASE TOOLS for software development. [8]



Total No. of Questions : 8]

SEAT No. :

P-3904

[Total No. of Pages : 2

**[6002]-162A**  
**S.E. (AI & DS/CS)**  
**SOFTWARE ENGINEERING**  
**(2019 Pattern) (Semester - IV) (210253)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

- Q1)** a) Define the importance of Project estimation. Compare lines of code (LOC) and Function Point (FP) based estimation of software. [9]
- b) Define Project Scheduling. What is a task network in project scheduling? Explain with an example. [9]

OR

- Q2)** a) Explain the project planning activities. Define Software scope and feasibility. [9]
- b) Explain COCOMO Model for project estimation with suitable example. [9]

- Q3)** a) Explain the following design concepts [9]
- i) Modularity
  - ii) Refinement
  - iii) Refactoring
- b) Define Cohesion ,Explain any four types of Cohesion. [8]

OR

- Q4)** a) List the different architectural styles. Explain in any two Architectural style. [9]
- b) Explain the interface design steps. [8]

**P.T.O.**

- Q5) a)** Define the different categories of risks? Explain Risk identification? [9]
- b) What are the elements that exist when an effective SCM system is implemented? Discuss each in briefly. [9]

OR

- Q6) a)** Define RMMM plan, Prepare RMMM plan for late delivery of software product to the customer. [9]
- b) Define the different categories of risks? Explain Risk Projection and Risk Refinement in detail. [9]

- Q7) a)** Define software testing? Explain the software testing strategies for software development? [9]
- b) How test strategies for object oriented software are different from that of conventional software? [8]

OR

- Q8) a)** What is system testing? Explain three types of test. [9]  
(Unit testing, Integration testing, Acceptance testing.)
- b) Explain Black box testing with its advantages. [8]



Total No. of Questions : 8]

SEAT No. :

**P1534**

[Total No. of Pages : 2

[6002]-163

**S.E. (Computer)**

**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) Figures to the right indicate full marks.

- Q1)** a) Enlist various types of system and non - system descriptors in the 80386. Explain their use in brief. [6]
- b) Explain the use of following instructions in detail: [6]
- i) LGDT
  - ii) LIDT
  - iii) SIDT
- c) With the necessary flowchart, explain the complete address translation process in 80386. [6]

OR

- Q2)** a) Explain the page translation process in 80386. [6]
- b) Draw and explain the general descriptor format available in various descriptor tables. [6]
- c) Differentiate and explain GDTR, LDTR, and IDTR. [6]
- Q3)** a) Explore five aspects of protection applied in segmentation. [6]
- b) What is DPL, EPL and IOPL? Explain in brief. [6]
- c) Explore the need for a protection mechanism in 80386. [5]

OR

**P.T.O.**

- Q4)** a) Explain how control transfer instructions are executed using the call gate in the system? [6]  
b) List and explain various Privilege Instructions. [6]  
c) Elaborate on the concept of combining segment protection and page level protection in 80386. [5]

- Q5)** a) Explain the structure of a V86 Task in detail. How is protection provided within the V86 task? [6]  
b) Draw and explain the Task State Segment of 80386. [6]  
c) With the necessary diagram, explain entering and leaving the virtual mode of 80386. [6]

OR

- Q6)** a) Explain the TSS descriptor and its role in multitasking. [6]  
b) List and explain various features of virtual 8086 mode. [6]  
c) Define Task Switching and explain the steps involved in task switching operation? [6]

- Q7)** a) How interrupts are handled in protected mode? Explain with the help of a neat diagram. [6]  
b) Elaborate about enabling and disabling interrupts in 80386. [6]  
c) List and elaborate on different applications of microcontrollers. [5]

OR

- Q8)** a) Explain the following exceptions in brief. [6]  
i) Divide error  
ii) Invalid Opcode  
iii) Overflow  
b) How interrupts are handled in protection mode. Explain with the help of a neat diagram. [6]  
c) Explain various features of the 8051 Microcontroller. [5]



Total No. of Questions : 8]

SEAT No. :

**P1535**

**[6002]-164**

[Total No. of Pages : 3

**S.E. ( Computer Engineering)**

**PRINCIPLES OF PROGRAMMING LANGUAGES**

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1) a)** Explain following features of java in detail **[6]**
- i) Security
  - ii) Platform Independence
  - iii) Object - oriented
- b) Write short note on **[6]**
- i) Garbage collector
  - ii) this
- c) Define constructor. Which are the types of Constructor used in Java? Explain with example. **[6]**

OR

- Q2) a)** Explain following features of java in detail **[6]**
- i) Portability
  - ii) Architecture Neutral
  - iii) Distributed
- b) Write short note on **[6]**
- i) final
  - ii) finalize ()
- c) Explain one dimensional and multi - dimensional array used in Java with suitable examples. **[6]**
- Q3) a)** What is mean by inheritance? Explain the various types of inheritance used in Java with suitable example. **[6]**

**P.T.O.**



- b) Explain following keywords of Java in detail [6]  
i) try  
ii) catch  
iii) finally
- c) Define package used in Java. Explain syntax, use, CLASSPATH, hierarchy of package with example. [6]

OR

- Q4)** a) Elaborate Method overriding and dynamic method dispatch in Java. [6]
- b) Explain various Exception Handling mechanisms in Java [6]
- c) What is the concept of stream, Explain byte stream and character stream in detail. [6]
- Q5)** a) Explain different ways to implement Threads in Java? With code example. [6]
- b) Explain the below methods in detail. [6]  
i) Isalive  
ii) notify  
iii) getpriority
- c) List the Features, advantages, and limitations of Vue JS. [5]

OR

- Q6)** a) Explain the uses of is Alive () and join () methods in the java thread with examples. [6]
- b) Explain the thread life cycle model in Java. [6]
- c) Write a short note on React JS and Angular JS. [5]

- Q7)** a) Explain the features of LISP programming. [6]
- b) Explain the following Equality predicates using a suitable example. [6]
- i) EQUAL
  - ii) EQ
  - iii) EQL
  - iv) =
- c) Explain the following number predicates using a suitable example. [5]
- i) NUMBERP
  - ii) ZEROP
  - iii) PLUSP
  - iv) EVENP
  - v) ODDP

OR

- Q8)** a) Explain the following functions with suitable examples. [6]
- i) CAR()
  - ii) CDR()
  - iii) FIRST()
- b) Describe Logical Programming. Enlist its features. Also, list the commonly used Logical programming languages. [6]
- c) Evaluate the following forms of LISP. [5]
- i) (car (cdr'(1 2 3 4 5 )))
  - ii) (car (cdr' (a (b c) d e)))
  - iii) (car (cdr (cdr'(1 2 3 4 5 6 7 8))))

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1537**

**[6002]-166**

[Total No. of Pages : 2

**S.E. (I.T.)**

**LOGIC DESIGN & COMPUTER ORGANIZATION  
(2019 Pattern) (Semester - III) (214442)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a) Define the following terms. [8]**

- i) Propagation Delay Time
- ii) Setup Time
- iii) Hold Time
- iv) Maximum Clock Frequency

b) Draw and explain SR flip-flop using NAND gate. [6]

c) Convert T flip-flop to D flip-flop. [4]

OR

**Q2) a) Design MOD-45 counter using IC 7490. [8]**

b) Draw and explain 4-bit serial-in serial-out shift register using D-FFs. [6]

c) Differentiate between Latch and Flip Flop. [4]

**Q3) a) Draw and explain Single bus organization of CPU? State functions of CPU? [8]**

b) Explain sequence of events that occur in Fetch cycle symbolically with diagram at each stage. [9]

OR

*P.T.O.*

- Q4)** a) Draw the block diagram of Hardwired control unit. [8]  
b) Describe the functions of registers: IR, MBR, MAR, PC, Flag register.[9]

- Q5)** a) What are key characteristics of RISC & CISC. Compare RISC and CISC. [9]  
b) What is mean by Instruction format? Explain 0-1-2-3 address formats with suitable example? [9]

OR

- Q6)** a) Draw and explain Cluster and Cluster Architectures. [9]  
b) Explain symmetric multiprocessors(SMP) organization with features.[9]

- Q7)** a) What are the different algorithms and techniques used in managing cache memory. [8]  
b) Explain Interrupt Driven I/O with a diagram. [9]

OR

- Q8)** a) Draw & explain memory hierarchy structure? What is mean by a Principle of Locality. [9]  
b) Explain the memory write cycle with help of suitable timing diagram.[8]



Total No. of Questions : 8]

SEAT No. :

**P1538**

[Total No. of Pages : 3

[6002]-167

S.E. (IT)

**DATA STRUCTURES & ALGORITHMS**  
**(2019 Pattern) (Semester - III) (214443)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

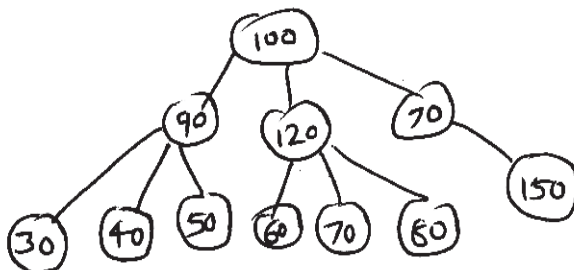
- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.

- Q1)** a) Define stack as an ADT. Use this stack to swap two no.s (Write Sudo Code). [6]
- b) Discuss the merits of circular queue over linear queue and write sudo code for over flow and under flow conditions of circular queue. [8]
- c) Discuss the time complexity of removing an item from priority queue if sequential memory organization is used. [4]

OR

- Q2)** a) Contrast between the characteristics of stack & queue data structures.[4]
- b) Convert the following infix expressions to postfix and show the contents of stack for each operation.
- i)  $p * (X/Y * Z - Q/(A+B))$ .
  - ii)  $A + B \$ (M-N)/D$  (\$ for power operation). [8]
- c) Explain with example the significance of priority queue over simple queue. [6]

- Q3)** a) Discuss the merits & demerits of implementing threaded binary tree. [6]
- b) Describe the characteristics of a general tree. Convert the following general tree into binary tree. [8]

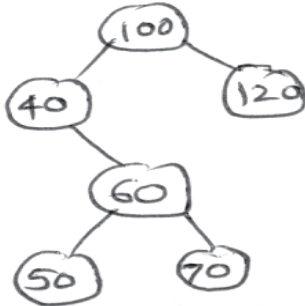


- c) Discuss the time complexities of inserting & deleting a node from BST.[4]

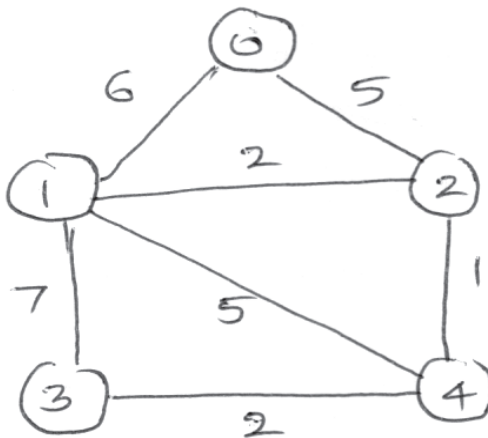
OR

P.T.O.

- Q4)** a) Discuss the applications of Binary search tree & expression tree. [4]  
 b) Write sudo code for non-recursive inorder tree traversal of binary tree.[6]  
 c) For the following binary tree, show (draw) threaded binary tree (inorder).



- Q5)** a) Write sudo code of Kruskal's algorithm for creating a MST. Demonstrate with steps for the following graph MST using same algorithm. [9]



- b) Discuss with example, what is AVL & time complexity to insert a node in an AVL. [8]

OR

- Q6)** a) Explain the time complexity of heap sort & sort the following No.s in ascending order using heap sort. 5, 3, 17, 10, 84, 19, 22. [9]  
 b) Contrast between the approaches of finding MST using prim's algorithm & Kruskal's algorithm. Discuss the time complexities of both algorithms. [8]

- Q7) a)** Explain prototype of the following function in C++ with examples. [8]
- i) Seekg
  - ii) Seekp
  - iii) tellg
  - iv) tellp
- b) Enlist characteristics of a good hash function. Create a hash table for the following set of integers, taking modulus function as hash function ( $h(k)=k\%10$ ).
- 29, 50, 28, 19, 17, 15, 18, 14, 38.
- Demonstrate Chaining with replacement. [9]

OR

- Q8) a)** Write pseudo codes to perform following operations on index sequential file. [8]
- i) inserting a record.
  - ii) updating a given record.
- b) Discuss with examples at least three types of hashing functions, clearly mentioning the advantages & disadvantages of each. [9]



Total No. of Questions : 8]

SEAT No. :

**P1539**

[Total No. of Pages : 2

[6002]-168

**S.E. (I.T.)**

**OBJECT ORIENTED PROGRAMMING**

**(2019 Pattern) (Semester-III) (214444)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Consider the definition of 'complex' class as below.

**[9]**

```
public class complex
{
private int real, img;
public complex ()
{
//constructor 1
}
public complex (int real, int img)
{
//constructor 2
}
public complex (complex c)
{
// constructor 3
}
}
```

Re-write the class 'Complex' as:

- i) Define the constructor 1 so that the private member variables are initialized to 0.
  - ii) Define the constructor 2 so that the private member variable real and img is initialized according to the value of the parameter.
  - iii) Define the constructors 3, where copy one object to another.
- b) With suitable code segments illustrate various uses of 'final' keyword.

**[9]**

OR

**P.T.O.**



- Q2)** a) What are the characteristics of Destructor? How is Destructor declared in OOP? Demonstrate with an example. [9]  
b) Write a program which demonstrate constructor with default arguments. [9]

- Q3)** a) Discuss diamond problem in detail? How it can be solved? [9]  
b) Enlist the benefits and costs of Inheritances. [8]

OR

- Q4)** a) How parameterized constructors get executed in multilevel inheritance? Explain with an example? [9]  
b) Define polymorphism? What are the types of Polymorphism? How can be run time polymorphism achieved in OOP? [8]

- Q5)** a) Define exception. What are its types? Discuss exception handling mechanism in detail. [9]  
b) What is Generic programming? Discuss any four methods of ArrayList class with their syntax. [9]

OR

- Q6)** a) Is there any difference between throw and throws in exception handling in Java? If 'yes', justify your answer. [9]  
b) How basic mathematical set operations union, intersection, and subset are performed using set interface? [9]

- Q7)** a) What is a design pattern? Write a short note on 'Singleton' design pattern. [9]  
b) Write program to handle primitive data types in file handling. [8]

OR

- Q8)** a) How do you write to a file and read from a file using File Writer and FileReader class, respectively? [8]  
b) What are the advantages of design patterns? Explain 'Adaptor' design pattern in detail. [9]



Total No. of Questions : 8]

SEAT No. :

P-1540

[Total No. of Pages : 2

[6002]-169

S.E. (Information Technology)

BASIC OF COMPUTER NETWORK

(2019 Pattern) (Semester - III) (214445)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

Q1) a) Discuss CSMA/CD in details. [9]

b) Explain Reservation, Polling & Token passing. [9]

OR

Q2) a) Write short note on IEEE 802.4(Token Bus) and IEEE 802.5(Token Ring). [9]

b) Discuss CSMA/CA random access technique. How collision avoidance is achieved in the same? [9]

Q3) a) Explain Subnetting and Supernetting with example. [9]

b) Describe Packet format of IPv6 in detail with suitable diagram. [8]

OR

Q4) a) Explain Network Address Translation with suitable diagram. [9]

b) Discuss in detail fragmentation in terms of IPv4. [8]

Q5) a) Explain Interdomain and Intradomain routing protocol in detail. [9]

b) Discuss EIGRP protocol in detail. [9]

OR

Q6) a) Explain RIP message format in detail. [9]

b) Discuss Distance Vector Routing protocol in detail. [9]

P.T.O.

- Q7) a)** Explain three way handshake algorithm for TCP connection establishment. [9]
- b) What is congestion Control? Explain Leaky bucket algorithm. [8]

OR

- Q8) a)** What is Socket? List & explain the socket primitives in client side & server side TCP connection. [9]
- b) Compare TCP and UDP Header with suitable diagram. [8]



Total No. of Questions : 8]

SEAT No. :

P-1541

[Total No. of Pages : 2

[6002]-170

S.E. (Information Technology)

PROCESSOR ARCHITECTURE (Theory)

(2019 Pattern) (Semester - IV) (214451)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 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) Explain the interrupt structure of PIC18 microcontroller along with IVT.[7]  
b) Draw and explain the interfacing of LCD with Port D and Port E of PIC18FXX microcontroller. [7]  
c) Illustrate the use of following bits of INTCON2 register i) INTEDG1  
ii)TMR0IP. [4]

OR

- Q2)** a) Discuss the steps in executing interrupts in PIC18 microcontroller. [7]  
b) Explain with neat diagram the external hardware interrupts of PIC18 microcontroller in detail. [8]  
c) What are peripheral interrupts, IVT and ISR? [3]

- Q3)** a) Explain the function of CCP1CON SFR along with its format. [6]  
b) Write short note on SPI protocol. [5]  
c) Explain the stepper motor interfacing with PIC18FXX microcontroller with suitable diagram. [6]

OR

- Q4)** a) Explain operation of capture mode of PIC18FXX microcontroller along with diagram. [6]  
b) Write short note on RS232 standard. [6]  
c) State the applications of CCP module in PIC. [5]

P.T.O.

- Q5)** a) Explain interfacing of LM35 temperature sensor with PIC 18FXX microcontroller. [6]  
b) State the features of on-board ADC of PIC18FXX microcontroller. [6]  
c) Explain RTC DS1306 interfacing with PIC18FXX microcontroller. [6]

OR

- Q6)** a) Explain in detail the functions of ADCON0 SFR of PIC 18 microcontroller. [6]  
b) State the features of RTC. [6]  
c) Draw and explain the interfacing diagram of DAC0808 with PIC18FXX microcontroller. [6]

- Q7)** a) Explain the AMBA BUS Protocol and programmer's model of ARM processor. [6]  
b) Compare the ARM7, ARM9 and ARM11 processors. [6]  
c) Describe CPSR of ARM7 in detail along with diagram and use of SPSR. [5]

OR

- Q8)** a) Describe the ARM design philosophy. [4]  
b) Differentiate between the PIC microcontroller and the ARM processor. [7]  
c) Draw and explain the ARM family core architecture? [6]



Total No. of Questions : 8]

SEAT No. :

P-1542

[Total No. of Pages : 4

[6002]-171

**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 side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** a) Describe Circumstances under which you would choose to use Embedded SQL than normal SQL or only a general purpose programming Language. **[4]**

b) Differentiate between : **[6]**

- i) Trigger & stored procedure
- ii) Embedded SQL and Dynamic SQL

c) Consider the following relations : **[8]**

Departments(Department\_id, Department\_name, manager\_id, Location\_id) Employees(Employee\_id, Employee\_name, mphone\_number, Hire\_Date, Job\_Id, Salary, commission\_PCT, manager\_Id, Department\_Id)

Write SQL queries for the following :

- i) Show the name, job, salary and commission of those employee who earn commission. Sort the data by the salary in descending order.
- ii) Show the department names, locations, names, job titles and salaries of employees who work in location 1800.

**P.T.O.**

- iii) How many employees have a name that ends with an “n”?
- iv) Show the names and locations for all departments and the number of employee working in each department. Make sure that departments without employees are included as well.

OR

**Q2) a)** Consider the relational database **[8]**

supplier(sid, sname, address)

parts(pid, pname, color)

catlog(sid, pid, cost)

Write SQL queries for the following :

- i) Find the name of supplier who supply some red parts.
  - ii) Find the name of all part whose cost is more than Rs. 250.
  - iii) Find the name of all part whose color is green.
  - iv) Find the name of all part supplied by each supplier.
- b) Explain need for following : **[4]**
- i) View
  - ii) Null values
- c) Write note on : **[6]**
- i) Set operations in SQL
  - ii) Aggregate Functions in SQL

**Q3) a)** What are the measure of query cost? **[4]**

b) Explain 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> normal form with example. **[6]**

c) What do you mean by normalization? Explain different anomalies. **[7]**

OR

**Q4) a)** Compare BCNF and 3NF. **[4]**

b) Which are different ways of evaluation of expression? Explain any one with example. **[6]**

c) Define functional dependency. List various types of functional dependency. Explain any one type of functional dependency. **[7]**

**Q5) a)** Give test for conflict serializability. Check whether following schedule is conflict serializable. [8]

T1	T2
Read(A)	
Write(A)	
	Read(A)
	Write(A)
Read(B)	
Write(B)	
	Read(B)
	Write(B)

b) What is concurrency control? Explain time stamping method. [4]

c) When do deadlock happens? How to prevent them? [6]

OR

**Q6) a)** Check whether given schedule is view serializable. [6]

T1	T2	T3
Read(Q)		
	Write(Q)	
		Write(Q)
Write(Q)		

b) Explain the concept of Transaction. Describe ACID properties of transaction. [8]

c) Explain Deferred database modification. [4]

**Q7) a)** State which database system architecture you will prefer for following application- support your answer with brief explanation : [6]

i) Railway Reservation System.

ii) Search Engine

iii) College admission system



- b) List and Explain any one Architecture of Parallel databases with neat diagram. [6]
- c) What are the benefits of NOSQL databases. [5]

OR

- Q8)**
- a) Write a note on SQL Lite database. [6]
  - b) Explain Architecture of Distributed database system. [6]
  - c) Explain two-tier and three-tier architecture. [5]



Total No. of Questions : 8]

SEAT No. :

**P1543**

[Total No. of Pages : 2

[6002]-172

**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 side 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(30,50), B (110,70) and PQ with P (50,30), Q (90,90) 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 3D reflection about XY, YZ and XZ plane. **[9]**

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 PQR with P (100,175), Q(170,250), R (250,165) and find the final coordinates of the clipped polygon. **[9]**

b) What is projection? Explain with diagram, Perspective Projection with vanishing points as 1 point, 2 point and 3 point. **[9]**

**Q3) a)** Explain in detail with Diagram. **[9]**

- i) RGB Color Model
- ii) HSV Color Model
- iii) CIE Chromaticity Diagram.

b) Define Shading. Explain with help of diagrams Gourand Shading algorithm in detail. **[8]**

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 Deletion and
  - iii) Segment Closing.
- b) Explain in detail combined diffuse and specular reflections with multiple light sources. [8]

- Q5)** a) What are the steps in design in animation sequence? Describe about each step briefly. [9]
- b) What is curve interpolation ? As far as splines are concerned what do Bezier and B-splines curves indicate? [9]

OR

- Q6)** a) Explain in detail with diagram how midpoint subdivision method can be used for Bezier-curve Generation. [9]
- b) Explain how koch curves are generated. Also calculate the fractal dimension of koch curve. [9]

- Q7)** a) Explain the behavioral modeling in Virtual Reality. [6]
- b) What are sound displays in Virtual Reality? [6]
- c) What is navigation and manipulation interfaces in virtual reality system?[5]

OR

- Q8)** a) Explain the graphics Rendering pipeline [6]
- b) Explain the applications of Virtual Reality systems. [6]
- c) Explain Kinematic modeling in Virtual Reality. [5]



Total No. of Questions: 8]

SEAT No. :

**P1544**

**[6002]-173**

[Total No. of Pages : 2

**S.E. (Information Technology)  
SOFTWARE ENGINEERING  
(2019 Pattern) (Semester-IV) (214454)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *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 design concepts: **[6]**

- i) Abstraction
- ii) Modularity

b) Write a note on User Interface Design. **[6]**

c) Explain effective modular design with neat diagram. **[6]**

OR

**Q2) a)** Define Usability. Explain different characteristics of usability and ISO characteristics. **[9]**

b) Explain the mechanisms applied in user interface design for fulfilling the Mandel's three golden rules. **[9]**

**Q3) a)** Write a note on effort estimation and scheduling. **[9]**

b) Enumerate the 4P's of project management. **[8]**

OR

**Q4) a)** State and explain the five more important goals of a project. **[10]**

b) Explain in detail categories of Software Metrics with suitable examples. **[7]**

*P.T.O.*

- Q5)** a) Describe the steps of defect management with neat diagram. [6]  
b) What are the parameters considered for writing a good defect report? [6]  
c) What is the difference between Testing and debugging? [6]

OR

- Q6)** a) What is software quality? Explain software quality dimensions parameters. [9]  
b) Enlist any three objectives of testing? Differentiate between Manual and automation testing. [9]

- Q7)** a) Write a short note on: [12]  
i) Business process re-engineering  
ii) Risk Management  
b) Explain in brief test driven development. [5]

OR

- Q8)** a) Explain in detail, the SCM repository features. [9]  
b) Write a note on elements of a Configuration Management System. [8]



Total No. of Questions : 8]

SEAT No. :

**P1545**

**[6002]-175**

[Total No. of Pages : 2

**S.E. B.Tech.(Biotechnology)  
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 indicate full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** Answer the following. **[18]**

- a) What is a peptide bond? Give the reaction for peptide bond formation.
- b) What is zwitterion? Give explanation on its amphoteric nature.

OR

**Q2)** Answer the following. **[18]**

- a) Write in short about dialysis and size exclusion chromatography.
- b) Differentiate between Cysteine and Cystine.

**Q3)** Answer the following. **[17]**

- a) Write in detail on double helix structure of DNA.
- b) Explain the formation of phosphodiester bonds with a suitable example.

OR

**Q4)** Answer the following. **[17]**

- a) Differentiate between nucleotide and nucleoside.
- b) What are the features of Watson-Crick Pairing.

**P.T.O.**

**Q5)** Answer the following. **[18]**

- a) What is glycolipid? Explain with suitable structure. Enlist the functions of same.
- b) Define lipids and enlist the functions of lipid.

OR

**Q6)** Answer the following. **[18]**

- a) Justify - unsaturated fatty acids, with one or several kinks cannot pack together as tightly as fully saturated fatty acids.
- b) Write in detail a about structural lipids in Membranes.

**Q7)** Answer the following. **[17]**

- a) State the iron deficiency diseases.
- b) Give the functions of zinc.

OR

**Q8)** Answer the following. **[17]**

- a) Explain any two vitamin deficiencies.
- b) Explain any two mineral deficiencies in detail.



Total No. of Questions : 8]

SEAT No. :

**P1547**

[Total No. of Pages : 2

[6002]-177

**S.E. (Biotechnology)**

**HEAT TRANSFER**

**(2019 Pattern) (Semester-III) (215463)**

*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) Give dimensionless numbers in case of natural and forced convection. [10]  
b) Explain in detail concept of maximum heat flux and critical temperature drop. [8]

OR

- Q2)** a) What is Newton's law of cooling? Where it can be used? How film heat transfer co-efficient is estimated? [9]  
b) Draw and explain in detail Pool boiling curve with significance of each point in the pool boiling. How is it used in design of equipments? [9]

- Q3)** a) Write a short note on 'Thermal Boundary layer and its significance. [9]  
b) What is monochromatic emissive power? Write a short note on Plank's distribution law. [8]

OR

- Q4)** a) Write short notes on J-factor analogy. [8]  
b) What is Radiation? how is it different from other two phenomena? Explain with examples. [9]

- Q5)** a) What is NTU effectiveness method? When is it used? Explain in detail Capacity, NTU and effectiveness. [9]  
b) Draw a neat sketch and write a short note on rotating matrix heat exchanger. [9]

OR

*P.T.O.*



- Q6)** a) What is the concept of log mean temperature difference (LMTD)? Derive an expression for countercurrent flow heat exchanger using LMTD method. [9]
- b) What is fouling? Give reasons for fouling and expression for fouling factor. How it affects the performance of heat exchanger? [9]
- Q7)** a) What is evaporation? Give detailed classification of evaporators. [9]
- b) Discuss the terms: [8]
- i) Evaporator Capacity
- ii) Evaporator Economy with its significance.

OR

- Q8)** a) Write a short note on calendria evaporator? State advantages, disadvantages and applications. [9]
- b) Draw neat sketches of feed forward and feed backward evaporator. [8]



Total No. of Questions : 8]

SEAT No. :

**P-1548**

[Total No. of Pages : 2

**[6002]-178**

**B.Tech. (Biotechnology)**

**MICROBIOLOGY**

**(2019 Pattern) (Semester - III) (215464)**

*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 right indicate full marks.*
- 3) *Assume suitable data if necessary.*

**Q1) a) Define [9]**

- i) Bacterial Growth
- ii) Generation Time and
- iii) Growth Rate

b) Definition, principle, process and applications of batch culture. [9]

OR

**Q2) a) What is bacterial growth and what are the 4 phases of typical bacterial growth curve? [9]**

b) What methods are used to measure microbial population. [9]

**Q3) a) What is filtration sterilization? Explain its types and applications. [9]**

b) Define antibiotics and how does it work? [8]

OR

**Q4) a) Explain the principle of autoclaving with its applications. [9]**

b) Tabulate different methods of control of microorganisms with its mode of action and examples. [8]

**P.T.O.**

- Q5)** a) Explain different types of microbial interactions in environment with examples. [8]
- b) Give role of microorganisms in [10]
- i) Food
  - ii) Soil and
  - iii) Air

OR

- Q6)** a) What is indicator microorganism and explain its significance in water microbiology. [10]
- b) Write short note on [8]
- i) Symbiosis and
  - ii) commensalisms

- Q7)** a) Explain Typhoid with respect to Symptoms, treatment, causes and prevention. [8]
- b) Write short note on [9]
- i) Pandemic and
  - ii) Epidemic

OR

- Q8)** a) Describe HIV with its etiological agent, symptoms, treatments and preventive measures. [8]
- b) Write etiological agent for [9]
- i) Tuberculosis
  - ii) Cholera and
  - iii) Influenza

**x x x**

Total No. of Questions : 08]

SEAT No. :

P-1549

[Total No. of Pages : 2

[6002]-179

S.E. (B.Tech. Biotechnology)

BIOCHEMISTRY-II

(2019 Pattern) (Semester - IV) (215470)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.

Q1) Answer the following.

- a) In glycolysis, which of the reactions produce adenosine triphosphate (ATP)? [9]
- b) Explain the significance of phosphorylated intermediates in glycolysis. [9]

OR

Q2) Answer the following.

- a) Depict the figure showing the feeder pathways for glycolysis. [9]
- b) Enlist the intermediates of glycolysis. [9]

Q3) Write in detail about.

- a) Draw the TCA cycle. [9]
- b) Write in detail about Cori cycle. [8]

OR

Q4) Answer the following.

- a) Describe in detail about glycogen synthesis [9]
- b) Draw a neat and labeled diagram showing electron transport chain. [8]

Q5) Answer the following.

- a) Describe in detail about purification of protein by affinity chromatography. Enlist the advantages of affinity chromatography and draw the diagram for same. [9]
- b) Enlist the steps of protein digestion and absorption in stomach and intestine. [9]

OR

P.T.O.

**Q6)** Answer the following.

- a) Write down the causes and consequences of acute pancreatitis. [9]
- b) Describe the significance of the urea cycle. Mention any one inherited defects of the urea cycle. [9]

**Q7)** Answer the following

- a) Draw a neat labeled diagram showing Mobilization of Stored Triacylglycerols by Hormones Trigger. [9]
- b) Describe in detail about carnitine shuttle [8]

OR

**Q8)** Answer the following

- a) Draw a neat labeled diagram showing Oxidation of Fatty Acids in three stages. [9]
- b) Explain the Oxidation of Saturated Fatty Acids with its Four Basic Steps.[8]



Total No. of Questions : 8]

SEAT No. :

P-1550

[Total No. of Pages : 2

[6002]-180

S.Y. (Biotechnology)

Cell Biology & Tissue Culture

(2019 Pattern) (Semester - IV) (215471)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.

**Q1)** a) How the G-protein coupled receptors (GPCR) function? Give its significance. [8]

b) What is intracellular signaling? What are the typical components of intracellular signaling? [10]

OR

**Q2)** a) Explain the cell cycle and describe in detail the steps involved in a typical cell cycle. [10]

b) Write a detailed note on Apoptosis, its functions and significance. [8]

**Q3)** a) What are Embryonic stem cells? What is their significance? [8]

b) Write short note on nervous tissue. [9]

OR

**Q4)** a) The Connective tissue connects and supports the entire human body. Explain. [8]

b) Cancers evolve by a reiterative process of clonal expansion, genetic diversification and clonal selection. Explain with a diagram. [9]

**Q5)** a) Explain the disaggregation of tissue with trypsinization and its significance. [8]

b) What is a cell line explain and give examples? How to establish a mammalian cell line, describe in detail and draw a flow chart. [10]

P.T.O.

OR

**Q6)** a) What is a viable cell count? How is it observed and calculated? State the significance in culture initiation. [9]

b) What are the different methods of surface sterilization? [9]

**Q7)** a) Describe and explain the various methods used for gene transfer to plant cells. [10]

b) What is micropropagation? Give significance with respect to regeneration of endangered plants. [7]

OR

**Q8)** Write short notes on :

a) Protoplast culture in plant tissue culture [9]

b) Callus culture, with help of a neat diagram describe the steps involved. [8]



Total No. of Questions : 8]

SEAT No. :

**P1551**

[Total No. of Pages : 2

[6002]-181

**S.E. (Biotechnology Engg.)**

**THERMODYNAMICS**

**(2019 Pattern) (Semester-IV) (215472)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1)** Give the Kelvin-Planck statement and the clausius statement of the second law of thermodynamics and show that they are equivalent. **[18]**

CO-A

OR

**Q2)** a) What are the limitations of the first law of thermodynamics? **[9]**

CO-A

b) Establish with examples why the concept of entropy is essential to explain the direction of spontaneous processes. **[9]**

CO-A

**Q3)** Define Helmholtz free energy, and prove that at constant temperature the decrease in work function measures the maximum work available from a given change of state. **[17]**

CO-B

OR

**Q4)** a) What are the fundamental differential equations for the energy properties? List the canonical variables for U,H,A, and G. **[8]**

CO-B

b) What are maxwell's equations and what is their importance in establishing relationships between thermodynamic properties? **[9]**

CO-B

*P.T.O.*



**Q5) a)** State and explain the phase rule and Duhem's theorem for reacting systems. [9]

CO-C

b) Derive an equation to predict the effect of temperature on the equilibrium constants. [9]

CO-C

OR

**Q6) a)** How is the equilibrium constant related to composition? Derive an expression for the same. [9]

CO-C

b) Derive the relationship between the mole fraction of components taking part in the reaction and the extent of the reaction. [9]

CO-C

**Q7) a)** How are the first and second law of thermodynamics applied to biological systems? Explain with examples. [8]

CO-D

b) Describe the application of Gibb's free energy for the study of biological systems with examples. [9]

CO-D

OR

**Q8)** Give any two examples of energy-yielding and energy-requiring biochemical reactions. How can they be explained using the laws of thermodynamics?[17]

CO-D



Total No. of Questions : 8]

SEAT No. :

**P1552**

[Total No. of Pages : 2

[6002]-182

**S.E. (Biotechnology)**

**GENETICS AND MOLECULAR BIOLOGY**

**(2019 Pattern) (Semester-IV) (215473)**

*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 a calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

**Q1)** Enlist all the enzymes playing a role in DNA replication and explain their function during the process. Wherever necessary draw a neat labeled diagram of the enzyme. **[18]**

**CO3**

OR

**Q2)** What is the difference between 5' to 3' and 3' to 5' DNA replication? Explain the process of formation of Okazaki fragments and replication of DNA on lagging strands. **[18]**

**CO3**

**Q3)** Explain the structures and functions of different types of RNA. **[17]**

**CO4**

OR

**Q4) a)** What is tRNA? Draw the structure of tRNA. What roles are they playing in central dogma? Explain. **[10]**

b) How rRNA forms ribosomes? Write a note on the structure of ribosomes formed in eukaryotes and prokaryotes with the help of a neat diagram. **[7]**

**CO4**

*P.T.O.*

**Q5)** Define Transcription and explain the process of initiation of Transcription with the help of the suitable diagram. **[18]**

**C05**

OR

**Q6)** Define the operon, and explain the process of gene transcription in the lacoperon. **[18]**

**C05**

**Q7)** Describe the process of translation with the help of the following stages. **[17]**

i) Initiation **C06**

ii) Elongation

iii) Termination

OR

**Q8)** Write a note on “Genetic Code”. How does tRNA help in the synthesis of Protein? Explain the concept of the wobble hypothesis. **[17]**

**C06**



Total No. of Questions : 9]

SEAT No. :

**P1553**

[Total No. of Pages : 5

[6002]-183

**S.E. (Production and Industrial) (Sandwich)**

**ENGINEERING MATHEMATICS-III**

**(2019 Pattern) (Semester-III) (207007)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Q.1 is compulsory. Attempt Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use graph paper for Graphical Solution.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)**  $\mu_2=16, \mu_4=162$ . coefficient of kurtosis  $\beta_2$  is given by. **[2]**

- |           |          |
|-----------|----------|
| i) 1      | ii) 1.51 |
| iii) 0.63 | iv) 1.69 |

b) A box contains 100 bulbs out of which 10 are defective. A sample of 5 bulbs are drawn. The probability that none is defective is **[2]**

- |                                    |                                  |
|------------------------------------|----------------------------------|
| i) $\left(\frac{1}{10}\right)^5$   | ii) $\left(\frac{1}{2}\right)^5$ |
| iii) $\left(\frac{9}{10}\right)^5$ | iv) $\frac{9}{10}$               |

c)  $\nabla \cdot \vec{r}$  where  $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  is equal to **[2]**

- |                        |       |
|------------------------|-------|
| i) 0                   | ii) 1 |
| iii) $x^2 + y^2 + z^2$ | iv) 3 |

d) A vector field  $\vec{F}$  is irrotational if **[1]**

- |                                  |                                  |
|----------------------------------|----------------------------------|
| i) $\nabla \cdot \vec{F} = 0$    | ii) $\nabla \times \vec{F} = 0$  |
| iii) $\vec{F} \cdot \vec{F} = 0$ | iv) $\vec{F} \times \vec{F} = 0$ |

**P.T.O.**



- Q4)** a) If mean and variance of a binomial distribution are 12 and 3 respectively, find  $P(r \geq 1)$  [5]
- b) An unbiased coin is thrown 10 times. Find the probability of getting exactly 6 heads and atleast 6 heads using binomial distribution. [5]
- c) An aptitude test for selecting officers in a bank conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the score find; [5]
- i) The number of candidates exceed 60
- ii) The number of candidates score lies between 30 and 60
- [Given  $A(0.75)=0.2734$ ,  $A(0.5)=0.1915$ ]

OR

- Q5)** a) 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 more than 2 individuals suffer a bad reaction. [5]
- b) On an average 20% of the workers in an industry suffer with a certain diseases. If 12 workers are chosen from the industry, find the probability that exactly 2 workers suffer from the disease. [5]
- c) A die is tossed 60 times and frequency of each face in indicated below

$x$	1	2	3	4	5	6
$y$	5	7	5	14	13	6

Test the die is fair [Given  $\chi^2_{0;0.05} = 11.07$ ] [5]

OR

- Q6)** a) Find the directional derivative of  $\phi=x^2yz^3$  at the point (2,1,-1) in the direction of  $3\bar{i} + 4\bar{k}$  [5]
- b) Show that  $\bar{F} = (y^2 \cos x + z^2)\bar{i} + (2y \sin x)\bar{j} + 2xz\bar{k}$  is irrotational. Find scalar  $\phi$  such that  $\bar{F} = \nabla \phi$  [5]
- c) Evaluate  $\int_c \bar{F} \cdot d\bar{r}$  along the straight line joining (0,0) and (3,2) where  $\bar{F} = (2x + y)\bar{i} + (3y - x)\bar{j}$  [5]

OR

**Q7) a)** Find the directional derivative of  $\phi = 2x - y^3 + z^2$  at the point (2,1,1) in the direction of  $\bar{i} + \bar{j} + \bar{k}$  [5]

b) Show that. (any one) [5]

i) 
$$\nabla \cdot \left[ r \nabla \frac{1}{r^n} \right] = \frac{n(n-2)}{r^{n+1}}$$

ii) 
$$\nabla^2 \left( \frac{\bar{a} \cdot \bar{b}}{r} \right) = 0$$

c) Using Green's theorem evaluate  $\oint_C \bar{F} \cdot d\bar{r}$  where  $\bar{F} = (2x + y)\bar{i} + (5x - y)\bar{j}$  and C is circle  $x^2 + y^2 = 16, z = 0$  [5]

**Q8) a)** If  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  represents the vibration of the string of length l, fixed at both ends, find solution with the conditions. [8]

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

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

iii)  $\frac{\partial u}{\partial t} = 0$  at  $t = 0$

iv)  $u(x, 0) = a \sin\left(\frac{\pi x}{l}\right)$

b) Solve  $\frac{\partial v}{\partial t} = K \frac{\partial^2 v}{\partial x^2}$  if [7]

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

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

iii)  $v_x = 0$  at  $x = 0$

iv)  $v(x, 0) = v_0$  for  $0 < x < l$

OR

**Q9) a)** An infinitely long plane uniform plate is bounded by two parallel edges in the  $y$  direction and an end at right angles to them. The breadth of the plate is  $\pi$ . This end is maintained at temperature  $u_0$  at all points and other edges at zero temperature. Find the steady state temperature function  $u(x,y)$  [8]

b) Use fourier transform to solve. [7]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 < x < \infty, t > 0$$

Subject to conditions

i)  $\left(\frac{\partial u}{\partial t}\right)_{x=0} = 0, t > 0$

ii)  $u(x,0) = \begin{cases} x & 0 < x < 1 \\ 0 & x > 1 \end{cases}$

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





Total No. of Questions : 8]

SEAT No. :

**P1554**

**[6002]-184**

[Total No. of Pages : 2

**S.E.(P.E. & I.E. / Production Sandwich)  
HEAT AND FLUID ENGINEERING  
(2019 Pattern) (Semester -III) (211081)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain Darcy Weisbachs equation. **[9]**
- b) Find the head lost due to friction in a pipe of diameter 300mm and length of 50m through which water is flowing at a velocity of 3m/s. using Darcy formula (Take kinematic viscosity of water = 0.01 stroke.) **[8]**

OR

- Q2)** a) State functions and applications of turbine and pump. **[9]**
- b) An oil of specific gravity 0.7 is flowing a pipe of diameter 300mm at the rate of 500 liters/second. Find the head lost due to friction and power required to maintain the flow for a length of 1000m. Take kinematic viscosity of water = 0.29 strokes. **[8]**

- Q3)** a) Explain types of boilers and compare water tube & fire tube boilers. **[9]**
- b) Discuss types of analysis for fuel. **[9]**

OR

- Q4)** a) What is boiler mounting and boiler accessories? Explain in detail. **[9]**
- b) Discuss boiler performance, boiler efficiency, equivalent of evaporation and energy balance sheet of boiler. **[9]**

*P.T.O.*

- Q5) a)** How types of air conditioning systems useful in manufacturing? Discuss it. [9]
- b) Compare vapour compression and vapour absorption refrigeration system. [8]

OR

- Q6) a)** Discuss any three terminology related to psychometric. [9]
- b) Explain the followings terms related to refrigeration. [8]
- i) Capacity of refrigeration.
- ii) Coefficient of performance of a refrigerator.

- Q7) a)** Explain multistage compression of reciprocating air compressor. [9]
- b) The following results refer to a test on a petrol engine. [9]

Indicated power = 30kw, Brake power = 26kw, Engine speed = 1000rpm,  
Fuel per brake power hr. = 0.35kg,

Calorific Value of fuel used = 43, 900 kj/kg.

Calculate;

- i) Indicated thermal efficiency.
- ii) Brake thermal efficiency &
- iii) Mechanical efficiency.

OR

- Q8) a)** Discuss types of systems for internal combustion engine. [9]
- b) A single stage, single acting air compressor delivers air at 5 bars. The suction temperature is 20°C & suction pressure is 1 bar. Volume of air entering the compressor is 3m<sup>3</sup>/minute, Index of compression is 1.2, Calculate isothermal efficiency & power required to drive the compressor. Neglect clearance volume. [9]



Total No. of Questions : 8]

SEAT No. :

**P1555**

**[6002]- 185**

[Total No. of Pages : 3

**S.E. (P.E& I.E./ Production SW)  
STRENGTH OF MATERIALS  
(2019 Pattern) (Semester - III) (211082)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Write assumption made in Pure bending theory. **[8]**
- b) A circular cantilever beam of span 4 Meter is subjected to a point load of 2KN at free end. If the cross section of beam is 50 mm wide and 75 mm deep. Determine maximum bending stress in beam. **[9]**

**OR**

- Q2)** a) A rectangular beam 150 mm wide and 300 mm deep is subjected to maximum shear force of 80 KN Determine Average shear stress and Maximum shear stress. **[8]**
- b) Derive relation between Maximum shear stress and average shear stress for Rectangular cross-sectional Beam. **[9]**
- Q3)** a) Derive strain energy stored in a body, when the load is gradually applied. **[5]**
- b) Two planes AB and BC which are at right angles are acted upon by tensile stress of 140 N/mm<sup>2</sup> and a compressive stress of 70 N/mm<sup>2</sup> respectively and also by stress 35 N/mm<sup>2</sup>. Determine the principal stresses and principal planes. Find also the maximum shear stress and planes on which they act. **[8]**
- c) An axial pull of 20 kN is suddenly applied on a steel rod 2.5 m long and 1000 mm<sup>2</sup> in cross-section. Calculate the strain energy, which can be absorbed in the rod. Take E = 200 Gpa. **[5]**

**OR**

*P.T.O.*

- Q4)** a) The principal tensile stresses at a point across two perpendicular planes are 100 MPa and 50 MPa. Find the normal and tangential stresses and the resultant stress and its obliquity on a plane at  $20^\circ$  with the major principal plane. [8]
- b) Calculate the strain energy stored in a bar 2 m long, 50 mm wide and 40 mm thick when it is subjected to a tensile load of 60kN. Take E as 200 GPa. [5]
- c) Derive strain energy stored in a body when the load is suddenly applied.[5]
- Q5)** a) Calculate (i) change in diameter, (ii) Change in length, and (iii) Change in volume of a thin cylinder shell 100 cm diameter, 1 cm thick and 5 Meter long when subjected to internal pressure of 3 N/ mm<sup>2</sup> Take the value of  $E=2 \times 10^5$  N/ mm<sup>2</sup> and Poisson's ratio=0.3 [9]
- b) A solid shaft transmit 100Kw at 150 rpm Determine suitable diameter of shaft if the maximum torque transmitted exceeds the mean 20% in each revolution. The shear stress is not exceeds 60 N/ mm<sup>2</sup>. Also find the angle of twist in a length 4 meter of the shaft  $G=80 \times 10^3$  N/ mm<sup>2</sup>. [9]

**OR**

- Q6)** a) A closed cylindrical vessel made of steel plate 4mm thick with plain end, carries a fluid pressure of 3 N/ mm<sup>2</sup> The diameter of cylinder is 25 cm and length is 75 cm. Calculate the longitudinal and Hoop stress in the cylinder wall and determine change in diameter and change in length. Take the value of  $E=2 \times 10^5$  N/ mm<sup>2</sup> and Poisson's ratio=0.286. [9]
- b) In a torsion test, the specimen is a hollow shaft with 50 mm external and 30 mm internal diameter. An applied torque of 1.6 kN-m is found to produce an angular twist of  $0.4^\circ$  measured on a length of 0.2 m of the shaft. The Young's modulus of elasticity obtained from a tensile test has been found to be 200 GPa. [9]

Find the values of

- (i) Modulus of rigidity. (ii) Poisson's ratio.

- Q7)** a) Euler's critical load for a column with both ends hinged is found as 40 kN. What would be the change in the critical load if both ends are fixed? [4]
- b) State assumption of Euler's theory for column design. [4]
- c) A girder of uniform section and constant depth is freely supported over a span of 200 Centimeters. Calculate the central deflection under a central load of 2000 N, if  $I_{xx}=780 \text{ cm}^4$ . Determine also the slopes at the ends of beam. [9]

**OR**

- Q8)** a) A both ends hinged cast iron hollow cylindrical column 3 m in length has a critical buckling load of P kN. When the column is fixed at both the ends, its critical buckling load raise by 300 kN more. If ratio of external diameter to internal diameter is 1.25 and  $E=100 \text{ GPa}$  determine the external diameter of column. [8]
- b) Explain the procedure for finding slope and deflection for a cantilever beam with a point load at free end Double integration method. [9]



Total No. of Questions : 8]

SEAT No. :

**P1556**

[Total No. of Pages : 2

[6002]-186

**S.E. (P.E. & I.E./Production SW)**

**MANUFACTURING PROCESSES-I**

**(2019 Pattern) (Semester-III) (211083)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Explain the following operations performed on lathe with suitable sketch. **[8]**

- i) Eccentric Turning
- ii) Facing
- iii) Parting off
- iv) Knurling

b) What are desirable properties of cutting tool? Describe any four cutting tool material in short? **[10]**

OR

**Q2) a)** Index 69 division by compound indexing method. The hole circle available are. **[8]**

Plate I : 15, 16, 17, 18, 19, 20

Plate II : 21, 23, 27, 29, 31, 33

Plate III : 37, 39, 41, 43, 47, 49

b) Describe with the help of neat sketch the 'Universal Milling Machine' indicating the various controls and constructional features. **[10]**

**Q3) a)** With the help of neat sketch explain the construction and working of radial drilling machine. **[9]**

b) What is twist drill? Draw neat sketch of twist drill showing various parts and name it properly. **[8]**

OR

**P.T.O.**

**Q4) a)** Name the different types of bonds used in the manufacture of abrasive wheel? Describe any one in detail stating its advantages and disadvantages. [8]

b) How do you classify cylindrical grinders? What is the difference between plain and Universal grinders? [9]

**Q5) a)** Compare the Honing and Lapping processes with respect to [6]

i) Principle of working

ii) Types of abrasive

iii) Area of applications

iv) Surface finish

b) Explain Buffing, Polishing and Tumbling processes in short, stating its applications. [11]

OR

**Q6) a)** Compare between the Electroplating, Galvanizing and Metal spraying processes [8]

b) Explain Hot dipping and Burnishing processes in detailed. [9]

**Q7) a)** What is additive manufacturing? What are its merits and demerits? [7]

b) Describe VAT Polymerization process in short. State its merits, demerits and applications. [11]

OR

**Q8) a)** Describe Material Extrusion process in short. State its merits, demerits, and applications. [9]

b) Explain Powder Bed Fusion process in short. State its merits, demerits, and applications. [9]



Total No. of Questions : 08]

SEAT No. :

P-1557

[Total No. of Pages : 2

[6002]-187

S.E. (P.E. & I.E./Production SW)

MATERIAL SCIENCE AND MATALLURGY

(211084)(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) Figures to the right side indicate full marks.
- 4) Draw neat figures whenever necessary.
- 5) Use of scientific calculator 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. [17]

OR

**Q2)** a) Write note on [10]  
i) Diamond impregnated Cutting Tools  
ii) Cemented carbide tipped tools  
b) Describe any two component which can be manufactured by only powder metallurgy technique. [7]

**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]

a) Quenching

b) Annealing

c) Normalizing

d) Carburizing

OR

**Q6) a)** Define hardenability. How it is measured? [8]

b) What is retained austenite? Why it is not desirable? [10]

**Q7) a)** Write note on High temperature alloy. [9]

b) Write Note on Copper and its Alloy. [9]

OR

**Q8) a)** Write Note on Aluminum and its Alloy. [9]

b) Write Note on Composite Material and Nano Materials. [9]



Total No. of Questions : 8]

SEAT No. :

P-1558

[Total No. of Pages : 2

[6002]-188

**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) What is GTO? Mention merits of GTO. [5]  
b) Explain the I-V characteristics of SCR. [6]  
c) Give the specifications and applications of SCR. [6]

OR

- Q2)** a) Explain I-V characteristics of DIAC and TRIAC. [5]  
b) Differentiate between IGBT and MOSFET. [6]  
c) Draw and explain the output characteristics of IGBT. [6]

- Q3)** a) Explain the working of Digital to analog converter. [5]  
b) Define fixed and variable voltage regulator. Explain the function of LM317 as adjustable voltage regulator. [6]  
c) What is Operational Amplifier? List parameters of an ideal Op-Amp. [6]

OR

- Q4)** a) Explain the working of voltage controlled oscillator by using IC 566. [5]  
b) State the ideal and practical characteristics of operational amplifier. [6]  
c) With the help of pin diagram explain the functions of Operational Amplifier. [6]

**P.T.O.**

- Q5)** a) With a neat block diagram explain overall system of PLC. [8]  
b) Explain the input and output devices with suitable example. [6]  
c) What are the merits and demerits of PLC. [4]

OR

- Q6)** a) Explain the input and output module of programmable logic controller. [8]  
b) What are the different applications of programmable logic controller? [6]  
c) Explain various rules for development of Ladder diagram. [4]

- Q7)** a) Mention various features of AT mega 328P. [4]  
b) Draw interfacing diagram of LED with Arduino board also write the algorithm to blink the LED. [8]  
c) Explain the following functions used to handle GPIO in AT mega 328P Arduino board with suitable example. [6]  
i) pinMode()  
ii) digitalWrite()  
iii) digitalRead()

OR

- Q8)** a) State and explain any three open source embedded platforms. [8]  
b) Explain the concept of GPIO in AT mega328P. [6]  
c) State any four significant features of Arduino IDE. [4]



[6002]-189

S.E. (Production &amp; Industrial Engg./Production SW)

THEORY OF MACHINES

(2019 Pattern) (Semester-IV) (211091)

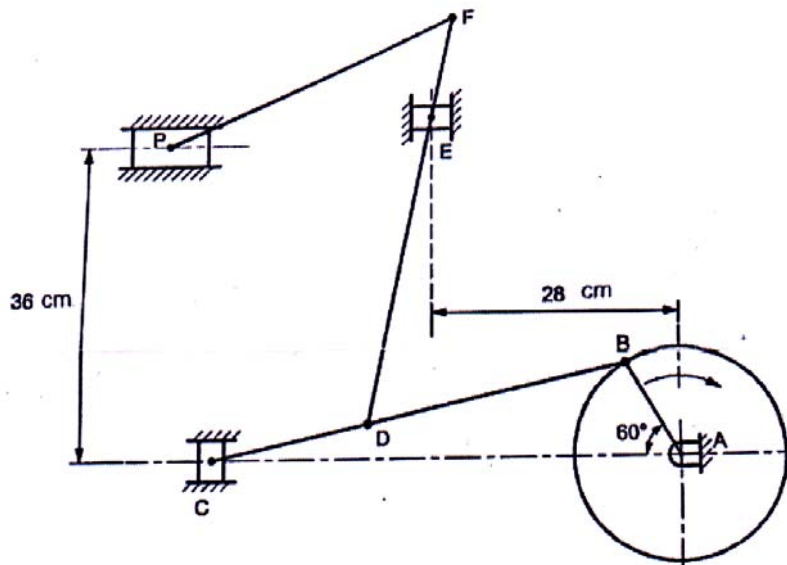
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6, Q.7 OR Q.8.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of logarithmic tables, slide rules, Moilier charts, electronic pocket calculator and steam table is allowed.

- Q1) a) Explain the properties of instantaneous centre of rotation. [6]
- b) In a mechanism shown in figure, the crank AB rotates at 200 rpm. The dimensions of various links are AB=12 cm, BC= 48 cm, CD18 cm, DE=36cm, EF=12 cm and FP = 36 cm. Find velocity of C,P and E. Use relative velocity method. [12]



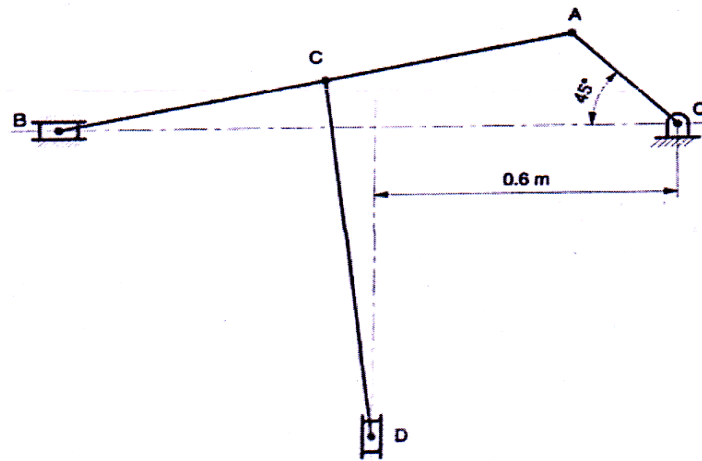
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P.T.O.

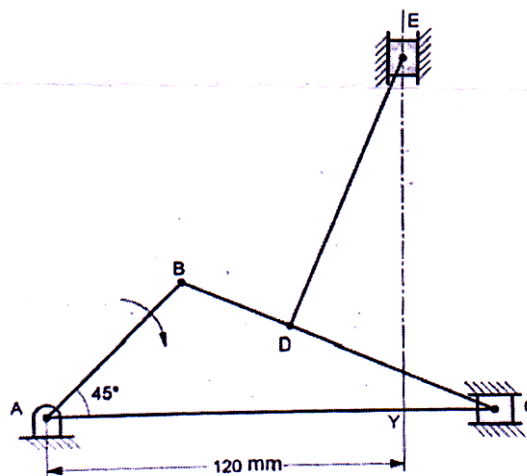
Q2) a) Explain different methods of locating instantaneous centre in various mechanisms. [8]

b) In a mechanism as shown in figure, link OA rotate at 1000 rpm in clockwise direction. The In a mechanism as shown in figure, link OA rotate at 60 rpm in clockwise direction. The dimensions of various links are  $OA = 0.3 \text{ m}$ ,  $AB = 1 \text{ m}$ ,  $CD = 0.8 \text{ m}$ , and  $AC = CB$ . Using instantaneous centre of rotation method, find [10]

- i) Velocity of slider B and D
- ii) Angular Velocity of link AB and CD.



Q3) In a mechanism as shown in figure, link AB rotates at 240 rpm in clockwise direction. The links lengths are  $AB = 50 \text{ mm}$ ,  $BC = 120 \text{ mm}$ ,  $BD = DC = 60 \text{ mm}$  and  $DE = 80 \text{ mm}$ . At the instant shown, find velocity and acceleration of slider C and E. [17]



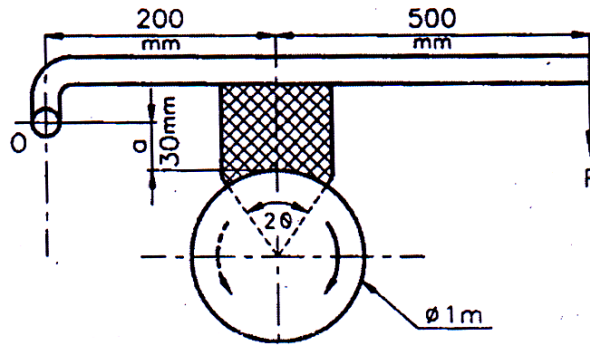
OR

- Q4) a)** The connecting rod of horizontal engine is 400 mm long between the centers. The obliquity ratio is 4 and crank rotate uniformly at 2000 rpm clockwise. When the piston has travelled 50 mm from inner dead centre, determine using analytical method i) Angular position of crank ii) Velocity and acceleration of piston iii) Angular velocity of connecting rod. [8]
- b) In a reciprocating engine, crank length is 10 cm and obliquity ratio is 4. The crank rotates at a uniform speed of 20 rad/sec clockwise. Crank is at  $45^\circ$  from IDC. Using Klein's construction method determine: i) velocity and acceleration of piston ii) Angular velocity and angular acceleration of connecting rod. [9]
- Q5) a)** What is meant by initial tension in belts? Explain the influence of initial tension and co-efficient of friction on power transmitted by belt drive. [8]
- b) Two parallel shafts having centre distance 5 meters are connected by open flat belt. The pulley diameters are 1.6 meters and 1 meter. Initial tension in belt is 3 kN. The belt has a mass of 1.5 kg per meter length. The coefficient of friction of belt and pulley is 0.3. Calculate power transmitted when the faster pulley rotates at 400 rpm. [10]

OR

- Q6) a)** Derive the relation between maximum permissible tension and centrifugal tension in belt so that it can transmit maximum power. [6]
- b) Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 r.p.m. The diameter of the driving pulley of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the centres of two pulleys is 3 meters. The density of the leather is  $1000 \text{ kg/m}^3$ . The maximum allowable stress in the leather is 2.5 MPa. The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt. [12]
- Q7) a)** What are the general requirements of good brake lining materials? State the materials used for brake lining. [8]

- b) Diameter of brake drum of single block brake shown in fig is 1 m. It sustains 280 Nm torque at 300 rpm. The coefficient of friction is 0.35 and the angle of contact is  $90^\circ$ . Determine the required force 'F' to be applied when the rotation of drum is i) clockwise ii) anticlockwise Also find new value of 'a' for self locking of brake [9]

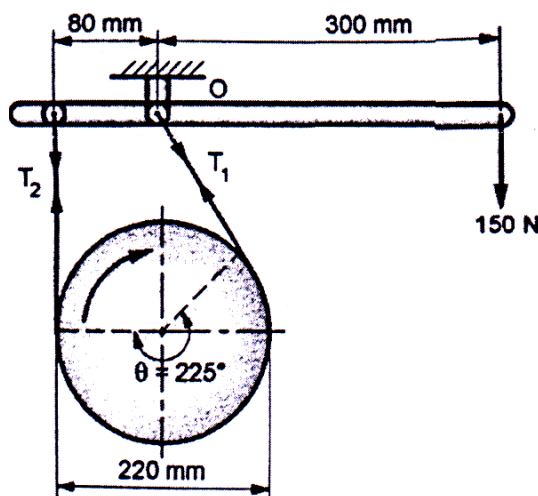


OR

- Q8) a) With the help of neat sketch, explain construction and working of Prony brake dynamometer. [8]
- b) A simple band brake applied to a shaft carrying a flywheel of mass 250 kg and radius of gyration of 350 mm, one end of the band is attached to the fulcrum and other at a distance 80 mm left from fulcrum. The force is applied to the brake lever at a distance 300 mm from fulcrum. The angle embraced by the band is  $225^\circ$ . Brake drum diameter is 220 mm and coefficient of friction 0.25. Shaft speed is 300 rpm clockwise. [9]

Determine :

- Brake torque when force of 150 N is applied.
- Number of revolutions of flywheel before it comes to rest.
- Time taken by flywheel to come to rest.



Total No. of Questions : 8]

SEAT No. :

P-1560

[Total No. of Pages : 3

[6002]-190

S.E. (P.E. & I.E./Production SW)

DESIGN OF MACHINE ELEMENTS

(2019 Pattern) (Semester - IV) (211092/211510)

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) Discuss the different types of threads used in power screw. [6]
- b) Derive the expression Maximum Efficiency of a Square Threaded Screw. [5]
- c) 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 moto. [7]

OR

- Q2)** a) The screw of a shaft straightener exerts a load of 30 kN as shown in Fig. 17.7. The screw is square threaded of outside diameter 75 mm and 6 mm pitch. Determine: i) Force required at the rim of a 300 mm diameter hand wheel, assuming the coefficient of friction for the threads as 0.12; ii) Maximum compressive stress in the screw, bearing pressure on the threads and maximum shear stress in threads; and iii) Efficiency of the straightener. [8]
- b) Derive the Expression for Efficiency of Self Locking Screw. [4]
- c) In the design of power screws, on what factors does the thread bearing pressure depend? Explain. [6]

P.T.O.



**Q3)** A screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor-bronze for which the elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm<sup>2</sup>. Design and draw the screw jack. The design should include the design of i) screw, ii) nut, iii) handle and cup, and iv) body. [18]

OR

**Q4)** a) Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm<sup>2</sup>. Take Wahl's factor,  $K = \frac{4C-1}{4C-4} + \frac{0.615}{C}$ , where C = Spring index. [8]

b) Derive the relationship between Springs in Series and Parallel. [6]

c) Explain what you understand by A.M. Wahl's factor and state its importance in the design of helical springs? [4]

**Q5)** a) The following particulars of a single reduction spur gear are given : Gear ratio = 10: 1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find: 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. [9]

b) Mention four important types of gears and discuss their applications, the materials used for them and their construction. [4]

c) Causes of Gear Tooth Failure explain in detail. [4]

OR

**Q6)** a) Discuss the design procedure of spur gears. [4]

b) How are the gears classified and what are the various terms used in spur gear terminology? [5]

- c) A pair of straight teeth spur gears, having  $20^\circ$  involute full depth teeth is to transmit 12 kW at 300 r.p.m. of the pinion. The speed ratio is 3 : 1. The allowable static stresses for gear of cast iron and pinion of steel are 60 MPa and 105 MPa respectively. Assume the following: Number of teeth of pinion = 16; Face width = 14 times module; Velocity factor ( $C_v$ ) =  $4.5/4.5 + v$ ,  $v$  being the pitch line velocity in m/s; and tooth form factor ( $y$ )  $0.154 - 0.912/\text{No. of teeth}$ . Determine the module, face width and pitch diameter of gears. Check the gears for wear; given  $\sigma_{es} = 600$  MPa;  $EP = 200 \text{ kN/mm}^2$  and  $EG = 100 \text{ kN/mm}^2$ . Sketch the gears. [8]

- Q7) a) Explain along with fig Types of Rolling Contact Bearings. [4]  
b) Write a short note on Types of Roller Bearings. [5]  
c) Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. [8]

OR

- Q8) a) The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is 720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability. [5]  
b) Select appropriate type of rolling contact bearing under the following condition of loading giving reasons for your choice. i) Light radial load with high rotational speed. ii) Heavy axial and radial load with shock. iii) Light load where radial space is very limited. iv) Axial thrust only with medium speed. [4]  
c) How do you express the life of a bearing? What is an average or median life? [4]  
d) Write a Short Note on Reliability of a Bearing. [4]



Total No. of Questions: 8]

SEAT No. :

**P1561**

**[6002]-191**

[Total No. of Pages : 2

**S.E. (Production Engineering/Industrial Engineering)**

**ADVANCED MATERIALS**

**(2019 Pattern) (Semester-IV) (211093)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Assume Suitable data if necessary*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat figures whenever necessary.*
- 5) *Use of scientific calculators is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

**Q1) a)** What are the main parameters need to consider to selecting polymers? **[8]**

b) What are the characteristics of polymer materials? **[8]**

OR

**Q2) a)** Which are important properties of ceramic materials? **[8]**

b) Which sector uses non-metallic materials? **[8]**

**Q3) a)** What is mean by composites? Which are the attractive features of composites make them suitable for special areas of applications? **[9]**

b) How functionally graded materials are prepared? **[9]**

OR

**Q4) a)** Which are the two phases present in a composite material? Describe the functions of each phase. **[9]**

b) Why additive manufacturing is attractive for developing functionally graded materials? **[9]**

**P.T.O.**

- Q5) a)** Explain with sketch any one technique of Polymer matrix composite processing. [9]
- b) Explain with sketch squeeze casting process. [9]

OR

- Q6) a)** Explain with sketch any one technique of Ceramic matrix composite processing. [9]
- b) Explain with sketch Rheo casting process. [9]
- Q7) a)** What are the four categories of advanced materials? Give one example of each. [9]
- b) What is the difference between ISO and ASTM? [9]

OR

- Q8) a)** Where are ASTM standards used? Who uses ASTM standard? [9]
- b) What are the importances of material standards? Who sets ASTM standards? [9]



Total No. of Questions: 8]

SEAT No. :

**P1562**

**[6002]-192**

[Total No. of Pages : 2

**S.E. (P.E & I.E/Production SW)  
INDUSTRIAL ENGINEERING AND MANAGEMENT  
(2019 Pattern) (Semester-IV) (211094)**

*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.*

- Q1)** a) How to perform Analysis of Financial performances. **[5]**
- b) What are Intellectual Property Rights? Why is it important for an Entrepreneur to be aware of IPR? **[6]**
- c) What is sole proprietorship? Explain the merits and demerits of sole proprietorship organization. **[6]**

OR

- Q2)** a) State the methods and importance of Record keeping systems. **[9]**
- b) What are the main features of a startup? Explain the role of Technology in Startups. **[8]**
- Q3)** a) How are wages and Incentives different? Explain the factors affecting Wages. **[8]**
- b) Explain **[9]**
- i) Total productivity
  - ii) Labor productivity
  - iii) Material productivity
  - iv) A factory produces 50,000 toys each week. The equipment costs Rs. 5,000 and will remain productive for three years. The annual labor cost is Rs. 8,000. What is the productivity as measured in units of output per Rupee of input over a 3 year period?

OR

*P.T.O.*

- Q4)** a) Explain the following: [8]  
 i) Job evaluation  
 ii) Merit rating.  
 b) Define Industrial Engineering and state its History and Development. [9]

- Q5)** a) Explain the following: [8]  
 i) Two Handed Process Chart  
 ii) SIMO chart  
 iii) Differences between Two Handed Process Chart and SIMO chart  
 b) Draw the following and State its meaning and uses: [10]  
 i) Any Four symbols used in Flow Process Charts  
 ii) Any Six Therbligs

OR

- Q6)** a) What do you mean by method Study? State its Steps and Applications. [10]  
 b) Explain Tools and Techniques used in the Method Study. [8]

- Q7)** a) Define Time Study and explain different steps of Time study. [8]  
 b) A job is subdivided into five elements. The time for each element and respective rating are as follows: [10]

Elements	Observed Time (minute)	Rating (%)
1	0.7	80
2	0.8	100
3	1.3	120
4	0.5	90
5	1.2	100

Calculate the normal time and standard time for each element and for the job if the allowance is 15%.

OR

- Q8)** a) What are the Second-Generation Methods of Time Study? [8]  
 b) What are the steps involved in developing the standard data? [6]  
 c) What is Work Factor System? State its types. [4]



Total No. of Questions : 8]

SEAT No. :

**P1563**

[Total No. of Pages : 2

[6002]-193

**S.E. (Production Engineering) (Sandwich)**

**MANUFACTURING PROCESS-II**

**(2019 Pattern) (Semester-IV) (211121)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

**Q1) a)** What are fixed cycles? What is difference between fixed cycle and Subroutine? **[9]**

b) List the advantages and dis-advantages of CNC machines. **[8]**

OR

**Q2) a)** Enlist profitable applications of CNC Machines. Explain any two applications in detail. **[9]**

b) Write short notes on the following. (any two) **[8]**

i) Canned Cycle

ii) G Codes

iii) M Codes

**Q3) a)** What is injection moulding? Explain process with a neat sketch. **[9]**

b) Explain extrusion of plastic. Also, elaborate on extruder. **[8]**

OR

**Q4) a)** What is thermoforming stage in plastic processing? Brief it's any applications. **[9]**

b) Compare with a neat sketch pressure forming process over vacuum forming process. **[8]**

**P.T.O.**

- Q5)** a) Explain with neat diagram construction and working of IBM processes.[9]  
b) Draw schematic diagram of EDM. Explain its construction and working.[9]

OR

- Q6)** a) Explain briefly USM process characteristics. [9]  
b) State various methods of rapid prototype. Compare any two methods.[9]

- Q7)** a) Describe the design principles for jigs and fixtures. [9]  
b) Explain the importance accessories of jig and fixture. [9]

OR

- Q8)** a) Explain briefly with neat sketch cylindrical and adjustable locators. [9]  
b) What is meant by clamping? Explain the principle involved in the design of clamp? [9]





Total No. of Questions : 8]

SEAT No. :

**P1564**

[Total No. of Pages : 5

[6002]-194

**S.E. (Printing Engineering)**

**THEORY OF PRINTING MACHINE AND MACHINE COMPONENTS**

**(2019 Pattern) (Semester-III) (202060)**

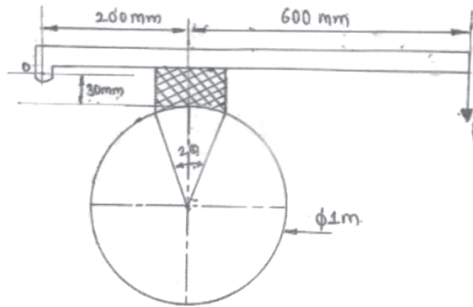
*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer (Q.1 & Q.2) or (Q.3 & Q.4) (Q.5 & Q.6) or (Q.7 & 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 electronic pocket calculator is allowed.*

- Q1) a)** Define brake and gives general requirements of good braking system. [5]
- b)** Write a short note on block brakes. [5]
- c)** A single block brake has a brake drum diameter of 1 m and angle of contact is  $30^\circ$ . It takes 280 Nm torque at 300 rpm. [Take  $\mu = 0.35$ ]
- Determine required force when drum rotating clockwise. [8]



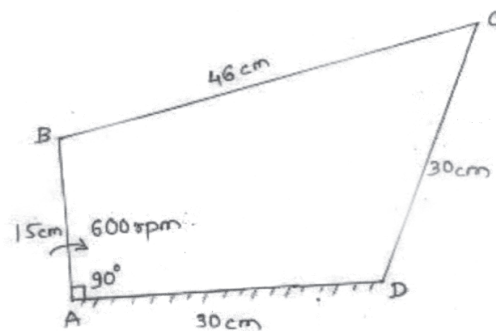
- Q2) a)** Derive an equation for length of cross belt drive. [5]
- b)** State and explain types of belts. [5]
- c)** The width of belts is 15 cm and maximum tension per cm width is not to be exceeded 140 N. The ratio of tension on the two sides is 2.25. The diameter of the driver is 1.05 m and it makes 220 rpm. Find power transmitted. [7]

*P.T.O.*

- Q3)** a) With the help of neat sketch explain single block brake. [5]
- b) Explain self-locking and self-energizing condition for differential band brake. [5]
- c) A bicycle and rider of mass 120 kg are travelling at a speed of 15km/hr on a level road. The rider applies brake to the rear wheel which is 0.9 m diameter. How far bicycle will travel before it comes to rest? Pressure applied 100N and  $\mu=0.05$ . Also find number of revolutions. [8]

- Q4)** a) Explain the following terms. [5]
- i) Belt drive.
- ii) Rope drive.
- b) Explain chain drive with its different types. [5]
- c) The initial tension in a flat belt drive is 1800N. The angle of lap on smaller pulley is  $170^\circ$ . The coefficient of friction of the belt and pulley is 0.25, pulley diameter 0.9 m and runs at 540 rpm. Find the power transmitted. neglect centrifugal tension. [7]

- Q5)** a) A four-bar chain mechanism ABCD with its dimension is shown in figure Q-5a. It is driven by crank AB which rotates at 600 rpm in clockwise direction. The link AD is fixed. Find the absolute velocity of link CB & CD. [10]



Q-5a

- b) The crank of IC. engine is 10 cm long and it rotates at a uniform speed of 20 rad/s clockwise. The length of connecting rod is 40 cm. Determine the velocity and angular acceleration of connecting rod when crank is at  $45^\circ$  from I.D.C. [8]

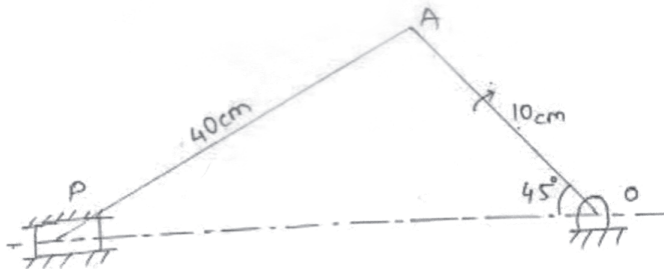


Fig Q-5b

- Q6)** A shaper mechanisms is shown in figure Q-6, A Straight link CD is used to drive the ram. Determine for the position shown the following when the crank AB rotates clockwise at 40 rpm. [17]

- a) Velocity of slider D and angular velocity of link CD.  
 b) Draw the acceleration polygon and find the linear acceleration of slider D and angular acceleration of link of slotted OC.

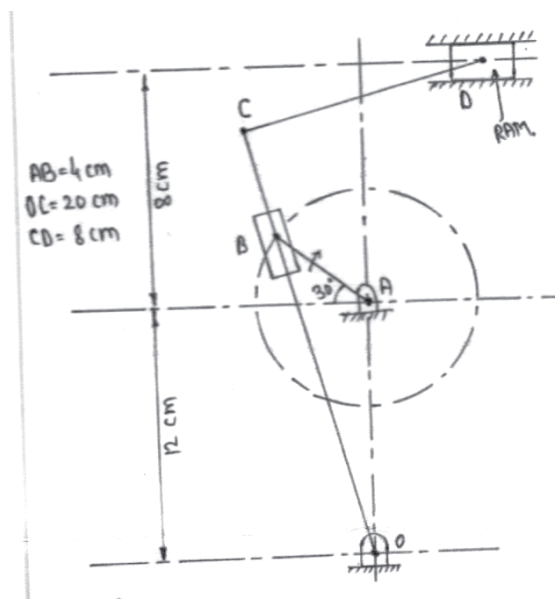


Fig. Q-6

- Q7) a)** In an engine mechanism as shown in figure. The crank BC is 120 mm and connecting rod AB is 250 mm and point X on link AB & 120 mm from B. The crank shaft has a speed of 75 rad/s and angular acceleration of 1400 rad/s<sup>2</sup>. **[12]**

Where, BC=120 mm, AB=250mm, XB=120 mm.

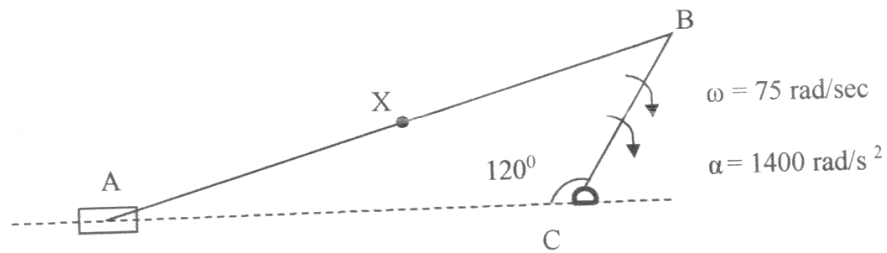


Fig Q-7a

- b)** In an I.C engine, Crank is 20 cm and the connecting rod is 80 cm. The crank is rotating at uniform speed of 30 rad/s clockwise. Find velocity of piston when the crank is at 40°. From IDC. **[6]**

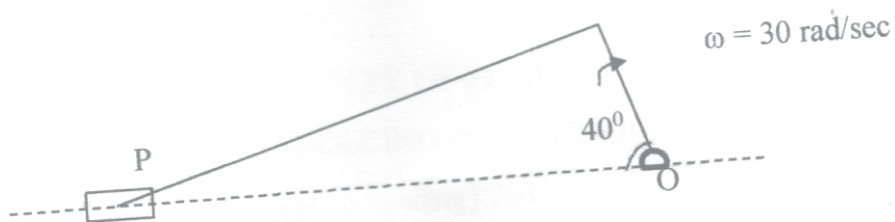


Fig Q-7b

**Q8)** Figure shows a mechanism having four links. Input link  $O_2P$  and  $O_4P$  (part of output link) are both in vertical position as shown. Link  $O_2P$  is having angular velocity  $15 \text{ rad/s}$  in anticlockwise sense and gives oscillatory motion to output link  $O_4RS$ .

Determine-

- Angular velocity of link  $O_4RS$
- Angular acceleration of link  $O_4RS$

[17]

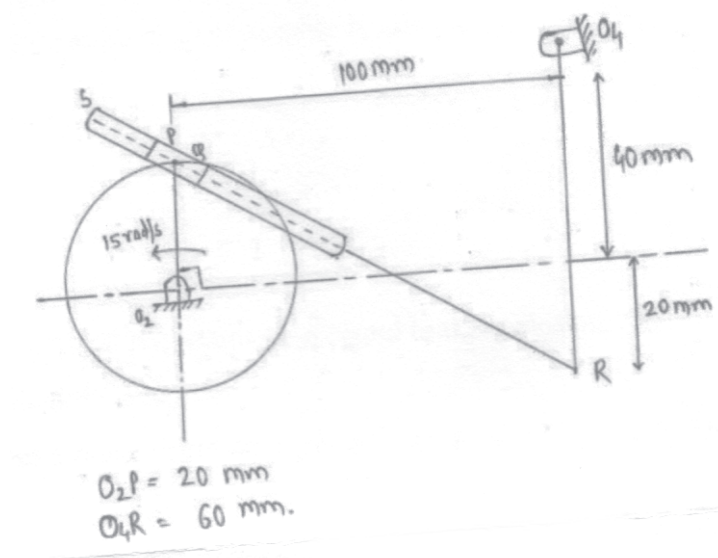


Fig Q-8



Total No. of Questions : 8]

SEAT No. :

**P3149**

[Total No. of Pages : 2

[6002]-195A

**S.E. (Printing)**

**INTRODUCTION TO PRINTING PROCESSES  
(2019 Pattern) (Semester - III) (208281)**

*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.*

- Q1)** a) Explain in brief the frame size selection criteria for screen printing process. [6]
- b) List down and explain in brief the screen frame purpose and requirement. [6]
- c) Explain in brief the squeeze selection criteria for screen printing applications. [5]

OR

- Q2)** a) List down the material required for screen printing and explain the purpose of each material. [6]
- b) Explain the squeeze types and its purpose in screen printing. [5]
- c) Explain in brief important elements affecting the screen printing process. [6]

- Q3)** a) Differentiate between a nylon mesh with stainless steel mesh. [6]
- b) Compare the role of thread diameter with fabric open area, color and ink film thickness in screen printing process. [6]
- c) Explain in brief the geometry (mesh count and thread diameter) in screen printing process. [6]

OR

- Q4)** a) List down the types of mesh used in screen printing process and explain in brief their advantages and disadvantages. [6]
- b) Explain in brief the mesh selection criteria for screen printing applications. [6]
- c) Compare the role of thread diameter with ink transfer in screen printing process. [6]

*P.T.O.*

- Q5)** a) Explain in brief screen angle and halftone process for screen printing process. [6]  
b) Explain in brief the glue selection criteria for screen making. [6]  
c) Compare pneumatic and mechanical fabric stretching methods. [5]

OR

- Q6)** a) List down the fabric stretching methods and explain in brief the fabric stretching methods. [6]  
b) Explain in brief the steps required in preparation for screen stretching process. [5]  
c) Explain in brief four color separation method for screen printing process. [6]

- Q7)** a) Explain in brief the direct screen stencil making process. [6]  
b) Explain in brief the Indirect screen stencil making process. [6]  
c) Explain in brief the direct/indirect screen stencil making process. [6]

OR

- Q8)** a) Explain in brief various screen stencil making process. [6]  
b) Explain in brief the exposure time calculation method for screen stencil making process. [6]  
c) Compare under and over exposure and optimum exposure for screen stencil making process. [6]



Total No. of Questions : 8]

SEAT No. :

**P1566**

[Total No. of Pages : 2

[6002]-196

**S.E. (Printing Engineering)**

**MATERIAL SCIENCE IN PRINTING AND PACKAGING**

**(2019 Pattern) (Semester-III) (208282)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1)** Paper acquires its machine and cross direction in Fourdrinier machine used for paper making. With the neat schematic diagram of wet section of machine, Explain how these directions are acquired by paper. What is significance of defining paper in these directions, what are applications of paper pertaining to MD and CD. **[18]**

OR

- Q2)** a) Aluminum is a preferred plate making material. Justify this statement with properties of aluminum. **[9]**
- b) What different operations are carried out on aluminum to make it eligible as plate making material. **[9]**

**Q3)** What are different ways by which various types of inks dry on substrate, explain each with detailed principle working diagram. **[17]**

OR

- Q4)** a) Explain following with diagram. **[9]**
- i) Caliper and GSM of paper
  - ii) PH of fountain solution
- b) What is importance and purpose of Refining process in manufacturing of paper. **[8]**

**P.T.O.**



**Q5)** Write properties and applications for following. **[18]**

- a) PE
- b) PP

OR

**Q6)** Which different types of flutes are used in corrugated fiber board, what are its applications. Explain with neat schematic diagram. **[18]**

**Q7)** What are the properties and applications of glass as a packaging material, explain in details. **[17]**

OR

**Q8)** Explain the concept of

- a) Surface tension and surface energy and its relation to printability if any
- b) Tensile property and bursting strength of paper

**[17]**



Total No. of Questions : 8]

SEAT No. :

P-1567

[Total No. of Pages : 2

[6002]-197

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 :

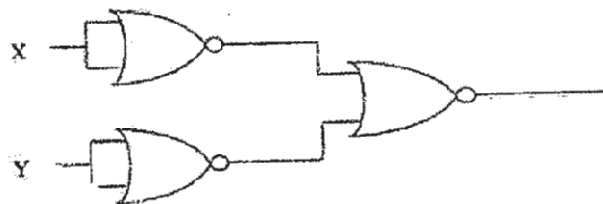
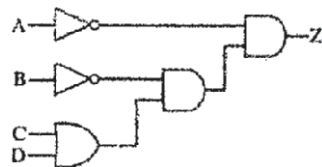
[18]

- a) 1's complement of 011010 =
- b) 2's complement of 11110001
- c)  $10011 \times 101$
- d)  $10001 \div 10$
- e) Solve (10-5) using 2's complement method
- f) Add 10011 and 110011
- g) Convert the 43 and 52 in BCD and add them in BCD form.
- h)  $110001 - 100101$
- i)  $11101 + 11011$

OR

Q2) a) Write down the equations for Following circuits.

[9]



P.T.O.

b) Draw the Circuit diagram for the following equations. [9]

$$Y = y'z' + w'yz + w'xz'$$

$$F1 = X'Y + XY'$$

$$F2 = X'Y'Z + XYZ$$

**Q3)** Draw the D flip flop circuit explain its function table and timing diagram.[17]

OR

**Q4)** Draw and explain BCD Counter with timing diagram. [17]

**Q5)** What is DAC? Describe its specification and Explain any one type of ADC with neat diagram. [18]

OR

**Q6)** a) Differentiate PAL and PLA. [9]

b) Explain any two types of memories. [9]

**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. :

**P-1568**

[Total No. of Pages : 2

**[6002]-198**

**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) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to right indicate full marks.*

- Q1)** a) Torque -Slip Characteristics of 3 phase Induction Motor in details. [9]  
b) Explain any two types of Starters used for 3 phase Induction Motor. [9]

OR

- Q2)** a) Explain any two types of Speed Control methods of 3 phase Induction Motor. [9]  
b) A 12-pole, 3-phase induction motor has rotor resistance per phase =  $1\Omega$  and stand-still reactance per phase =  $3\Omega$ . At stand still rotor induced EMF is 100 volts between the slip rings. Calculate the rotor current per phase and rotor power factor when [9]  
i) slip-rings are short-circuited  
ii) when resistance of  $3\Omega$ /phase is inserted in the rotor circuit.

- Q3)** a) Explain nine requirements of Good Lighting Scheme. [9]  
b) The front of a building  $50\text{ m} \times 16\text{ m}$  is illuminated by sixteen 1000-W lamps arranged so that uniform illumination on the surface is obtained. Assuming a luminous efficiency of 17.4 lumens/watt and a coefficient of utilization of 0.4, determine the illumination on the surface. [8]

OR

**P.T.O.**

- Q4) a)** Explain the types of Lighting Scheme with diagrams. [9]
- b) A badminton hall to be provided with a lighting installation. The hall is 30 m × 20 m × 10 m (high). The mounting height is 5 m and the required level of illumination is 150 /m/m<sup>2</sup>. Using metal filament lamps, estimate the size and number of single lamp luminaries and also draw their spacing layout.

Assume : Utilization coefficient 0.6, Maintenance factor = 0.75, Space/height ratio = 1, Lumens/watt for 300W lamp = 13 lumens/watt for 500W lamp = 16. [8]

- Q5) a)** Explain in details principal of Induction Heating and Vertical Core Type Induction Furnace. [9]
- b) Explain in details of Dielectric Heating with types. [9]

OR

- Q6) a)** Explain in details Temperature Control Methods of Furnaces. [9]
- b) Explain in details Core Less type Induction Furnace. [9]

- Q7) a)** Enumerate the selection of motors depending on load characteristics.[9]
- b) Explain in details Solenoids and Photocells. [8]

OR

- Q8) a)** State the difference between Individual & Group Drive. [9]
- b) Explain in details various types of Relays and Electric Encoders used Printing Industries. [8]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-1569

[Total No. of Pages : 2

**[6002]-199**  
**S.E. (Printing)**  
**FINISHING TECHNIQUES**  
**(2019 Pattern) (Semester - IV) (208286)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.No. 1 or Q.No. 2, Q.No.3 or Q.No. 4, Q.No. 5 or Q.No. 6, Q.No. 7 or Q.No. 8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data, if necessary.*
- 4) *Neat diagrams must be drawn wherever necessary.*

- Q1)** a) 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]

**P.T.O.**

- 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

- 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 10000 books in royal 8 vo size with 1% wastage allowances. [6]  
b) Calculate boards of 90Dkg of 22" × 28" for 1000 books in A5 size. [6]  
c) Calculate cost of endpapers in RA1 size with 90 GSM @ Rs. 75 per kg for 2000 books in A5 size having 240 pages with 2% wastage allowance. [6]

OR

- Q8)** a) Calculate papers for endpaper in double crown size for 5000 books in crown 8 vo size with 1% wastage allowance. [6]  
b) Estimate boards of 90Dkg in RA1 size for 10000 books in A5 size. [6]  
c) Calculate cost of papers for endpapers in 2RA0 size with 70 gsm @ R.70 per kg for 5000 books in A5 size. [6]



Total No. of Questions : 8]

SEAT No. :

P-1570

[Total No. of Pages : 2

[6002]-200

S.E. (Printing Engineering)

INTRODUCTION TO PACKAGING CONCEPTS

(2019 Pattern) (Semester - IV) (208287)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

Q1) a) How packaging is promoting the product in market explain in detail. [9]

b) Explain 5 P's of marketing. [9]

OR

Q2) a) Explain market considerations for package design. [9]

b) How retail marketing has extreme importance. [9]

Q3) a) Write down chemical characteristics of packaging. [9]

b) Explain the effect of barrier properties on product. [8]

OR

Q4) a) How packaging is providing protection to product from biological effects. [8]

b) Write down paper characteristics. [9]

P.T.O.



- Q5)** a) Write down specific ISO standards used in packaging industry. [9]  
b) What is the need of quality control in packaging [9]

OR

- Q6)** a) Explain conditioning in packaging. [9]  
b) What are the general benefits of holding ISO accreditation. [9]

- Q7)** a) Explain the growth of pharmaceutical packaging industry in India. [8]  
b) What improvements needs to be done for packaging waste. [9]

OR

- Q8)** a) What is the packaging scenario of world and India. [8]  
b) How India has become the world's fifth largest packaging industry. [9]



Total No. of Questions : 8]

SEAT No. :

**P1571**

[Total No. of Pages : 2

[6002]-201

**S.E. (Printing Engg.)**

**MICROPROCESSOR AND MICROCONTROLLER**

**TECHNIQUES IN PRINTING**

**(2019 Pattern) (Semester-IV) (208288)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1)** Explain the pin configuration of 8051 microcontroller. **[18]**

OR

**Q2)** a) Explain the PSW, flag register of 8051 microcontroller. **[9]**

b) Describe the RAM and ROM memory organization in 8051 microcontroller. **[9]**

**Q3)** Explain the addressing modes used in 8051 microcontroller. **[17]**

OR

**Q4)** a) Differentiate the microcontroller and microprocessor. **[5]**

b) Explain following instructions in microcontroller 8051 (Any six) **[12]**

- i) MOV A, R5
- ii) MOVC A, @A+DPTR
- iii) MOV A, @R1
- iv) SWAPA
- v) RR A
- vi) MUL AB
- vii) RET
- viii) MOVX A, @DPTR

**P.T.O.**

**Q5)** Describe the pin configuration of 8255. [18]

OR

**Q6)** a) Describe the block diagram of programmable IC 8253. [9]

b) Explain Control word register (CWR) of 8255. [9]

**Q7)** Explain the Interfacing of printer with 8085. [17]

OR

**Q8)** Explain the use of microprocessor and microcontroller in the printing industry. [17]



Total No. of Questions : 8]

SEAT No. :

**P1572**

[Total No. of Pages : 1

[6002]-202

**S.E. (Printing)**

**PRINT PRODUCTION TECHNIQUES  
(2019 Pattern) (Semester - IV) (208289)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary*

**Q1)** a) Explain Additive colour theory and subtractive colour theory. [10]  
b) What is halftone and how it is created. [8]

OR

**Q2)** a) What is hybrid screening with its advantages. [10]  
b) Explain AM and FM Screening with diagrams. [8]

**Q3)** Draw the diagram and explain Subtractive Color Model for C,M,Y, C+M, M+Y, Y+C, C+M+Y. [17]

OR

**Q4)** Explain UCR and GCR with diagram. [17]

**Q5)** a) Explain types of densitometers. [10]  
b) Calculate Hue Error and grayness for Magenta Patch [8]

Where

Density of C = 0.76

Density of M = 1.18

Density of Y = 0.35

OR

**Q6)** a) Explain mechanical dot gain and factors responsible for the same. [10]  
b) Explain optical dot gain and factors responsible for the same. [8]

**Q7)** Explain various parameters of Post Press Consideration. [17]

OR

**Q8)** Explain Relation between Customer-Printer-Designer. [17]



Total No. of Questions : 8]

SEAT No. :

**P1573**

[Total No. of Pages : 5

[6002]-203

**S.E. (Mechanical/Automobile) (Automation & Robotics)**

**(Mechanical Sandwich)**

**SOLID MECHANICS**

**(2019 Pattern) (Semester-III) (202041)**

*Time : 2½ Hours]*

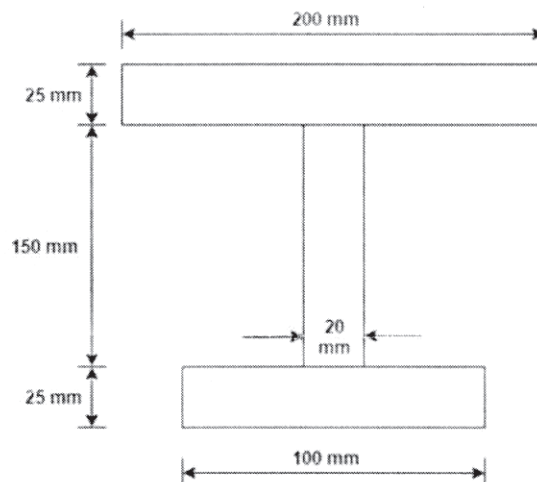
*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use graph paper for Graphical Solution.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** A square beam  $20\text{mm} \times 20\text{mm}$  in section and 2 m long is supported at the ends. The beams fails when a point load of 400 N is applied at the centre of the beam. What uniformly distributed load per meter length will break a cantilever of the same material 40 mm wide, 60 mm deep and 3m long? **[9]**

b) A simply supported beam of span 4 m carries a central point load 100 kN. The beam is I-section of unequal flange as shown in Figure 1. Calculate shear stress at neutral axis and also draw shear stress distribution over the depth of the section. **[9]**



**Figure 1**

OR

*P.T.O.*

- Q2) a)** A T section of flange  $180 \text{ mm} \times 30 \text{ mm}$  and web  $200 \text{ mm} \times 30 \text{ mm}$  is simply supported at the both ends. It carries two concentrated loads of  $110 \text{ kN}$  each acting  $2 \text{ m}$  distance from each support. Span of the beam is  $10 \text{ m}$ . Determine the maximum bending stress induced in the beam and draw bending stress distribution diagram and also find bending stress at the layer  $110 \text{ mm}$  from the bottom. [9]
- b) A simply supported beam of span  $8 \text{ m}$  is subjected to point loads of  $60 \text{ kN}$ ,  $80 \text{ kN}$  and  $50 \text{ kN}$  at  $2 \text{ m}$ ,  $4 \text{ m}$  and  $6 \text{ m}$  from left support respectively. Determine slope at left support and deflection under  $60 \text{ kN}$  and  $80 \text{ kN}$  loads. Take  $EI = 2.668 \times 10^9 \text{ kNm}^2$ . [9]

- Q3) a)** A hollow shaft with diameter ratio  $3/5$  is required to transmit  $450 \text{ kW}$  at  $120 \text{ rpm}$  with a uniform twisting moment. The shearing stress in the shaft must not exceed  $60 \text{ N/mm}^2$  and the twist in a length of  $2.5 \text{ m}$  must not exceed  $1^\circ$ . Calculate the external diameter of the shaft satisfying these conditions. Take the modulus of rigidity is  $8 \times 10^4 \text{ N/mm}^2$ . [9]
- b) A  $4 \text{ m}$  length of a tube has a buckling load of  $2 \text{ kN}$  when used as a column hinged at both ends. Calculate buckling load for  $4.5 \text{ m}$  length of the same tube when used as column if [8]
- Both ends are fixed
  - One end fixed and other is hinged
  - One end is fixed and the other free.

OR

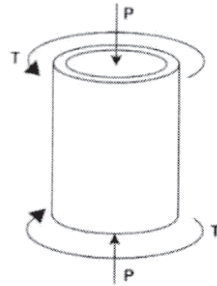
- Q4) a)** A composite shaft consist of copper rod of  $20 \text{ mm}$  diameter enclosed in a steel tube of  $60 \text{ mm}$  external diameter and  $20 \text{ mm}$  thick. The shaft is required to transmit to torque of  $1200 \text{ Nm}$ . Determine the shear stresses developed in the copper and steel 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. [9]
- b) Calculate the critical load for a strut which is made up of a bar circular in section,  $1.2 \text{ m}$  long and which is hinged at one end and fixed at the other end. The same bar when freely supported at its ends gives the central deflection of  $3 \text{ mm}$ , when a load of  $100 \text{ N}$  is placed at its centre. Also find the safe load taking factor of safety is  $3$ . [8]

- Q5) a)** At a point in a strained material, there are two mutually perpendicular stresses of 30 MPa and 70 MPa, both tensile. They are accompanied by a shear stress of 20 MPa. Determine principal plane and principal stresses. Use Mohr's stress circle method only. [9]
- b) A solid circular shaft is subjected to a bending moment of 45 kNm and a torque of 15 kNm. Design the diameter of the shaft according to: [9]
- Maximum principal stress theory
  - Maximum shear stress theory
  - Maximum strain energy theory
- Take  $\mu = 0.25$ , Stress at elastic limit = 200 MPa and factor of safety is 2.

OR

- Q6) a)** A rectangular block of material is subjected to a tensile stress of 110 N/mm<sup>2</sup> on one plane and a tensile stress of 60 N/mm<sup>2</sup> on a plane at right angles, together with shear stresses of 70 N/mm<sup>2</sup> on the faces. Find the following terms: [9]
- The magnitude of principal stresses
  - The magnitude of greatest shear stress
  - The location of principle plane
  - The location of plane containing maximum shear stress.
- b) An axial pull of 25 kN along with a shear force of 20 kN is applied to a circular bar of 20 mm diameter. The elastic limit of the bar material is 250 MPa and Poisson's ratio,  $\mu = 0.3$ . Determine the factor of safety against failure based on: [9]
- Maximum shear stress theory
  - Maximum strain energy theory
  - Maximum principal strain energy theory
  - Maximum shear strain energy theory

- Q7) a)** A segment of a generator shaft is subjected to a torque  $T$  and an axial force  $P$ , as shown in the figure 2. The hollow shaft having outer diameter  $d_2=280$  mm and inner diameter  $d_1=230$  mm and delivers 1800 kW at 4.0Hz. If the compressive force,  $P=525$  kN. What are the maximum tensile, compressive and shear stresses in the shaft? [9]

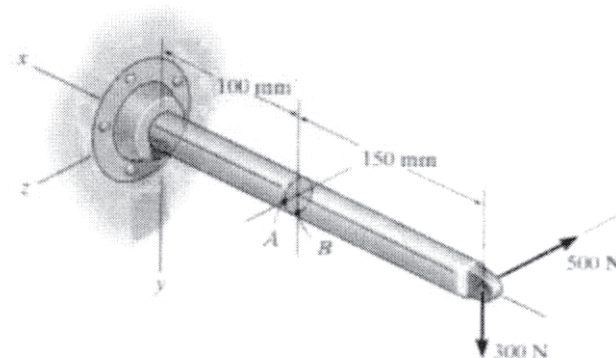


**Figure 2**

- b)** A hollow rectangular section is having external size 600 mm  $\times$  550 mm and internal size 500 mm  $\times$  450 mm. It carries a vertical load of 110 kN at the outer edge of the column on X-axis. Calculate maximum and minimum intensities of stress in the section. Assume 600 mm side horizontal. [8]

OR

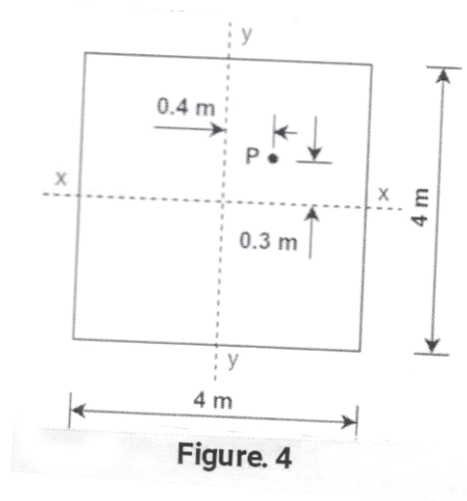
- Q8) a)** The bar has a diameter of 40mm. if it is subjected to the two force components at its end as shown in figure3. Determine the state at point A and B and show the results on a different volume element located at this point. [9]



**Figure 3**



- b) Determine the stress resultant at four corners of Column subjected to eccentric load of 500 kN, as shown in Figure.4 [8]



Total No. of Questions : 8]

SEAT No. :

**P1574**

**[6002]-204**

[Total No. of Pages : 3

**S.E.(Automation & Robotics/Mechanical/Automobile**

**&Mechanical/ Mechanical Sandwich)**

**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) *Figures to the right indicate full marks.*
- 3) *Draw the neat sketch wherever necessary.*

- Q1)** a) List out the various features of solid modeling? **[4]**
- b) What is sweep representation in solid modeling? Explain any four types with neat sketches? **[8]**
- c) What are solid representations? Explain the properties that a solid model should capture mathematically. **[8]**

OR

- Q2)** a) Explain the concept of constructive solid geometry with suitable example? **[4]**
- b) Write a short note on following related to CAD, **[8]**
- i) Design for manufacturing
  - ii) Design for assembly
  - iii) Design for disassembly
  - iv) Design for safety
- c) What do you mean by half space in solid modeling? Explain with types and suitable example? **[8]**

*P.T.O.*

- Q3)** a) A triangle ABC with vertices A(2, 4) B (4, 6), and C(2, 6) is to be reflected about the line  $x - 2y + 4 = 0$ . [8]

Determine:

- i) The composite transformation matrix; and
  - ii) The coordinates of the vertices for a reflected triangle.
- b) What is the significance of homogeneous coordinates in geometric transformations? Explain the two dimensional Translation, Rotation, Scaling and Reflection in matrix form. [8]

OR

- Q4)** a) Prove that the multiplication for transformation matrices for each of the following sequence of operation is commutative, [8]

- i) Two successive rotations.
- ii) Two successive translations.
- iii) Two successive scaling.

Also prove in general uniform scaling is cumulative but not about non-uniform scaling.

- b) Explain the concept of orthographic and perspective view in computer graphic with matrix form for various views? [8]

- Q5)** a) List out the points to be considered for Best Practices of CAD conversion. What are key aspects that are essential and to be considered while performing CAD conversion from one system to another? [8]

- b) Explain the concept of data exchange in CAD with its types of content and any two types? [8]

OR

- Q6)** a) Define additive manufacturing? Explain the 3D printing with principal of working, advantages, disadvantages and applications? [8]

- b) Explain the concept of multibody dynamics with suitable example and applications? [8]

- Q7) a)** Define Direct Data Translators? Explain the role of neutral file formats in CAD with its advantages and disadvantages? **[10]**
- b) Explain CAD customization with advantages, disadvantages and applications? **[8]**

OR

- Q8) a)** Explain the advantages of PMI over conventional 2D drawings? List out the advantages user can achieve by using PMI in creating 2D drawings. **[10]**
- b) Explain the following Types of customization with suitable examples, (any two) **[8]**
- i) Cosmetic
  - ii) Transparent
  - iii) Adaptive
  - iv) Collaborative



Total No. of Questions : 8]

SEAT No. :

**P1575**

**[6002]- 205**

[Total No. of Pages : 2

**S.E. (Automation & Robotics)  
ELECTRICAL TECHNOLOGY  
(2019 Pattern) (Semester - III) (202521)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain two types of rotor construction of a three phase induction motor with the help of suitable diagrams. [6]
- b) Derive the generalised torque equation of three phase induction motor and draw torque-slip characteristics of this motor. [6]
- c) A 3 phase, 4 pole, 50Hz slip ring induction motor used in electrically operated public transport bus has a star connected rotor winding. The rotor has resistance of  $0.1 \Omega$  per phase and standstill reactance of  $2 \Omega$  per phase. Induced emf between the slip rings is 100 V while the speed is 1460 rpm. Calculate (i) synchronous speed (ii) slip (iii) induced emf per phase in rotor (iv) rotor reactance per phase while running (v) rotor current and (vi) rotor power factor. [6]

**OR**

- Q2)** a) Explain the concept of rotating magnetic field with the help of suitable diagrams. [6]
- b) Explain working principle of a linear induction motor and state its applications. [6]
- c) Why starting current of a Induction motor is high? What will happen if high capacity induction motor is started without using starting arrangement? [6]
- Q3)** a) With help of suitable diagram, explain working of permanent magnet type of stepper motor. [6]
- b) Write one important feature and an application each of the following motors. [6]
- (i) stepper motor (ii) servo motor and (iii) universal motor
- c) Explain construction and working of a synchronous machine. [5]

**OR**

*P.T.O.*

- Q4)** a) Explain the working of an universal motor with help of suitable diagram.[6]  
b) Describe the types of a servo motor. [6]  
c) State any five factors for selection of motor for specific applications with brief explanation of each. [5]

- Q5)** a) Explain structure of an electrical power system with the help of suitable diagram and list down various methods of generating electricity. [6]  
b) Differentiate between transmission and distribution system. [6]  
c) Explain EHVDC transmission system with the help of suitable diagram.[6]

**OR**

- Q6)** a) Compare EHVAC and EHVDC transmission systems. [6]  
b) Explain any two renewable generation methods with their advantages and drawbacks. [6]  
c) Explain layout of a typical substation with suitable diagram and list down main components of the same. [6]

- Q7)** a) Compare open loop and closed loop control systems. [6]  
b) Draw typical signal flow diagram and state Mason's gain formula. What is the advantage over block diagram reduction method? [6]  
c) Explain transfer function of an AC servo motor with suitable diagram.[5]

**OR**

- Q8)** a) Write advantages of modeling a physical system and explain the concept of transfer function with the help of suitable example. [6]  
b) State the rules followed while applying block diagram reduction technique. [6]  
c) Obtain the transfer function of a tacho-generator in steps. [5]



Total No. of Questions : 8]

SEAT No. :

**P1576**

[Total No. of Pages : 2

[6002]-206

**S.E. (Mechanical/Automobile/Mechanical SW/Automation & Robotics)**

**ENGINEERING MATERIALS AND METALLURGY**

**(2019 Pattern) (Semester-III) (202044)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.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) *Use Graph paper for graphical solution.*
- 4) *The use of an electronic pocket calculator is allowed.*
- 5) *Assume Suitable data if necessary.*

- Q1)** a) Explain Gibbs phase rules for metallurgical application? [6]  
b) Discuss nucleation & crystal growth in solidification of pure metals?[6]  
c) With neat lables draw Iron Carbon Equilibrium Diagram? [6]

OR

- Q2)** a) Explain homogenous and heterogeneous nucleation with neat sketches.[6]  
b) List and explains all critical temperature of Iron Carbon Equilibrium Diagram? [6]  
c) Draw neat microstructures of the following. [6]  
i) 0.2% carbon steel,  
ii) 0.8% carbon steel  
iii) 1.2% carbon steel

- Q3)** a) What is tempering process? Why tempering is carried out after hardening? List classification and application of tempering process? [6]  
b) What is retained austenite & how it affects properites of steel? List process to remove retain austenite. [6]  
c) Define hardenability? Differentiate betwen austempering and Martempering with diagram? [5]

OR

*P.T.O.*

- Q4)** a) Define annealing and explain types of annealing? [6]  
b) Draw isothermal time temperature transformation diagram? What is the importance of TTT diagrams in Heat Treatment processes? [6]  
c) Differentiate between Carburizing and Nitriding. [5]
- Q5)** a) What is IS, AISI and SAE? Explain in detail. [6]  
b) Define steel? Explain classification of steel with application? [6]  
c) Draw the microstructure of Grey Cast Iron, White Cast Iron and Nodular Cast Iron. [6]

OR

- Q6)** a) State the composition of the following steel which is specified as per Indian Standard Designation System. [6]  
i) T75W18Cr4V1  
ii) Fe410K  
iii) C20  
iv) St 310Kv  
v) 80 T11  
vi) FeE 330
- b) Write a short note on Grey Cast Iron and Nodular Cast Iron. [6]  
c) Write short note on tool steel? [6]
- Q7)** a) Give typical composition, important properties and applications of Inconel? [6]  
b) What is age hardening? Explain with example applications of age hardening? [6]  
c) List important properties of aluminium? Write composition and application of duralumin? [5]

OR

- Q8)** a) Give typical composition, important properties and applications of Cartridge brass? [6]  
b) Differentiate between Brass and Bronze? [6]  
c) What properties are required for bearing materials? Give composition of any two nonferrous alloy used as bearing? [5]





Total No. of Questions : 8]

SEAT No. :

P-1577

[Total No. of Pages : 3

[6002]-207

S.E. (Automation & Robotics Engineering)

INDUSTRIAL ELECTRONICS

(2019 Pattern) (Semester - III) (202522)

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) State the types of programming languages and explain any two. [6]  
b) Explain UP Counter and DOWN Counter. [6]  
c) Explain Bit Instructions with neat ladder diagram and symbol : [6]  
i) XIC  
ii) XIO  
iii) OTL

OR

- Q2)** a) Explain the rules for constructing the ladder diagram of PLC. [6]  
b) State the types of timers. Explain on delay timer operation with diagram. [6]  
c) Draw the ladder diagram for traffic light controller for following  
Switch I1 is used to start and I2 is used to stop the cycle. There will be three lamps red, yellow and green lamps as output. [6]

- Q3)** a) List out the Communication Protocols used in PLC. [6]  
b) Differentiate between SCADA and HMI. [6]  
c) What are the functions of HMI. [5]

OR

P.T.O.

- Q4)** a) Explain the types of HMI. [6]  
b) Explain with neat diagram hierarchical level in Industrial Communication Networks. [6]  
c) Explain the advantages of HMI. [5]

- Q5)** a) Explain the types of models in Batch Process. [6]  
b) Develop PLC Programming Batch Process ladder logic program according to logic given below, [6]  
i) Ingredient A is sent to the tank first by energizing solenoid 1. The flow meter gives one pulse for every gallon of flow. Solenoid Valve will be open until 200 gal has poured in.  
ii) After ingredient A is in the tank, 200 gal of ingredient B should be added. The process of adding follows the same procedure as ingredient A.  
iii) Once step 2 is done, the mixer motor starts and runs for 10s.  
iv) After mixing is complete, solenoid 3 should open, let the mixed batch goes to the finished tank.  
v) When the tank is empty, the low-level sensor turns ON to open solenoid 3 to close and restarts the process again.  
c) What is Extrusion? Explain in detail types of extrusion? [6]

OR

- Q6)** a) Define recipe as per ANSI/ISA S88 standard. Explain its types. [6]  
b) Develop ladder logic program for Multiple Pumps Control according to the logic given below : [6]  
i) The start/stop push button is provided for control of the two input pump motors P1 and P2.  
ii) The Start/Stop pushbutton station is operated to control pump P1.  
iii) When the tank is full drain pump motor P3 is started automatically and runs until the low-level sensor is actuated.  
iv) After 3 fillings of the tank by pump P1 control automatically shifts to pump P2.  
v) The operation of the start/stop pushbutton now controls pump P2.  
vi) After 3 fillings of the tank by pump P2, the sequence is repeated.  
c) Describe the three types of control typically needed in batch manufacturing. [6]

- Q7)** a) Compare CMOS and TTL logic family. [6]  
b) Define the following terms : [6]  
i) Power Dissipation  
ii) Propagation delay  
iii) Noise Margin  
c) Explain with a neat diagram CMOS NOR gate. [5]

OR

- Q8)** a) Explain the concept of Tristate logic. [6]  
b) What is logic family? Give comparisons between TTL, ECL and CMOS logic families. [6]  
c) Explain with a neat diagram CMOS inverter. [5]



[6002]-208

**S.E. (Automation & Robotics/Automobile &  
Mechanical/Mechanical/Mechanical SW)  
KINEMATICS OF MACHINERY  
(2019 Pattern) (Semester-IV) (202047)**

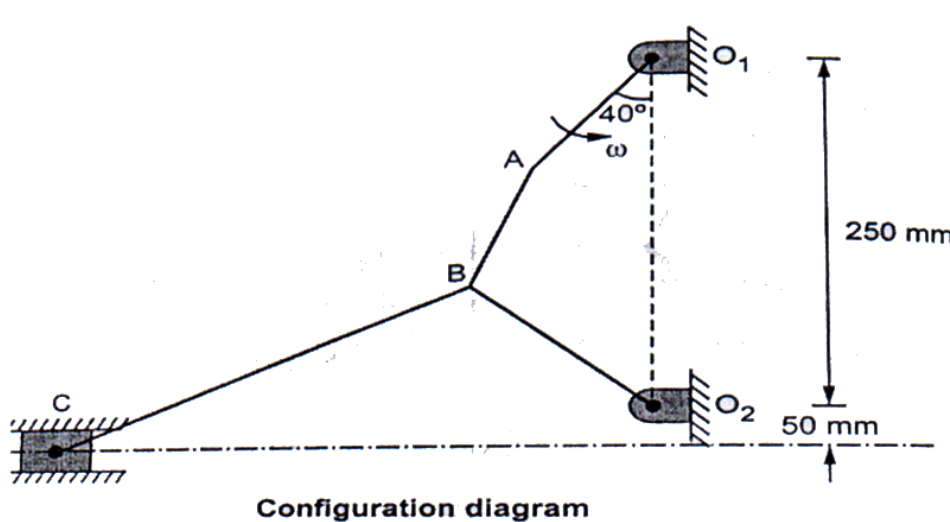
Time : 2½ Hours]

[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) Use of calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Explain acceleration image principle with neat sketch. [5]
- b) For the mechanism as shown in fig, the length of the links are  $O_1A = 100\text{mm}$ ,  $O_2B = 150\text{ mm}$ ,  $AB = 105\text{ mm}$ ,  $BC = 300\text{ mm}$ . Crank  $O_1A$  rotates at 180 rpm. find the acceleration of slider C using relative velocity and acceleration method. [13]

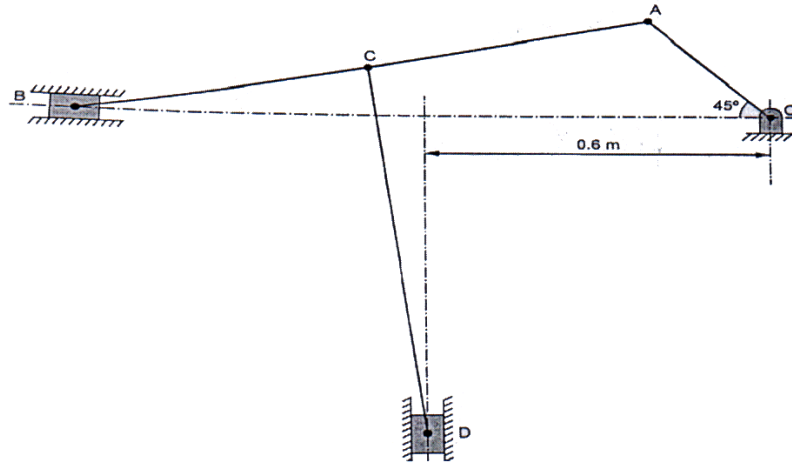


OR

- Q2)** a) Explain coriolis component of acceleration with neat sketch. [5]

P.T.O.

- b) The length of various links of mechanisms as shown in fig are  $OA = 0.3$  m,  $AD = 1$  m,  $CD = 0.8$  m and  $AC = CB$ . Determine for the given configuration, (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 ICR method. [13]



- Q3) a) Explain 3 position relative pole method for synthesis of four bar chain mechanism. [5]
- b) A four bar chain Mechanism is to be synthesized by using three precision points, to generate the function  $y = x^{1.5}$  for the range  $1 < x < 4$ , Input link is to start from  $30^\circ$  and is to have range of  $90^\circ$ . The output link is to start at  $0^\circ$  and is to have range of  $90^\circ$ . Find out the values of  $x, y$  (Input angles) and (Output angles) corresponding to the three precision points. [12]

OR

- Q4) a) Explain the following terms : [6]
- Dimensional Synthesis
  - Type Synthesis
  - Number Synthesis
- b) Design a four bar mechanism with input link  $l_2$ , coupler link  $l_3$  & output link  $l_4$ . Angles  $\theta$  &  $\phi$  for 3 successive positions are given below.

[11]

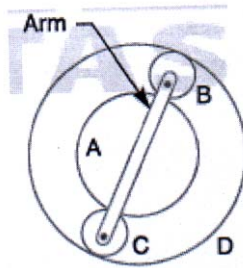
Position	1	2	3
$\theta$	$40^\circ$	$55^\circ$	$70^\circ$
$\phi$	$50^\circ$	$60^\circ$	$75^\circ$

If grounded link  $l_1 = 30$ mm, using frudenstein's equation, find out lengths of other links to satisfy given positional conditions. Also draw synthesize mechanism in its first position

- Q5) a)** Explain classification of gears along with applications of each type. [6]  
**b)** Two involute gears of  $20^\circ$  pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find : [12]  
 i) The angle turned through by pinion when one pair of teeth is in mesh ; and  
 ii) The maximum velocity of sliding.

OR

- Q6) a)** Define in case of Spur gear : (i) Module (ii) gear ratio (iii) Addendum (iv) diametral pitch (v) contact ratio [5]  
**b)** The pinions of an epicyclic train of gears is arranged as shown in Fig. How many revolutions does the arm, to which B and C are attached, make? [13]  
 i) when A makes one revolution clockwise and D makes half a revolution anticlockwise and  
 ii) when A makes one revolution clockwise and D is stationary. The number of teeth on the gears A and D are 40 and 90 respectively.



- Q7) a)** Outline how storage buffers may be deployed in automated production lines. [5]  
**b)** A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: [12]  
 1. To raise the valve through 50 mm during  $120^\circ$  rotation of the cam.;  
 2. To keep the valve fully raised through next  $30^\circ$ ;  
 3. To lower the valve during next  $60^\circ$ ; and  
 4. To keep the valve closed during rest of the revolution i.e.  $150^\circ$ ;  
 The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm.  
 Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft.

OR

**Q8) a)** Write Methods of Transfer Lines with suitable example. **[5]**

b) The following data related to a cam profile for knife edge follower, in which the follower moves with uniform acceleration and retardation during the lift and returning it with S.H.M

1. Minimum radius of cam,  $r_b = 30$  mm.
2. Lift of follower,  $S = 25$ mm.
3. Offset of follower axis,  $e = 6$ mm towards right
4. Angle of ascent,  $\theta_0 = 60^\circ$
5. Outer dwell angle,  $\theta_d = 45^\circ$ .
6. Angle of return,  $\theta_r = 75^\circ$

Draw the cam profile. Also find maximum velocity during lift of follower and Maximum acceleration during return of follower. Cam is rotating uniformly with 250 rpm **[12]**



Total No. of Questions : 8]

SEAT No. :

P-1579

[Total No. of Pages : 3

[6002]-209

S.E. (Automation and Robotics)

PRINCIPLES OF ROBOTICS

(2019 Pattern) (Semester - IV) (202524)

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer four questions from the following*
- 2) *Draw neat labeled diagrams wherever necessary*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of non-programmable electronic calculator is permitted.*
- 5) *Assume Suitable/Standard data if necessary.*

- Q1)** a) What are adaptive grippers? State its applications in industrial robot. [4]
- b) Discuss in details Mechanical Grippers. State its applications in industrial robot. [6]
- c) What is a RCC device? For what purpose is it used in a robot? [8]

OR

- Q2)** a) Discuss the design considerations for robot end-effectors in industrial use. [4]
- b) Give at least two applications of the following grippers: Linkage actuation gripper, Gear and rack actuation gripper, Screw actuated gripper. [6]
- c) Distinguish active and passive compliance in end effector with industrial application. [8]
- Q3)** a) Discuss in details need of sensor in robotics? [4]
- b) How will you determine the response time of a sensor in ROS? [6]
- c) Distinguish between Sensor and transducer? Explain role of a transducer in a control system? [7]

*P.T.O.*



OR

- Q4)** a) Discuss in details role of Encoder in robotic system. Explain any one Encoder with neat sketch? [6]  
b) Write a short note on Laser Range Meter? [4]  
c) Write Short notes on industrial robotic application of Light Curtains and Laser Area Scanner. [7]

- Q5)** a) Explain the homogenous transformation matrix approach in planning of Cartesian path trajectories. [4]  
b) Sketch and explain Forward and Inverse Kinematics. [6]  
c) A point P (8, 4, 2) is attached to frame and subjected to following transformations. [8]

Find coordinate of point relative to reference frame.

- i) Rotation of 90 Degrees about z-axis  
ii) Followed by rotation of 90 Degrees about y-axis.  
iii) Followed by translation of [5, -4, 8]

OR

- Q6)** a) A frame F has been moved 8 units along y-axis and 4 units along z axis of reference frame. Find new location of frame. [4]

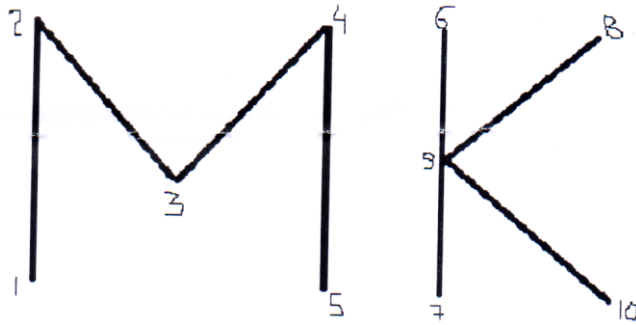
$$F = \begin{bmatrix} 0.527 & -0.574 & 0.628 & 5 \\ 0.369 & 0.819 & 0.439 & 3 \\ -0.766 & 0 & 0.643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- b) What are the methods to obtain the jacobian for a six-link manipulator with rotator joints? [6]  
c) Sketch and explain kinematic pair, kinematic chain and Mechanism. Revolute Joint and Prismatic Joint? [8]

- Q7)** a) Give any four examples of Industrial Programming Language. [4]  
b) Distinguish On-line and off-line programming. [6]  
c) Sketch and explain with suitable example “A Robot Program as a Path in Space”. [7]

OR

- Q8) a) What is meant by Robot Programming? [4]  
b) Write a program to write below letters by Robot using VAL Language. [6]



- c) Write short notes on : [7]  
i) Humanoid Robot  
ii) Robots in non-manufacturing applications



Total No. of Questions : 8]

SEAT No. :

P-1580

[Total No. of Pages : 3

[6002]-210

S.E. (Automation & Robotics)

FLUID AND THERMAL ENGINEERING

(2019 Pattern) (Semester - IV) (202523)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer four questions from the following.
- 2) Draw neat labeled diagrams wherever necessary.
- 3) Figures to the right side indicate full marks..
- 4) Use of non programmable electronic calculator is permitted.
- 5) Assume Suitable/Standard data if necessary.

**Q1)** a) Two sharp ended pipes of diameters 50 mm and 100 mm respectively, each of length 100 m are connected in parallel between two reservoirs which have a difference of level of 10 m. If the coefficient of friction for each pipe is 0.32, calculate the rate of flow for each pipe and also the diameter of single pipe 100 m long which would give the same discharge, if it were submitted for original two pipes. [10]

b) What are major and minor losses? Derive an expression for Darcy-Weisbach equation. [8]

OR

**Q2)** a) Derive an expression of velocity and shear stress distribution for laminar flow between fixed parallel plates. [8]

b) A siphon of diameter 0.2m connects two reservoirs having a difference in elevation of 20m. The length of the siphon is 500m and summit is 3m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100m. Determine the discharge through the siphon and also pressure at the summit. Neglect minor losses. Take coefficient of friction  $f = 0.005$ . [10]

P.T.O.

**Q3) a)** Explain applications and selection criterion of valves in robotics and automation systems. [8]

- b) Define control valve. State the characteristics of : [9]
- i) Globe Valve
  - ii) Ball Valve
  - iii) Plug Valve.

OR

**Q4) a)** Discuss the desired characteristics of control valves. [8]

- b) Write a note on : [9]
- i) Electric actuator
  - ii) Solenoid actuator and
  - iii) Digital actuator

**Q5) a)** A single-stage single-acting compressor delivers  $15 \text{ m}^3$  of free air per minute from 1 bar to 8 bar. The speed of compressor is 300 r.p.m. Assuming that compression and expansion follow the law  $p v^{1.3} = \text{constant}$  and clearance is  $1/16$  of the swept volume, find the diameter and stroke of the compressor. Take  $L/D = 1.5$ . The temperature and pressure of air at the suction are same as atmosphere. [10]

- b) Explain the concept of inter-cooler and after cooler. [7]

OR

**Q6) a)** A single-stage, single-acting air compressor running at 1000 r.p.m delivers air at 25 bar. For this purpose, the induction and free air conditions can be taken as 1.013 bar and  $150^\circ\text{C}$  and the free air delivery as  $0.25 \text{ m}^3/\text{min}$ . The clearance volume is 3% of the swept volume and the stroke bore ratio is 1:2:1. Take the index of compression and expansion as 1.3. Calculate also the indicated power and the isothermal efficiency. [12]

- b) Differentiate between Reciprocating and Rotary Compressors. [5]

**Q7) a)** A wall of furnace is made up of inside layer of silica brick 120 mm thick covered with a layer of magnesite brick 240 mm thick. The temperatures at the inside surface of silica brick wall and outside surface of magnesite brick wall are  $725^\circ\text{C}$  and  $110^\circ\text{C}$  respectively. The contact thermal resistance

between the two walls at the interface is  $0.0035^{\circ}\text{C}/\text{W}$  per unit wall area. If thermal conductivities of silica and magnesite brick are  $1.7 \text{ W/m }^{\circ}\text{C}$  and  $5.8 \text{ W/m }^{\circ}\text{C}$ , calculate. [9]

- i) The rate of heat loss per unit area of walls and
  - ii) The temperature drop at the interface.
- b) Derive general three dimensional heat conduction equation in Cartesian coordinates. Also, deduce the equation in simplified forms. [9]

OR

Q8) a) Explain the concept of thermal diffusivity and thermal contact resistance. [7]

- b) The furnace wall consists of 120 mm wide refractory brick and 120 mm wide insulating fire brick separated by an air gap. The outside wall is covered with a 12 mm thickness of plaster. The inner surface of wall is at  $1090^{\circ}\text{C}$  and the room temperature is  $20^{\circ}\text{C}$ . The heat transfer coefficient from the outside wall surface to the air in the room is  $18 \text{ W/m}^2 \text{ }^{\circ}\text{C}$  and the resistance to heat flow of air gap is  $0.16 \text{ K/W}$ . If the thermal conductivities of the refractory brick, insulating fire brick and plaster are 1.6, 0.3, and  $1.4 \text{ W/mK}$ , respectively calculate: [11]

- i) The rate at which heat is lost per  $\text{m}^2$  of the wall surface
- ii) Each interface temperature and
- iii) Temperature of the outside surface of the wall



Total No. of Questions : 8]

SEAT No. :

**P1581**

[Total No. of Pages : 2

[6002]-211

**S.E. (Mechanical/Automobile)(Automation & Robotics)**

**MANUFACTURING PROCESSES  
(2019 Pattern) (Semester-IV) (202050)**

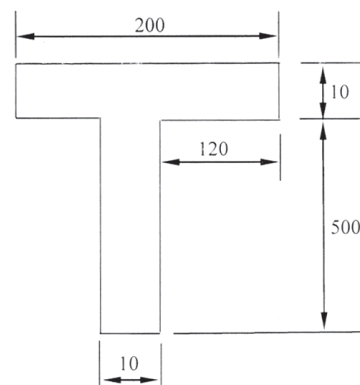
*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All question are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *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 a compound die and a combination die. [4]  
b) Explain the method of reducing cutting forces in sheet metal work. [4]  
c) Find center of pressure of the component as shown in fig. [10]



All dimensions are in mm.

OR

- Q2)** a) What is strip layout? Explain with proper sketch. [4]  
b) Washer with 12 mm internal hole and 25 mm outside diameter is to be made from a strip of 1.5 mm thickness. Considering elastic recovery of the material, find [10]  
i) Clearance  
ii) Blanking die opening size  
iii) Blanking punch size  
iv) Piercing punch size  
v) Piercing die opening size. Assume clearance to be 5% of the stock thickness.  
c) Explain with neat sketch-Metal spinning [4]

*P.T.O.*

- Q3)** a) Explain principle of resistance welding with neat sketch. State its advantages and limitations. [5]  
b) Explain different types of flames with neat sketches in gas welding process. [6]  
c) Explain any three welding defects with their causes and remedies. [6]

OR

- Q4)** a) Differentiate between TIG welding and MIG welding. [5]  
b) Explain submerged arc welding process with neat sketch. [6]  
c) What are the functions of coating in coated electrode? [6]

- Q5)** a) Explain blow moulding with suitable sketch. State its advantages, limitations and applications. [6]  
b) Explain with neat sketch pressure thermoforming. State its advantages and disadvantages. [6]  
c) Explain extrusion process for thermoplastic plastics. [6]

OR

- Q6)** a) With neat sketch describe injection molding process with its advantages, limitations and applications. [6]  
b) Compare between Thermosetting plastic and Thermoplastic plastic. [6]  
c) Describe screw type injection moulding with neat sketch. [6]

- Q7)** a) What are composites? State its advantages, limitations and applications. [6]  
b) Explain fiber reinforced composites and particle reinforced composites. [5]  
c) Differentiate between open mould and closed mould process. [6]

OR

- Q8)** a) Explain compression moulding process of composite manufacturing. [6]  
b) Write a short note on-polymer matrix composites (PMC) [5]  
c) Explain hand lay-up process of composite manufacturing. [6]



Total No. of Questions : 9]

SEAT No. :

**P1582**

[6002]-212

[Total No. of Pages : 5

**S.E. (Automobile/ Mechanical/ Mechanical Sandwich/ Mechatronics/  
Automation & Robotics)**

**ENGINEERING MATHEMATICS -III  
(2019 Pattern) (Semester - III & IV) (207002)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Question No.1 is compulsory.*
- 2) *Solve Q.No.2 or Q.No.3, Q.No.4 or Q.No.5, Q.No.6 or Q.No.7, Q.No.8 or Q.No.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 correct option of the following.

a) The curl of vector field  $\vec{F} = x^2y\vec{i} + xyz\vec{j} + z^2y\vec{k}$  at point (0,1,2) is \_\_\_\_\_. [2]

i)  $4\vec{i} - 2\vec{j} + 2\vec{k}$

ii)  $4\vec{i} + 2\vec{j} + 2\vec{k}$

iii)  $4\vec{i} + 2\vec{k}$

iv)  $2\vec{i} + 4\vec{k}$

b) The most general solution of wave equation  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  subjected to usual initial and boundary conditions [2]

I)  $u(0, t) = 0, \forall t,$

II)  $u(l, t) = 0, \forall t,$

III)  $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$

IV)  $u(x, 0) = f(x)$  is  $u(x, t) =$

i)  $(C_1 \cos mx + C_2 \sin mx) (C_3 \cos cmt + C_4 \sin cmt)$

ii)  $(C_1 \cos mx + C_2 \sin mx)$

iii)  $C_3 \cos cmt + C_4 \sin cmt$

iv)  $C_1 e^{mx} + C_2 e^{-mx}$

**P.T.O.**



c) In a Poisson distribution if  $n = 100, p = 0.01$  then  $P(r = 0) = \underline{\hspace{2cm}}$ . [2]

i)  $\frac{1}{e}$

ii)  $\frac{2}{e}$

iii)  $\frac{3}{e}$

iv)  $\frac{4}{e}$

d) The first four moments about value 4 are 0, 2, 0, 11; then the value of fourth central moment is [2]

i) 0

ii) 2

iii) 11

iv)  $\frac{2}{11}$

e) The Regression line of  $y$  on  $x$  is given by [1]

i)  $(x - \bar{x}) = b_{xy}(y - \bar{y})$

ii)  $(y - \bar{y}) = b_{yx}(x - \bar{x})$

iii)  $(x - \bar{x}) = b_{yx}(y - \bar{y})$

iv)  $(y - \bar{y}) = b_{xy}(x - \bar{x})$

f) The value of  $\nabla e^r = \underline{\hspace{2cm}}$  [1]

i)  $e^r \bar{r}$

ii)  $\frac{e^r}{r}$

iii)  $\frac{e^r - r}{r}$

iv)  $\frac{r - e^r}{e^r}$

**Q2) a)** Fit a straight line  $y = mx + c$  to the following data. [5]

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

b) First four moments of a distribution about the value 2 are 1, 2.5, 5.5 and 16. Find first four central moments  $\beta_1$  and  $\beta_2$ . [5]

c) Calculate the coefficient of correlation for the following data. [5]

$x$	-1	1	2	4	6	7
$y$	-1	2	3	3	5	8

OR

**Q3) a)** Fit a straight line of the form  $y = ax + b$  to the following data. [5]

$x$	0	1	2	3	4
$y$	14	27	40	55	68

b) The first four moments of distribution about working mean 3.5 are 0.0375, 0.4546, 0.0609 and 0.5074. Calculate the first four central moments. [5]

c) Obtain regression line of the following data. [5]

$x$	2	4	5	6	8	11
$y$	18	12	10	8	7	5

**Q4) a)** A series of five one day matches is to be played between India and Sri Lanka. Assuming that the probability of India's win in each match as 0.6 and result of all five matches is independent of each other. Find the probability that India wins the series. [5]

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

i) with no breakdown

ii) at most one breakdown in a week.

c) The 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 [Given :  $A(z = 1.2) = 0.3849$ ,  $A(z = 1.3) = 0.4032$ ]. [5]

OR

**Q5) a)** A coin is tossed 4 times.  $X$  denote the number of heads. Find the expectation of  $x$ . [5]

b) If 10% of the rivet's produced by the machine are defective, find the probability that out of 5 rivets chosen at random at least two will defective. [5]

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

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

Are the data consistent at 5% level of singificance with hypothesis that the die is unbiased? (Given :  $\chi_{5,0.05}^2 = 11.07$ ). [5]

- Q6) a)** Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$  and  $x^2 + y^2 - 3 = z$  at the point  $(2, -1, 2)$ . [5]

- b) Show that  $\vec{F} = (ye^{xy} \cos z) \vec{i} + (xe^{xy} \cos z) \vec{j} - e^{xy} \sin z \vec{k}$  is irrotational. Find scalar potential function  $\phi$  such that  $\vec{F} = \nabla\phi$ . [5]

- c) Evaluate  $\int_C \vec{F} \cdot d\vec{r}$  where  $\vec{F} = x^2\vec{i} + xy\vec{j}$  where C: is arc of parabola  $y = x^2$  joining  $(0, 0)$  &  $(1, 1)$ . [5]

OR

- Q7) a)** Find the directional derivative of  $\phi = xyz$  in the direction normal to the surface  $x^2y + xy^2 + yz^2$  at  $(1,1,1)$ . [5]

- b) Solve any one. [5]

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

ii) Prove that  $\nabla \left( \frac{\vec{a} \cdot \vec{r}}{r^3} \right) = \frac{\vec{a}}{r^3} - 3 \frac{(\vec{a} \cdot \vec{r})}{r^5} \vec{r}$

- c) Evaluate by using Green's theorem  $\int_C (\cos x \sin y - 4y) dx + \sin x \cos y dy$  where C is  $x^2 + y^2 = 1$ . [5]

- Q8) a)** A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is [8]

$$u(x, 0) = x, \quad 0 \leq x \leq 50$$

$$= 100 - x, \quad 50 \leq x \leq 100.$$

Find the temperature  $u(x, t)$  at any time  $t$ .

- b) A string is stretched and fastened to two points  $l$  apart, motion is stretched by displaying the string in the form  $u = a \sin \left( \frac{\pi x}{l} \right)$  from which is released at time  $t = 0$ . Find the temperature distribution  $u(x, t)$  from one end. [7]

OR

- Q9) a)** An infinitely long uniform metal plate is enclosed between lines  $y = 0$  and  $y = l$ , for  $x > 0$ . The temperature is zero along the edges  $y = 0$  and  $y = l$  and at infinity. If the edge  $x = 0$  is kept at a constant temperature  $u_0$ , find the temperature distribution  $u(x, t)$ . [8]

- b) Use Fourier sine transform to solve  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, 0 < x < \infty, t > 0$ .

Subjected to [7]

- i)  $u(0, t) = 0, \forall t > 0$ .
- ii)  $u(x, 0) = 1, 0 < x < 1$   
 $= 0, x > 1$
- iii)  $u(x, t)$  is bounded.

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1583**

**[6002]-213**

[Total No. of Pages : 2

**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 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)** State the following engine nomenclature with neat sketch. **[8]**

- i) Cylinder Bore
- ii) TDC
- iii) BDC
- iv) Compression ratio

b) Explain carnot cycle with neat diagram. **[8]**

OR

**Q2) a)** Explain various stages of combustion in S.I. Engine with neat sketch. **[8]**

b) Write detailed classifications of Internal combustion engines. **[8]**

**Q3) a)** Explain the various modes of heat transfer with suitable real life examples. **[9]**

b) A 50 cm × 50 cm copper slab 6.25 mm thick has a uniform temperature of 300°C. Its temperature is suddenly lowered to 36°C. Calculate the time required for the plate to reach the temperature of 108°C.  
Take  $\rho = 9000 \text{ kg/m}^3$ ,  $c = 0.38 \text{ kJ/kg } ^\circ\text{C}$ ;  $k = 370 \text{ W/m } ^\circ\text{C}$  and  $h = 90 \text{ W/m}^2 \text{ } ^\circ\text{C}$ . **[9]**

OR

**Q4) a)** Define and give significance for the following. **[9]**

- i) Thermal conductivity
- ii) Thermal diffusivity
- iii) Critical radius of insulation

b) State fourier's law of heat conduction. Derive an expression for rate of heat transfer through the plane wall. **[9]**

**P.T.O.**

- Q5) a)** What are the differences between natural convection and forced convection? Give real life examples. [8]
- b)** Calculate the heat transfer from 60 W from incandescent bulb at 115°C to ambient air at 25°C. Assume the bulb as a sphere of 50 mm diameter. [10]  
Use  $Nu = 0.60 (Gr. Pr)^{0.25}$   
Take properties of air at 70°C as  $k = 0.02964 \text{ W/mK}$ ,  
 $\nu = 20.02 \times 10^{-6} \text{ m}^2/\text{s}$ ,  $Pr = 0.694$

OR

- Q6) a)** Explain significance of any three dimensionless numbers used in various modes of heat transfer for thermal analysis. [9]
- b)** State and explain with mathematical expressions of the following laws in radiation heat transfer: [9]
- i) Kirchhoff's law
  - ii) Stefan's Boltzmann's law
  - iii) Wien's Displacement law
- Q7) a)** Derive an expression for LMTD for parallel flow heat exchanger with neat sketch. [8]
- b)** In a counter flow double pipe heat exchanger; water is heated from 25°C to 65°C by oil with a specific heat of 1.45 kJ/kg K and mass flow rate of 0.9 kg/s. The oil is cooled from 230°C to 160°C. If overall heat transfer coefficient is 420 W/m<sup>2</sup> °C, calculate the following: [10]
- i) The rate of heat transfer
  - ii) The mass flow rate of water
  - iii) The surface area of heat exchanger

OR

- Q8) a)** Explain the six regimes of the pool boiling curve with the help of a neat diagram. [10]
- b)** In a certain double pipe heat exchanger hot water flows at a rate of 50000 kg/hr and gets cooled from 95°C to 65°C. At the same time 50000 kg/hr of cooling water at 30°C enters the heat exchanger. The flow conditions are such that overall heat transfer coefficient remains constant at 2270 W/m<sup>2</sup> K. Determine the heat transfer area required and the effectiveness, assuming two streams are in parallel flow. Assume for the both the streams  $c_p = 4.2 \text{ kJ/kg K}$ . [8]



Total No. of Questions : 8]

SEAT No. :

**P1584**

[6002]-214

[Total No. of Pages : 2

**S.E. (Mechatronics Engineering)  
DIGITALELECTRONICS  
(2019 Pattern) (Semester - III) (217543)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Convert the following Flip-flop. **[9]**

- i) S-R Flip flop to D Flip flop.
- ii) J-K flip flop to T flip flop.

b) Design binary sequence generator to generate binary sequence '1010' using MS JK flip-flops. **[9]**

OR

**Q2) a)** Draw and explain ring counter using D flip-flop. Also draw the necessary timing diagram. **[9]**

b) Explain the internal diagram of IC 7490. Design MOD 24 counter using IC 7490. **[9]**

**Q3) a)** Draw an ASM chart and state diagram for 2 bit up binary counter having one enable line E such that E = 1 (counting enabled) E = 0 (counting is disabled). **[8]**

b) What is PLD? What are the different PLDs? **[9]**

OR

**Q4) a)** What is ASM chart? State and explain the basic components of ASM Chart. Write list of application of ASM chart. **[8]**

b) Implement the following functions using PLA: **[9]**

$$f_1(A, B, C) = m(0, 3, 4, 7)$$

$$f_2(A, B, C) = m(1, 2, 5, 7)$$

**P.T.O.**

- Q5)** a) Differentiate TTL and CMOS logic family. [9]  
b) Explain the following characteristics of TTL logic families. [9]  
i) Power dissipation.  
ii) Noise margin.  
iii) Propagation delay.

OR

- Q6)** a) What is tri-state? What is the use of tri-state buffers? Explain with suitable circuit diagram. [9]  
b) Explain the standard characteristics of TTL in details. [9]
- Q7)** a) Explain the registers in microprocessor. [9]  
b) Explain 4 - bit multiplier circuit using ALU & shift registers. [8]

OR

- Q8)** a) Explain basic Arithmetic operations using ALU IC 74181? [8]  
b) Explain architecture of 8086 microprocessor with diagram. [9]





Total No. of Questions : 8]

SEAT No. :

P1585

[Total No. of Pages : 4

[6002]-215

**S.E. (Mechatronics Engineering)**  
**ANALYSIS OF MECHANICAL STRUCTURE**  
**(2019 Pattern) (Semester-III) (217544)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1) a) A T section with 200 mm X 50 mm and web 200 mm X 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]

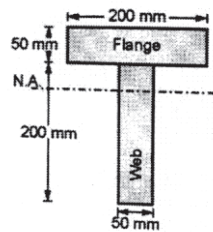


Figure 1

- 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  $I = 6.5 \times 10^4 \text{ mm}^4$ .

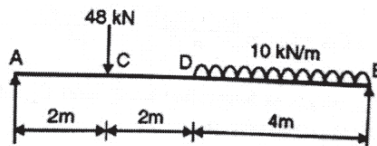


Figure 2

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]

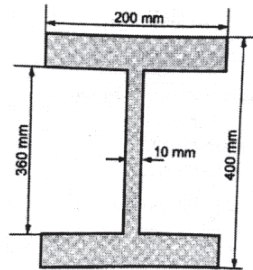


Figure 3

- 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]

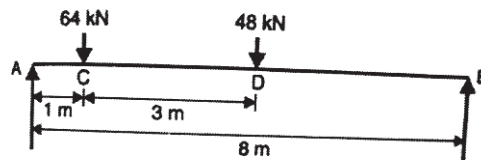


Figure 4

- 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]

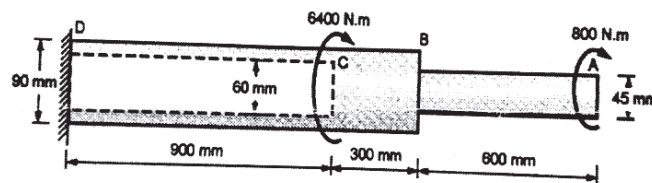


Figure 5

- 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  $3.6^\circ$  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]
- Both ends are fixed
  - 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]

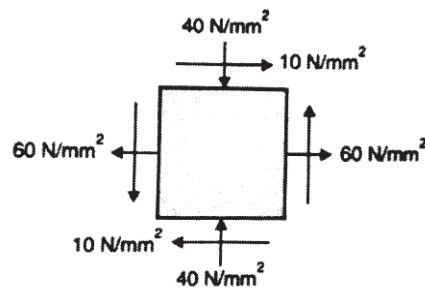


Figure 6

- 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]
- Maximum shear stress theory
  - 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]
- Maximum shear stress theory
  - Maximum normal stress theory
  - 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]

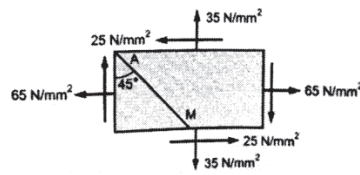


Figure 7

- 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]

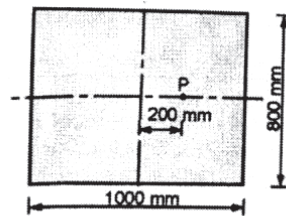


Figure 8

- 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]

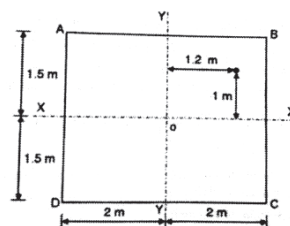


Figure 9

- 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. :

P-1586

[Total No. of Pages : 2

[6002]-216

**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) *Draw a neat diagram wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data if necessary.*

- Q1)** a) State the Hume Rothery's rule of solid solubility and explain the factor that govern Hume Rothery's rule. [7]
- b) Explain substitutional & interstitial solid solution with diagram. [7]
- c) State and Explain Gibbs phase rule. [4]

OR

- Q2)** a) Explain the types of cooling curves. [7]
- b) Draw and Explain Fe-C equilibrium diagram showing all details like temperature, composition, phases, critical lines and reactions. [7]
- c) Define the following terms : [4]
- i) Grain
  - ii) Dendrite
  - iii) Pearlite
  - iv) Cementite

- Q3)** a) Explain with the suitable figure the transformation of austenite into pearlite, martensite and bainite. [7]
- b) Draw continuous cooling transformation (CCT) diagram and explain all processes. [7]
- c) Differentiate Between Flame Hardening and Induction hardening. [4]

**P.T.O.**

OR

- Q4)** a) What is tempering of steel? Explain the types of tempering treatment in detail. [7]  
b) Explain the Nitriding process in detail with a suitable diagram. Write advantages and disadvantages of Nitriding. [7]  
c) Write the comparison between Annealing and Normalizing. [4]

- Q5)** a) Explain the classification of steel on the basis of carbon content with its applications. [6]  
b) Differentiate between steel and cast iron on the basis of composition, properties and applications. [6]  
c) Write a short note on : Tool Steel and its classification. [5]

OR

- Q6)** a) Explain the classification of Alloy Steel with respect to the relation with carbon. Give examples for each category. [6]  
b) Explain white cast iron with its composition. [6]  
c) Differentiate between ferrous and non-ferrous metals. Write suitable examples. [5]

- Q7)** a) Give typical composition, properties and applications of following : [6]  
i) Red Brass  
ii) Muntz metal  
iii) Free cutting brass  
b) Define bronze and explain in brief types of bronze with suitable examples. [6]  
c) What is  $\alpha$ - $\beta$  Brass? Explain its types with applications. [5]

OR

- Q8)** a) Differentiate between brass and bronze. [6]  
b) Explain brass and its types with suitable examples. [6]  
c) Write a short note on bearing materials. State properties and applications. [5]



[6002]-217

**S.E. (Mechatronics Engineering)**  
**KINEMATICS OF MACHINERY**  
**(2019 Pattern) (Semester - IV) (217547)**

Time : 2½ Hours]

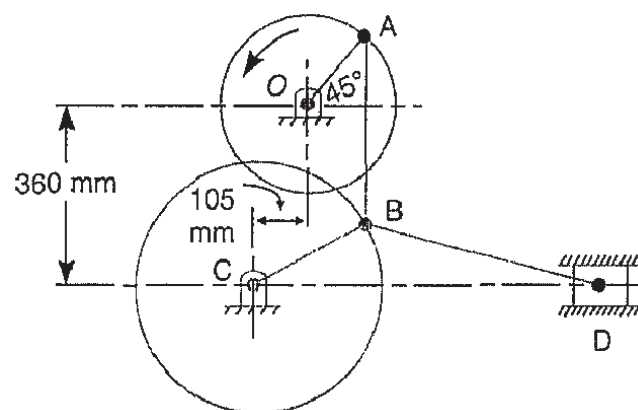
[Max. Marks : 70

*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)** In the toggle mechanism shown in Fig. 8.16, the slider D is constrained to move on a horizontal path. The crank QA is rotating in the counter-clockwise direction at a speed of 180 r.p.m. increasing at the rate of  $50 \text{ rad/s}^2$ . The dimensions of the various links are as follows : OA = 180 mm ; CB = 240 mm ; AB = 360 mm ; and BD = 540 mm. For the given configuration, find 1. Velocity of slider D and angular velocity of BD, and 2. Acceleration of slider D and angular acceleration of BD.

[10]

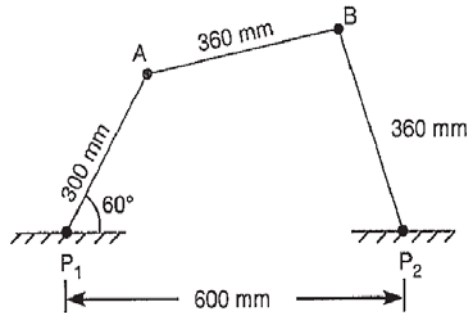


- b) Explain the Concept of Acceleration Image Principal. [4]
- c) State and explain Kennedy's theorem of three centers inline. [4]

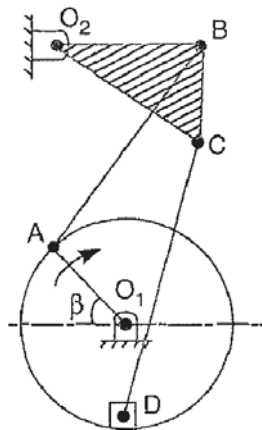
OR

P.T.O.

- Q2) a)** The dimensions and configuration of the four bar mechanism, shown in Fig., are as follows :  $P_1A = 300$  mm;  $P_2B = 360$  mm;  $AB = 360$  mm and  $P_1P_2 = 600$  mm. The angle  $AP_1P_2 = 60^\circ$ . The crank  $P_1A$  has an angular velocity of  $10$  rad/s and an angular acceleration of  $30$  rad/s<sup>2</sup>, both clockwise. Determine the angular velocities and angular accelerations of  $P_2B$  and  $AB$  and the velocity and acceleration of the joint  $B$ . **[10]**



- b)** Fig. shows a sewing needle bar mechanism  $O_1ABO_2CD$  where in the different dimensions are as follows : Crank  $O_1A = 16$  mm;  $\theta = 45^\circ$ ; Vertical distance between  $O_1$  and  $O_2 = 40$  mm; Horizontal distance between  $O_1$  and  $O_2 = 13$  mm;  $O_2B = 23$  mm;  $AB = 35$  mm;  $O_2BC = 90^\circ$ ;  $BC = 16$  mm;  $CD = 40$  mm.  $D$  lies vertically below  $O_1$ . Find the velocity of needle at  $D$  for the given configuration. The crank  $O_1A$  rotates at  $400$  r.p.m. **[8]**



- Q3) a)** Synthesize a four bar mechanism for three successive positions given in the table below :

Positions	1	2	3
$\theta$	30	90	180
$\phi$	40	115	175



Consider L1 = Grounded Link, L2 = Input Link, L3 = Coupler Link, L4 = Output Link,  $\theta$  = input link angle  $\phi$  = output link angle, if the grounded link of length 100 mm is horizontal and input link is of 20 mm length, synthesize the mechanism using precision positions of the input link and precision position of output link. Ground the pivot of the input link on left hand side and ground the pivot of output link on right hand side. Input and output links are rotating in opposite directions. Use the method of inversion Draw the mechanism in its first precision position. [10]

- b) Explain the term Path Generation. [3]  
 c) Explain structural error related to synthesis of mechanism. [4]

OR

**Q4)** a) Determine the chebyshev spacing for function  $Y = e^x$  for the range  $0 \leq X \leq 4$  where three precision points are required. For these position points, determine The value of  $\theta$  and  $y$  when  $\Delta\theta = 90^\circ$  and  $\Delta\theta = 120^\circ$ . [10]

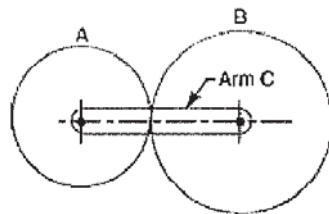
- b) Explain the three position synthesis of single slider mechanism by using inversion method. [7]

**Q5)** a) Derive the expression for a minimum number of teeth on gear wheel required to avoid interference with neat sketch. [8]

- b) Define the following terms : [3]

- i) Length of path of recess  
 ii) Backlash in gears  
 iii) Working depth of gear tooth

- c) In an epicyclic gear train, an arm carries two gears A & B having 30 and 45 teeth respectively and is shown in fig. [6]



If the arm rotates at 100 rpm in anticlockwise direction about the centre of gear A which is fixed, determine the speed of gear B. Use tabular method.

OR

- Q6)** a) Compare cycloidal and involute gear tooth profile. [5]  
b) Define formative number of teeth for Helical gear and express the formula with terms. [3]  
c) A pair of spiral gears is required to connect two shafts 150 mm apart, the shaft angle being  $70^\circ$ . The velocity ratio is to be 1.5 to 1, the faster wheel having 80 teeth and a pitch circle diameter of 100 mm. Find the spiral angles for each wheel. [9]

- Q7)** a) A cam, with a minimum radius of 35 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below : [13]  
1. To raise the valve through 50 mm with uniform velocity during  $60^\circ$  rotation of the cam;  
2. To keep the valve fully raised through next  $40^\circ$ ;  
3. To lower the valve during next  $120^\circ$  with S.H.M.; and  
4. To keep the valve closed during rest of the revolution i.e.  $140^\circ$ .  
The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft.  
b) Write note on Artificial intelligence in automation. [5]

OR

- Q8)** a) A cam is to be designed for a knife edge follower with the following data : [13]  
1. Cam lift = 40 mm during  $60^\circ$  of cam rotation with simple harmonic motion.  
2. Dwell for the next  $40^\circ$ .  
3. During the next  $90^\circ$  of cam rotation, the follower returns to its original position with simple harmonic motion.  
4. Dwell during the remaining  $170^\circ$ .  
Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft.  
b) Write note on automated assembly line for car manufacturing. [5]



Total No. of Questions : 8]

SEAT No. :

P-1588

[Total No. of Pages : 3

[6002]-218

S.E. (Mechatronics Engineering)

FLUID MECHANICS AND MACHINERY

(2019 Pattern) (Semester - IV) (217548)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Answer Q.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) Figure to the right indicate full marks.
- 5) Assume suitable data, if necessary.

Q1) a) Define HGL and TEL. Derive an expression of Velocity & Shear Stress distribution for laminar flow passing through circular pipe. [8]

b) Explain the concepts of pipes are connected in series, parallel and equivalent pipe with neat sketch. [8]

OR

Q2) a) Derive an expression for Darcy-Weisbach equation. [8]

b) A pipe of diameter 300 mm and length 3500 m is used for transmission of power by water. Total head at the inlet of pipe is 500 m. Find the maximum power available at the outlet of pipe, if the value of coefficient of friction  $f = 0.006$ . [8]

Q3) a) Write a short note on : [10]

- i) Hydrodynamic entrance region
- ii) Dimensional Homogeneity
- iii) Boundary layer thickness
- iv) Laminar Flow
- v) Buckingham's Pi theorem

b) The efficiency  $\eta$  of a fan depends on density  $\rho$ , dynamic viscosity  $\mu$ , of the fluid, angular velocity  $\omega$ , diameter  $D$  of the rotor and discharge  $Q$ . Express  $\eta$  in terms of dimensionless parameters. [8]

P.T.O.

OR

**Q4) a)** Write a short note on Dimensionless number and their significance (give any four). [8]

b) Determine the dimensions of the quantities given below [10]

i) Velocity

ii) Acceleration

iii) Density

iv) Force

v) Work done

**Q5) a)** A Reaction turbine works at 450 rpm under a head of 120 m, diameter at inlet is 120 cm and flow area is  $0.4 \text{ m}^2$ . Angles made by absolute and relative velocity are  $20^\circ$  and  $60^\circ$  respectively at inlet. Determine i) Volume flow rate ii) power developed iii) Hydraulic efficiency. Assume whirl velocity at outlet zero. [8]

b) Explain the following for hydraulic turbine [4]

i) Hydraulic Efficiency

ii) Mechanical Efficiency

c) Explain construction and working principle of Kaplan Turbine with application. [6]

OR

**Q6) a)** Write the difference between Impulse turbine and Reaction turbine. [4]

b) Explain construction and working of Francis Turbine with application. [6]

c) A Pelton wheel is to be designed for the following specifications :

Shaft Power = 11,772 kW, Head = 380 meters, Speed = 750 r.p.m; Overall efficiency = 86 %; Jet diameter is not to exceed one- sixth of the wheel diameter. Determine : [8]

i) The wheel diameter

ii) The number of jets required

iii) Diameter of the jet.

Take  $K_{v1} = 0.985$  and  $K_{ul} = 0.45$

- Q7)** a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5m/s. The vanes are set back at an angle of 40 at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine: [8]
- i) Vane angle at inlet
  - ii) Work done by the impeller on water per second
  - iii) Manometric efficiency
- b) Explain the following efficiency for centrifugal pump [6]
- i) Manometric Efficiency
  - ii) Mechanical Efficiency
  - iii) Overall Efficiency
- c) Explain the following : [4]
- i) Static Head
  - ii) Manometric Head

OR

- Q8)** a) Explain construction and principle of working of Centrifugal pump. [6]
- b) Explain in detail classification of hydraulic pump. [4]
- c) 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. [8]



Total No. of Questions : 8]

SEAT No. :

P-1589

[Total No. of Pages : 2

[6002]-219

S.E. (Mechatronics Engineering)

ELECTRICAL MACHINES AND DRIVE

(2019 Pattern) (Semester - IV) (217549)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve 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) With suitable diagram explain the Armature reaction in Synchronous Machine. [9]

b) Give comparison between salient pole and non-salient pole type synchronous machine. [9]

OR

**Q2)** a) Develop circuit model for 3 phase Synchronous Machine. [9]

b) For 2200 volt, 440KVA, single phase alternator the armature resistance is  $0.5 \Omega$ , field current of 40 A, gives an open circuit voltage of 1160 V and circuit current of 200 A. Calculate synchronous impedance and reactance. Also find percent regulation at 0.8 power factor lag. [9]

**Q3)** a) Justify steady state depends on relative characteristics of motor and load both. [8]

b) Explain in detail block diagram of electrical drives. [9]

OR

**Q4)** a) Explain four quadrant operation of motor driving a hoist load. [9]

b) A drive has following parameters  $T = (150 - 0.1N)$  N-m where N is speed in RPM  $T_1 = 100$  N-m. Test whether the motor will start or not? Find the equilibrium speed. Test steady state stability of this motor load using condition for stability. [8]

P.T.O.

- Q5) a)** Explain regenerative braking in case of DC motor. [9]  
b) Write a short note on step down chopper-controlled DC drives. [9]

OR

- Q6) a)** Explain Plugging of DC motor. [9]  
b) Explain single phase fully controlled rectifier fed DC motor drives. [9]

- Q7) a)** Explain V/F control method of speed control of DC motor. [8]  
b) What are the advantages and disadvantages of stepper motor? Write down the applications of stepper motor. [9]

OR

- Q8) a)** Write a short note closed loop control of Induction motor drives. [9]  
b) Compare VSI and CSI for Induction motor drive. [8]



Total No. of Questions : 8]

SEAT No. :

**P1590**

[Total No. of Pages : 2

[6002]-220

**S.E. (Mechatronics Engineering)**

**SENSORS AND ACTUATOR**

**(2019 Pattern) (Semester-IV) (217550)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) What are different types of Elastic Pressure measurement techniques? Explain working principle of Piezoelectric pressure sensors? [6]
- b) Explain Bernoulli's Principle/Theorem for flow measurement techniques? [6]
- c) Explain basic Principle of working of RTD, Thermocouple and Thermistor for Temperature measurement? [6]

OR

- Q2)** a) Explain various methods of Vacuum Pressure measurement? [6]
- b) What is basic Principle of working ultrasonic flow meter? [6]
- c) Explain working Principle of Hall effect Sensors? What are its applications? [6]

- Q3)** a) Explain DC motor modelling? Mention its applications? [6]
- b) What are the Characteristics of 3-Phase Induction Motor? [5]
- c) What are the Characteristics of Stepper Motor? [6]

OR

- Q4)** a) What is Concept of Actuators? Explain working of solenoid? [6]
- b) Explain working of 3-Phase Induction motors? [5]
- c) What the types of Stepper Motors? How can we calculate step Angle of Stepper Motors? [6]

*P.T.O.*



- Q5)** a) What are the Components of pneumatic and hydraulic systems? [6]  
b) What is the role of Pumps and Compressor used in Hydraulic and Pneumatic Systems? [6]  
c) What are filters hydraulic Systems? Explain in detail. [6]

OR

- Q6)** a) How pressure regulation is done pneumatic circuits? [6]  
b) Compare between hydraulic and pneumatic actuator system? [6]  
c) Explain Smart material actuator? [6]

- Q7)** a) Explain following [6]  
i) Actuator bandwidth  
ii) Frequency Response  
b) What are power and energy consideration during actuator selection? [6]  
c) Write a short note on tradeoffs between force/displacement. [5]

OR

- Q8)** a) What are industrial considerations during actuator selection? [6]  
b) Write a short note on tradeoffs between torque/Speed. [5]  
c) Write a short note on control system and electronics. [6]



[6002]-221

S.E. (Mechatronics)

**APPLICATIONS OF INTEGRATED CIRCUITS****(2019 Pattern) (Semester - IV) (217551)**

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 indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.

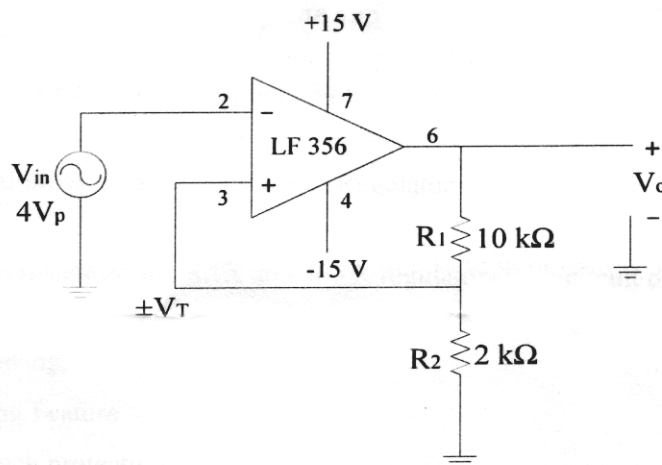
**Q1) a)** Explain the working of Inverting Comparator. [6]

b) Explain in detail with neat circuit diagram sample and hold circuit, also draw its input and output waveform. [6]

c) Explain with a neat circuit diagram working of inverting Schmitt trigger with its input–output waveform and hysteresis plot. [6]

OR

**Q2) a)** For the Inverting Schmitt trigger shown in fig. below Calculate UTP. LTP and hysteresis width. Draw input and output waveforms. Also comment on Hysteresis loop. [6]



P.T.O.

- b) Explain in detail working of square wave generator with neat circuit diagram. Draw waveforms of output voltage and capacitor voltage. [6]
- c) Draw circuit diagram and input-output waveform of precision half wave & full wave rectifier. [6]

- Q3)**
- a) Draw circuit diagram and explain D/A converter with binary weighted resistors and write output voltage equation,  $V_o$ . [6]
  - b) Write a short note on Performance parameters of DAC. [6]
  - c) Explain the operation of Dual Slope ADC. [5]

OR

- Q4)**
- a) With the help of neat Diagram, Explain Flash type ADC. [6]
  - b) Draw the circuit diagram of R/2R Ladder type DAC. [6]
  - c) Write a short note on Performance parameters of ADC. [5]

- Q5)**
- a) Explain the working of functional block diagram of IC 555 Timer. [6]
  - b) Write a short note on Basic operation of Power Amplifier LM 380. [6]
  - c) Explain PLL operation in detail with neat block diagram. [6]

OR

- Q6)**
- a) Explain Voltage Controlled Oscillator 566 and write its applications. [6]
  - b) Explain with neat block diagram, any one application of IC PLL 565 in detail. [6]
  - c) Explain voltage Divider using multiplier 534. [6]

- Q7)**
- a) Explain with neat block diagram IC Voltage Regulator. [5]
  - b) Explain typical connections of 78XX and 79XX regulators with circuit diagram. [6]
  - c) Explain the following. [6]
    - i) Current limiting Feature
    - ii) Current fold back protection

OR

- Q8)**
- a) Draw and explain the functional diagram of 723 regulator. [6]
  - b) Write a short note on IC LM 317. [6]
  - c) What are the Switching regulator topologies? Explain any one. [5]



Total No. of Questions : 08]

SEAT No. :

P-1592

[Total No. of Pages : 3

[6002]-222

S.E. (Artificial Intelligence and Data Science)

OPERATING SYSTEMS

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

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Solve questions 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 synchronization? Operating system support and programming language support for synchronization. [6]
- b) What is inter process communication? Explain pipes and shared memory. [6]
- c) What are classical synchronization problems? Explain any one in detail. [6]

OR

- Q2)** a) What is deadlock? Explain its characteristics with example. [6]
- b) What are different methods of handling deadlock? Explain deadlock detection with example. [6]
- c) Consider a system that contains five processes P1, P2, P3, P4, P5 and the three resource types A, B and C. Following are the resources types: A has 10, B has 5 and the resource type C has 7 instances. Determine if the system is safe or not. [6]

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P1	0	1	0	7	5	3	3	3	2
P2	2	0	0	3	2	2			
P3	3	0	2	9	0	2			
P4	2	1	1	2	2	2			
P5	0	0	2	4	3	3			

P.T.O.

- Q3)** a) Explain the virtual memory system with suitable diagram. [6]  
b) Explain the basic method for implementing paging. Draw the paging model of logical and physical memory. [6]  
c) What is swapping? Does swapping increase the Operating system's overheads? [6]

OR

- Q4)** a) Explain the differences between: [6]  
i) Logical and physical address space  
ii) Paging and segmentation  
b) What is internal fragmentation and external fragmentation? How are they reduced? [6]  
c) What are advantages of partitioning the memory? What are different ways memory partitioning? [6]

- Q5)** a) List and explain file types and file access methods. [6]  
b) What are different disk scheduling policies? Explain SCAN and CSCAN with example. [6]  
c) Explain how free space management is done by Operating System? [5]

OR

- Q6)** a) What are different disk scheduling policies? Explain LIFO and SCAN with example. [6]  
b) 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]  
c) What is Directory? Explain directory implementation and allocation methods. [5]

- Q7)** a) What are goals of Linux? Also interfaces to linux. [6]  
b) What is kernel? Explain structure of kernel. [6]  
c) Explain various process management system calls in Linux with example. [5]

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 exec() and brk() in detail. [6]
- c) Explain implementation of process and threads in Linux. [5]



Total No. of Questions : 8]

SEAT No. :

P-1593

[Total No. of Pages : 4

**[6002]-223**  
**S.E. (A.I.D.S)**  
**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) *Use of calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** The following marks have been obtained by a class of students in 2 papers of mathematics. **[9]**

Paper I	45	55	56	58	60	65	68	70	75	80	85
Paper II	56	50	48	60	62	64	65	70	74	82	90

Calculate the coefficient of correlation for the above data.

**b)** Find the quartile deviation and coefficient of quartile deviation of the following frequency distribution. **[9]**

Marks	<10	10-20	20-30	30-40	40-50	50-60
No. of Students	10	20	30	50	40	30

OR

**Q2) a)** Determine the eq<sup>ns</sup> of regression lines for the following data. Also find the value of (i)  $y$  for  $x = 4.5$  (ii)  $x$  when  $y = 13$  **[9]**

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

**b)** The first four moments of four distribution about the value 4 are 2, 20, 40 and 100 respectively. **[9]**

- i) Obtain the first central moments
- ii) Find mean, standard deviation
- iii) Find coefficients of skewness and kurtosis

**P.T.O.**

**Q3) a)** In a certain company install 2000 LED bulbs on each floor. If LED bulbs have average life of 1000 burning hours with standard deviation of 200 hours. Using normal distribution find what number of LED bulbs might be expected to Fail in 700 hours. [6]

(Given :  $P(0 < z < 1.5) = 0.4332$ )

b) Between 2 pm to 4 pm the average no of phone calls per minute coming into a switch board of a company is 2.5. Find the probability that during a particular minute there will be [5]

- i) no phone call
- ii) exactly 3 phone calls

c) A dice is thrown 10 times. If getting an odd number is a success. What is the probability of i) 8 success ii) At least 6 success [6]

OR

**Q4) a)** Weights of 4000 students are found to be normally distributed with mean 50 kg and standard deviation 5 kgs. Find the number of students with weights i) less than 45 kgs ii) between 45 to 60 kgs

(for standard normal distribution  $z$ , area under the curve between  $z = 0$  to  $z = 1$  is 0.3413 and that between  $z = 0$  to  $z = 2$  is 0.4772) [6]

b) If 10% bolts produced by a machine are defective. Determine the probability that out of 10 bolts chosen at random. [5]

- i) two will be defective
- ii) at most two will be defective.

c) In a continuous distribution density function  $f(x) = kx(2 - x)$ ,  $0 < x < 2$  Find the value of  $k$ , mean and variance. [6]

**Q5) a)** Random sample of 400 men and 600 women were asked whether they would have a school near their residence 200 men and 325 women were in favour of proposal. Test the hypothesis that the proportion of men and women in front of proposal is same at 5% level of significance.

(Given  $Z_{\alpha} = 1.96$  at 5% l.o.s) [6]

b) The values given below are

- i) Observed frequencies of a distribution
- ii) The frequencies of a normal distribution having same mean, standard deviation and the total frequency as in a) apply  $\chi^2$  test of godness of fit.

a)	1	5	20	28	42	22	15	5	2
b)	1	6	18	25	40	25	18	6	1

(Given  $\chi^2 = 12.592$  at 5% l.o.s.) [6]



- c) Fertilizers A and B are tried respectively on 10 and 8 randomly chosen experimental plots. The yields in the plots were as given below. Test using t-test whether in effects of the fertilizer as reflected in the mean yields. [6]

Fertilizers	Yields									
A	8.0	7.6	8.2	7.8	8.3	8.4	8.2	7.8	7.1	8.0
B	7.4	8.1	7.6	8.1	7.5	7.6	7.3	7.2	-	-

(Given  $t_{0.05} = 2.201$  at d.o.f 16)

OR

- Q6) a) The average marks in mathematics of a sample of 100 students was 51 with S.D. of 6 marks. Could this have a random sample from the population with average marks 50? [6]

(Given  $z_{\alpha} = 1.96$  at 5% l.o.s.)

- b) A coin is tossed 160 times and following are expected and observed frequencies for number of heads.

No of heads	0	1	2	3	4
Expected frequency	17	52	54	31	6
Observed frequency	10	40	60	40	10

Find the  $\chi^2$  value. [6]

- c) In two independent samples of size 8 and 10 the sum of squares deviations of the values from the respective sample means were 84.4 and 102.6. Test whether the difference of variances of the population is significant or not. [6]

(Given  $F_{0.05} = 3.29$  at degrees of freedom (7,9))

- Q7) a) State and prove Neyman-pearson Fundamental lemma. [9]

- b) Let p is the probability that a given die shows even number. To test

$H_0: P = \frac{1}{2}$  Vs  $H_1: P = \frac{1}{3}$  following procedure is adopted. Toss the die twice and accept  $H_0$  if both times. It shows even number. Find the probabilities of Type I and Type II error. [8]

OR

Q8) a) For distribution

[9]

$$df = \begin{cases} \beta e^{-\beta(x-\gamma)} dx, & x \geq \gamma \\ 0 & x < \gamma \end{cases}$$

Show that for  $H_0 : \beta = \beta_0 = \gamma = \gamma_0$  and  $H_1 : \beta = \beta_1 = \gamma = \gamma_1$  is the best critical region is given by

$$\bar{x} = \frac{1}{\beta - \beta_0} \left\{ \gamma_1 \beta_1 - \gamma_0 \beta_0 - \frac{1}{n} \log k + \log \frac{\beta_1}{\beta_0} \right\}$$

b) Write short notes on :

[8]

- i) Critical region and Most powerful critical region.
- ii) Level of significance and power of Test.



Total No. of Questions : 8]

SEAT No. :

**P1594**

[Total No. of Pages : 2

[6002]-224

**S.E. (Artificial Intelligence & Data Science)**

**INTERNET OF THINGS**

**(2019 Pattern) (Semester-IV) (217529)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Attempt Questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Draw neat and Clean Diagrams.*
- 3) *Assume suitable data, if necessary.*

- Q1)** a) Explain Next Generation Kiosks & smart vending machines in detail? **[9]**  
b) Justify how the asset management impacts on end to end users by integrating IOT technology? **[9]**

OR

- Q2)** a) Explain in brief Smoke for gas detection and Air quality monitoring? **[10]**  
b) How is security a big concern in IOT? How do IDS work in IoT? **[8]**

- Q3)** a) Differentiate M2M and IoT? Also differentiate COAP and MQTT? **[8]**  
b) Explain the IOT System working block with the help of Control units, Communication Modules and Sensors? **[9]**

OR

- Q4)** a) Explain Link layer protocol like ethernet, Wi-Fi, WiMax, Zigbee in Protocol architecture? **[9]**  
b) How information is exchanged in real time without human intervention? **[8]**

- Q5)** a) Describe Cloud of Things. Explain how cloud is an integration of Grid Computing and SOA. **[10]**  
b) Explain on Devices Security and Privacy of IoT cloud. Why do we need IoT Security? **[8]**

OR

- Q6)** a) Describe the need of semantic web technology and business impacting IoT? **[10]**  
b) Explain in detail vulnerabilities of Internet of Things. **[8]**

*P.T.O.*

- Q7)** a) Discuss Cloud computing. Explain the setup of a cloud environment in an IoT? **[10]**
- b) What are IoT design ethics, explain? **[7]**

OR

- Q8)** a) How does Vehicle-to-Vehicle (V2V) communication enhance safety and efficiency in the internet of Things (IoT) ecosystem? **[10]**
- b) Elaborate on how you will use IoT for remote healthcare. **[7]**



Total No. of Questions : 8]

SEAT No. :

**P1595**

[Total No. of Pages : 2

[6002]-225

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

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) What is IT infrastructure? Explain management issues. [8]  
b) Explain role of telecommunication. Internet and wireless technology in Business intelligence. [9]

OR

- Q2)** a) What is Business Intelligence? Explain its foundations database and Information management. [9]  
b) What is IT infrastructure? Explain in brief its components. [8]

- Q3)** a) How to enhance decision making with information systems give suitable examples. [9]  
b) Explain importance of project Management and how to manage project risk. [8]

OR

- Q4)** a) Enterprise Application and explain with examples. [8]  
b) Discuss managing global system with technology issues and opportunities for global value chain. [9]

- Q5)** a) Elaborate functional business system in detail with cross functional enterprise systems. [9]  
b) Describe e-commerce with its applications and issues. [9]

OR

*P.T.O.*

- Q6)** a) How to manage Supply chain with business network? [9]  
b) Explain decision support trends in businesses. How data mining and knowledge management is used in Decision Support Systems. [9]

- Q7)** a) Write short note on  
i) Fuzzy Logic  
ii) Virtual Reality  
iii) Business and AI [9]  
b) Explain the role of MIS in data science, explore an open source tool to generate reports. [9]

OR

- Q8)** a) Write short note on  
i) Intelligent Agents  
ii) Genetic Algorithms,  
iii) Neural Network [9]  
b) Explain the value of expert systems with its benefits and limitations [9]



[6002]-226

S.E. (Information Technology) (Artificial Intelligence &amp; Machine Learning)

**DISCRETE MATHEMATICS****(214441, 218541) (2019 Pattern) (Semester - III)**

Time : 2½ Hours]

[Max. Marks : 70

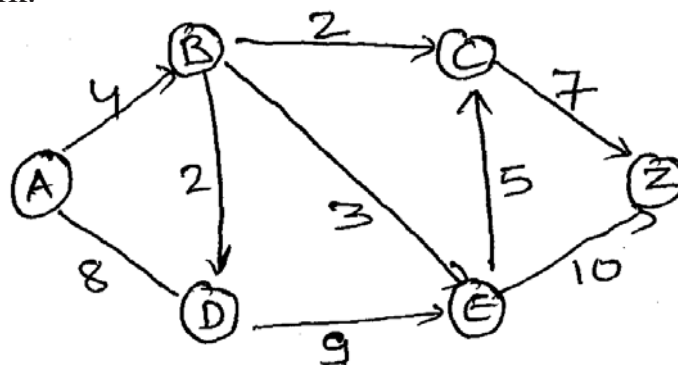
*Instructions to the candidates:*

- 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 fill marks.
- 4) Assume suitable data, if necessary.

Q1) a) Show that the maximum number of edges in a simple graph with  $n$  vertices is  $n(n-1)/2$ . [5]

b) Construct an optimal tree for the weights 3,5, 9, 18, 30, 40, 55. Find the weight of the optimal tree. [6]

c) Using the labelling procedure, find the max flow for the following transport network. [6]

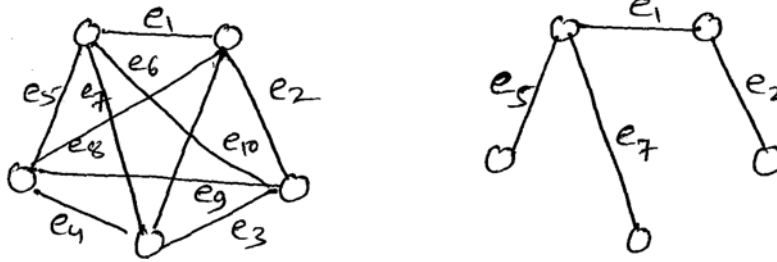


OR

Q2) a) Determine the number of edges in a graph with 7 nodes, 2 of degree 4, 2 of degree 3 and 3 of degree 2. Draw one such graph. [5]

P.T.O.

- b) Find the fundamental system of cutsets and fundamental system of the circuit for graph, G with respect to the spanning tree, T. [6]



- c) Find the chromatic number with the help of graph coloring for: [6]
- $K_6$  (complete graph with 6 vertices)
  - Any complete bipartite graph.
  - $C_7$  (cyclic graph with 7 vertices).

- Q3) a) Consider these relations on the set of integers : [6]

$$R_1 = \{(a, b) \mid a \leq b\};$$

$$R_2 = \{(a, b) \mid a > b\};$$

$$R_3 = \{(a, b) \mid a = b \text{ or } a = -b\};$$

$$R_4 = \{(a, b) \mid a = b\};$$

$$R_5 = \{(a, b) \mid a = b + 1\};$$

$$R_6 = \{(a, b) \mid a + b \leq 3\};$$

Which are symmetric and which are antisymmetric?

- b) Functions,  $f$ ,  $g$  &  $h$  are defined on the set  $X = \{1, 2, 3\}$  as [6]

$$f = \{(1, 3), (2, 1), (3, 2)\}$$

$$g = \{(1, 2), (2, 3), (3, 1)\}$$

$$h = \{(1, 2), (2, 1), (3, 3)\}$$

- Find  $f \circ g$  and  $g \circ f$ . Are they equals?
  - Find  $f \circ g \circ h$  and  $f \circ h \circ g$ .
- c) If  $A = \{a, b, c, d\}$  and  $R = \{(a, b), (c, d), (c, c), (d, a), (a, a), (b, b), (d, d)\}$  is a relation on A. Draw a digraph R and  $\bar{R}$ . [6]

OR



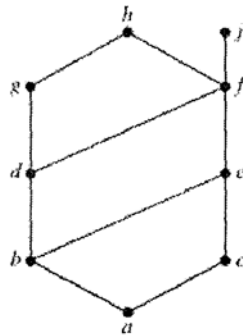
**Q4) a)** Let  $A = B$  be the set of real numbers [6]

$f: A \rightarrow B$  given by  $f(x) = 2x^3 - 1$

$g: B \rightarrow A$  given by  $g(y) = 3\sqrt{\frac{1}{2}y + \frac{1}{2}}$

Show that  $f$  is a bijection between  $A$  and  $B$  and  $g$  is a bijection between  $B$  and  $A$ .

**b)** [6]



- i) Find the lower and upper bounds of the subsets  $\{a, b, c\}$ ,  $\{j, h\}$ , and  $\{a, c, d, f\}$  in the poset with the Hasse diagram shown in Figure?
- ii) Find the greatest lower bound and the least upper bound of  $\{b, d, g\}$ , if they exist, in the poset shown in Figure?

**c)** Solve the following recurrence relation [6]

$$a_r - 3a_{r-1} = 2, \quad r \geq 1, a_0 = 1$$

**Q5) a)** Using Euclidean Algorithm find GCD of 268 & 884. [6]

**b)** Using Fermat's Theorem and Fermat's Euler Theorem solve the following: [6]

- i)  $7^{121} \pmod{4}$
- ii)  $11^{100} \pmod{17}$

**c)** Find the multiplicative Inverse of 37 mod 26 using Extended Euclidean Algorithm. [6]

OR

**Q6) a)** Using the Chinese Remainder Theorem, find the value of P using the following data. [8]

$$P = 1 \pmod{2}$$

$$P = 2 \pmod{3}$$

$$P = 3 \pmod{5}$$

b) State and explain Fermat - Euler's Theorem with example. [4]

c) Find the Totient function of the following numbers : [6]

i) 75

ii) 143

iii) 108

**Q7) a)** Let  $G = \{\text{even, odd}\}$  and binary operation  $\oplus$  be define as, [6]

$\oplus$	even	odd
even	even	odd
odd	odd	even

Show that  $(G, \oplus)$  is a group

b) Define the following terms with an example : [6]

i) Monoid

ii) Group

iii) Abelian group

iv) Ring

c) Find the hamming distance between code words of:  $C = \{(0000), (0101), (1011), (0111), (1111)\}$

Rewrite the message by adding an even parity check bit and odd parity check bit. [5]

OR

**Q8)** a) Consider the (2,6) encoding function  $e$ .  $e(00)=100000$ ,  $e(10)=101010$   
 $e(01)=001110$ ,  $e(11)=101001$  [6]

i) Find the minimum distance of  $e$

ii) How many errors will  $e$  detect?

b) Let  $I$  be the set of all integers. For each of the following determine whether  
 $*$  is an associative operation or not : [8]

i)  $a*b = \max(a,b)$

ii)  $a*b = \min(a + 2, b)$

iii)  $a*b = 2a - 2b$

iv)  $a*b = \min(2a - b, 2b - a)$

v)  $a*b = \text{LCM}(a,b)$

vi)  $a*b = a/b$

vii)  $a*b = \text{power}(a,b)$

viii)  $a*b = a^2 + 2b + ab$

c) Define field with an example. [3]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P1597

[Total No. of Pages : 3

[6002]-227

S.Y. E. (AI & ML)

**DATA STRUCTURES & ALGORITHMS**

**(2019 Pattern) (Semester - III) (218542)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Discuss how stack can be used to convert a given infix expression to post fix/pre fix expression using sudo code. [8]
- b) Contrast between linear queue and circular queue, also discuss the time complexities of insert and delete operations of a queue. [5]
- c) Discuss types of priority queue and how it is different from simple queue.[5]

OR

- Q2)** a) Convert the following infix expressions to prefix expressions using stock. Clearly indicate the stock contents for each operation [10]
- i)  $(A+2) \$3*(P+Q)/(X - Y)$
- ii)  $M/N*(R+S - T * 2) \$ B$
- (\$ is for power operation)
- b) Enlist applications of queue data structure & establish using sudo code conditions for queue overflow and queue under flow for circular queue.[8]

- Q3)** a) Write sudo code for inserting a node in binary search tree. [6]
- b) Enlist applications of Binary trees & write sudo code for inorder-tree traversal with non-recursive approach. [8]
- c) What is the space complexity of threaded binary tree. Justify your answer.[3]

OR

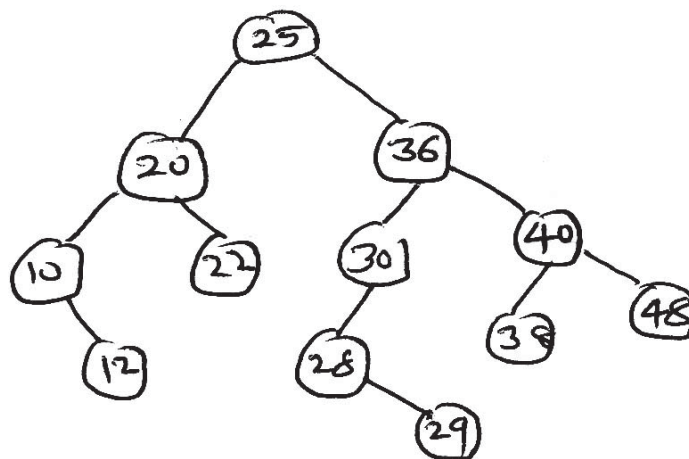
**P.T.O.**

- Q4)** a) Write sudo code for inserting a node in inorder - threaded binary tree. [8]  
 b) Discuss the various scenarios of deleting a node from binary search tree. [6]  
 c) Construct a binary tree from the given traversal. [3]

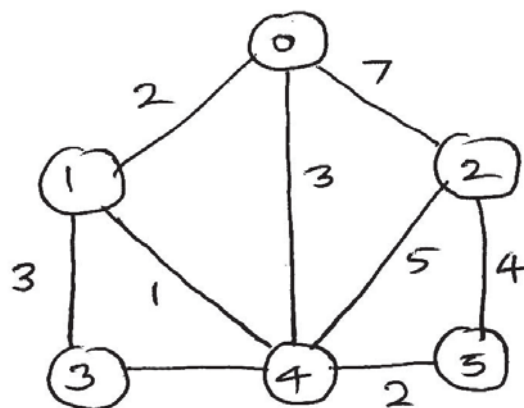
Inorder : H, D, I, B, E, A, J, F, K, C, e

Postorder : H, I, D, E, B, J, K, F, e, C, A

- Q5)** a) For a given following tree, convert it to balanced AVL tree. Indicate balance factor and type of rotation for each operation. After conversion insert node 15 & 24 in the tree. After insertion if the tree becomes inbalanced, convert it again to AVL. [10]



- b) For the given graph below draw MST, using prim's algorithm. [8]



OR

- Q6)** a) Construct heap data structure to sort the following set of no. S. Demonstrate all heapify operations. (Use - max heap) [8]  
6 4 15 12 85 18 7 25 9
- b) Discuss the significance of topological sorting. Contrast the time-complexities of Kruskal's and Prim's algorithm to find MST. [6]
- c) Enlist graph traversal techniques and explain briefly. [4]

- Q7)** a) Explain the significance of a file. Contrast & Discuss features of different types of file organizations. [8]
- b) Enlist features of a good hash function. Discuss briefly with the help of example different types of collision resolution techniques. [9]

OR

- Q8)** a) Discuss the importance of file opening & file closing operations. Explain the purpose of the following modes. [9]
- i) ios :: app
  - ii) ios :: trunc
  - iii) ios :: binary
  - iv) ios :: ate
- b) Create hash table and resolve collision using linear probing with replacement.  
table size = 10 hash function = key % 10 [8]  
18, 15, 23, 69, 52, 65, 98, 21, 25, 16

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P1598**

[6002]-228

[Total No. of Pages : 2

**S.E. (Artificial Intelligence & Machine Learning)**

**COMPUTER NETWORKS**

**(2019 Pattern) (Semester - III) (218543)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) Answer 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 CRC? Generate the CRC code of message 1101110111. Given generator Polynomial  $g(x) = x^3 + x + 1$ . [9]

b) Explain the working mechanism of [9]

i) Stop and Wait ARQ

ii) Go back-N ARQ

OR

**Q2) a)** Explain with example fixed-size framing and variable size framing. [9]

b) What is hamming code? Also find Hamming code word for following Data word 1010001 using odd parity. [9]

**Q3) a)** Discuss Link State Routing protocol in detail. [9]

b) Explain Network Address Translation with suitable diagram. [8]

OR

**Q4) a)** Explain Subnetting and Supernetting with example. [9]

b) Discuss DHCP protocol in details. [8]

**Q5) a)** What is congestion Control? Explain Token bucket algorithm. [9]

b) Explain three way handshake algorithm for TCP connection establishment. [9]

OR

**Q6) a)** Explain various socket primitives used in connection oriented client server approach. [9]

b) Differentiate between TCP and UDP protocol. Explain how TCP provides flow control facility. [9]

**P.T.O.**

- Q7) a)** What is DNS Server? Explain lookup methods used by the DNS to resolve the remote names. **[9]**
- b) Explain control and data connection of FTP? Explain any two FTP commands. **[8]**

OR

- Q8) a)** What is SNMP? What is the purpose SMI and MIB in relation to SNMP? **[9]**
- b) What is MIME? Discuss its role in SMTP. **[8]**

✱ ✱ ✱



Total No. of Questions : 8]

SEAT No. :

**P1599**

[Total No. of Pages : 2

[6002]-229

S.E. (AI & ML)

**OBJECT ORIENTED PROGRAMING**

**(2019 Pattern) (Semester-III) (218544)**

*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)** Consider the definition of 'complex' class as below:

**[9]**

```
public class complex
{
private int real, img;
public complex ()
{
//constructor 1
}
public complex (int real, int img)
{
//constructor 2
}
public complex (complex c)
{
//constructor 3
}
}
```

Re-write the class 'complex' as:

- i) Define the constructor 1 so that the private member variables are initialized to 0.
  - ii) Define the constructor 2 so that the private member variable real and img is initialized according to the value of the parameter.
  - iii) Define the constructors 3, where copy one object to another.
- b) With suitable code segments illustrate various uses of 'final' keyword.[9]

OR

**P.T.O.**

**Q2) a)** What are the characteristics of Destructor? How is Destructor declared in OOP? Demonstrate with an example. [9]

b) Write a program which demonstrate constructor with default arguments. [9]

**Q3) a)** Discuss diamond problem in detail? How it can be solved? [9]

b) Enlist the benefits and costs of Inheritances. [8]

OR

**Q4) a)** How parameterized constructors get executed in multilevel inheritance Explain with an example? [9]

b) Define Polymorphism? What are the types of Polymorphism? How can be run time polymorphism achieved in OOP? [8]

**Q5) a)** Define Exception. What are its types? Discuss exception handling mechanism in detail. [9]

b) What is Generic Programming? Discuss any four methods of Arraya List class with their syntax. [9]

OR

**Q6) a)** Is there any difference between throw and throws in exception handling in Java? If 'yes', justify your answer [9]

b) How basic mathematical set operations union, intersection, and subset are performed using set interface? [9]

**Q7) a)** What is a design pattern? Write a short note on 'Singleton' design pattern. [9]

b) Write program to handle primitive data types in file handling. [8]

OR

**Q8) a)** How do you write to a file and read from a file using File Writer and File Reader class, respectively? [8]

b) What are the advantages of design patterns? Explain 'Adaptor' design pattern in detail. [9]



Total No. of Questions : 8]

SEAT No. :

P-1600

[Total No. of Pages : 2

[6002]-230

**S.E. (Artificial Intelligence & Machine Learning)**

**SOFTWARE ENGINEERING**

**(2019 Pattern) (Semester - III) (218545)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

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

- Q1)** a) What are the characteristics of a good design? Explain Software Quality Guidelines and Attributes of software design. [9]
- b) What is an architectural style? Explain different architectural style with suitable example. [9]

OR

- Q2)** a) What is a component? Explain An Object-Oriented View of components with suitable example. [9]
- b) Explain design evaluation cycle. What are design issues we have to consider while designing user interface? [9]

- Q3)** a) What do you mean by Work Breakdown Structure? Explain representations of WBS with suitable examples. List advantages of WBS. [8]
- b) What is Project Management Spectrum? Explain the W<sup>5</sup>HH Principle. [9]

OR

- Q4)** a) What is Critical Path Method (CPM)? Explain the components of CPM. Explain key steps in Critical Path Method using suitable example. [8]
- b) What do you mean by Software Measurement? Explain size & function-oriented metrics with suitable examples. [9]

*P.T.O.*

- Q5) a)** Define quality. What is Cost of Quality? Explain types of Cost of Quality in details. [9]
- b) What is software testing? Why it is important? Explain Principles of Software Testing. [9]

OR

- Q6) a)** Explain defect management. Explain various stages of defect management process. [9]
- b) Compare Software Quality Assurance, Software Quality Control and Software Testing. [9]
- Q7) a)** What do meant by Software Configuration? Define baseline. What is Software Configuration Objects? [9]
- b) Explain test-driven development with neat diagram. [8]

OR

- Q8) a)** What is CASE workbench? Explain types of CASE workbenches. [9]
- b) Explain software reuse. What are approaches of Reuse-based software engineering? What are benefits of software reuse? [8]



Total No. of Questions : 08]

SEAT No. :

P-1601

[Total No. of Pages : 2

[6002]-231

**S.E. (Artificial Intelligence and Machine Learning)**

**OPERATING SYSTEMS**

**(2019 Pattern) (Semester - IV) (218552)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) *Attempt 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 the critical section problem? Discuss the criteria for a solution to a critical section problem. **[8]**

b) What is a deadlock? What is a safe, unsafe, and deadlock state? Explain the deadlock detection algorithm for resources with multiple instances with a suitable diagram. **[9]**

OR

**Q2) a)** Explain the Dining Philosopher problem with the help of pseudo code. **[8]**

b) What are the four necessary conditions for deadlock? How is a deadlock detected in a system with resources having single instances? Explain with an example. **[9]**

**Q3) a)** For the physical memory of 1MBytes, demonstrate the following memory requests and release using the buddy system.

Request 120K, Request 155K, Request 42K, Request 240K. Release 120K. Release 42K. Request 80K. Release 240K. Release 155K, Release 80K.

Also, draw the tree representation after Request 240K. **[9]**

b) Why is the capability to relocate processes desirable? Explain in detail with the help of a neat diagram. **[9]**

OR

*P.T.O.*

- Q4)** a) Consider the page reference string: 1, 2, 3, 4, 1, 2, 5, 1, 2, 3, 4, 5. Calculate the number of page faults for the FIFO page replacement algorithm with 3 frames and with 4 frames. Discuss your observations from the number of page faults in both cases. [9]
- b) What are the distinctions among logical, relative and physical addresses? Give Example. [9]

- Q5)** a) With the help of a neat diagram, explain free space management methods in secondary storage. [9]
- b) Describe different methods of record blocking with the help of a neat diagram. [9]

OR

- Q6)** a) A disk drive has 200 tracks, numbered 0-199. The drive is currently serving the request at track no 100. The queue of pending requests in FIFO order is 27, 129, 110, 186, 147, 41, 10, 64, 120. 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 decreasing order of track number for SCAN and C-LOOK. [12]
- |             |          |
|-------------|----------|
| i) FCFS     | ii) SCAN |
| iii) C-LOOK | iv) SSTF |
- b) Explain in brief, with the help of a diagram different techniques for performing I/O. [6]

- Q7)** a) Explain the imperative statement, declarative statement and assembly directive of assembly language programming. [6]
- b) Give a complete design of an Absolute Loader with a suitable example. [6]
- c) Define Macro. How are Macros different from functions? [5]

OR

- Q8)** a) What is system software? Explain any 4 system software in brief. [6]
- b) What are assembler directives? Explain with example [6]
- c) Discuss with an example what is forward reference problem. [5]



Total No. of Questions : 8]

SEAT No. :

P-1602

[Total No. of Pages : 2

[6002]-232

**S.E. (Artificial Intelligence & Machine Learning)**  
**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**  
**AND MACHINE LEARNING**  
**(2019 Pattern) (Semester - IV) (218553)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

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

- Q1)** a) Explain Semantic Network Representation with example? State the drawbacks of Semantic Network Representation. [6]
- b) What is Proposition in AI? Explain types of Propositions with example. [6]
- c) State and explain rules of inference. [6]

OR

- Q2)** a) Explain Frame Representation with its merits and demerits. [6]
- b) Compare Forward Chaining and Backward Chaining. [6]
- c) What is the relationship between knowledge and intelligence? Explain AI knowledge cycle. [6]

- Q3)** a) What is difference between AI and ML? [8]
- b) Explain the Cross-validation with diagram. [9]

OR

- Q4)** a) Explain qualitative and quantitative data. [8]
- b) Explain data preprocessing with example. [9]

*P.T.O.*

- Q5)** a) What is Supervised and Unsupervised Learning? Give real life example of supervised and unsupervised learning. [6]  
b) What is Dimensionality Reduction? Explain Subset Selection in detail. [6]  
c) Write short note Principal Component Analysis. [6]

OR

- Q6)** a) Explain different types of Learning Models in Machine Learning. [6]  
b) Explain with example Forward and Backward Selection method for Subset Selection. [6]  
c) Why do we need Dimensionality Reduction? What are its drawbacks? [6]

- Q7)** a) What is univariate and multivariate regression? Explain any two measures of performance evaluation of Regression Model. [7]  
b) Explain One-Vs-One construction method of multiclass classifier with suitable example. [6]  
c) Justify the following : [4]  
i) Prediction of the height of a person. Is it a regression task?  
ii) Find the gender of a person by analyzing his writing style. Is it a classification task?  
iii) Filter out spam emails. Is it a example of unsupervised learning.  
iv) "Identifying type of fruit" Is this a regression task or classification?

OR

- Q8)** a) What is regression? Explain SSE, MSE and MAE in context of regression. [7]  
b) Define following terms with suitable example : [6]  
i) Confusion Matrix  
ii) False Positive Rate  
iii) True Positive Rate  
iv) Accuracy  
v) F1-Score  
c) Explain under fit, over fit and just fit models for Regression. [4]





Total No. of Questions : 8]

SEAT No. :

**P1603**

[Total No. of Pages : 3

[6002]-233

**S.E. (Artificial Intelligence & Machine Learning)**

**DATABASE MANAGEMENT SYSTEM**

**(2019 Pattern) (Semester-IV) (218554)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

**Q1) a)** Explain Different type of join with suitable example. **[6]**

b) Consider following Database. **[6]**

Student(roll\_no, name, address)

Subject(sub\_code,sub\_name)

Marks(roll\_no, sub\_code, mark)

Write following queries in SQL:

- i) Find Average marks of each student along with name of student.
  - ii) Find how many Student have failed in the subject DBMS.
- c) Write a note on Embedded and Dynamic SQL. **[5]**

OR

**Q2) a)** What is view? How is it created and stored? List two major problem with modification of database through view. **[6]**

b) Suppose there are two relation r and s such that the foreign key B of r references the primary key A of s. Describe how the trigger mechanism can be used to implement the on delete cascade option when a tuple is deleted from s. **[6]**

c) Explain Set membership and set comparison operator. **[5]**

**P.T.O.**

**Q3) a)** Compute closure of the following set F of FD for relational schema. [6]

$R=(A,B,C,D,E)$

$F : (A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A)$

List candidate key of R.

b) Define BCNF. How it differs from 3 NF? Why is it consider a stronger from 3 NF? [6]

c) Write a note on Evaluation of expression. [6]

OR

**Q4) a)** What is query processing? Explain steps involved in processing query with suitable diagram. [5]

b) Explain with suitable example Update Anomalies. [6]

c) What is normalization? What is the importance in DBMS design? Explain 1NF, 2NF, 3NF with suitable example. [7]

**Q5) a)** Check whether given scheduled is view serializable [4]

T1	T2	T3
Read(Q)		
	Write(Q)	
		Write(Q)
Write(Q)		

b) Explain the concept of transaction. Describe ACID properties for transaction. [6]

c) What is recoverable schedule? Why is recoverability of schedule desirable? Are there any circumstances under which it could be desirable to allow nonrecoverable schedule? Explain your answer. [7]

OR

- Q6) a)** Define Serializability. Give test for conflict Serializability. Check Whether following schedule is conflict serializable. [7]

T1	T2
Read(A)	
Write(A)	
	Read(A)
	Write(A)
Read(B)	
Write(B)	
	Read(B)
	Write(B)

- b) Explain deferred database modification and immediate database modification and there difference in the context of recovery. [6]
- c) Explain Timestamp based Concurrency Control [4]

- Q7) a)** Explain following term related to distributed database system. [6]

- i) Homogeneous and heterogeneous distributed database
- ii) Data replication
- iii) Data fragmentation
- iv) Transparency

- b) Explain Architecture of parallel databases. [6]
- c) Discuss the speedup and scaleup issue in parallelism with suitable diagram. [6]

OR

- Q8) a)** State which database architectures you will prefer for following application. Support your answer with brief explanation. [6]

- i) Banking System
- ii) Airline reservation System

- b) Write short note on: [12]
- i) Internet Database
  - ii) SQLite Database
  - iii) Cloud Database



Total No. of Questions : 8]

SEAT No. :

**P1604**

[Total No. of Pages : 2

[6002]-234

**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) *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)** Use the Cohen Sutherland Line Clipping Algorithm with the help of region codes to clip a line AB with A(50,30), B(110,70) and PQ with P (30,70), 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) What is projection? Explain with diagram, oblique - Cavalier, Cabinet, Orthographic-isometric, diametric, trimetric Parallel projections. **[9]**

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 PQR with P (165,240), Q (180,90), R (100,175) and find the final coordinates of the clipped polygon. **[9]**

b) Explain the basic transformation techniques in 3D Graphics **[9]**

- i) Rotation
- ii) Translation
- iii) Reflection about XY Plane

**Q3) a)** Explain in detail with Diagram **[9]**

- i) RGB Color Model
- ii) CIE Chromaticity Diagram,
- iii) Color Gamut

b) Define Shading. Compare Constant Intensity, Halftoning, Gouraud Shading and Phong Shading algorithm. **[8]**

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 Deletion and  
iii) Segment Renaming.
- b) Explain in detail combined diffuse and specular reflections with multiple light sources. [8]

- Q5)** a) Write short note on Hilbert's and Koch Curve along its Topological and Fractal Dimensions. [9]  
b) Write short note on [9]  
i) Design of animation sequence  
ii) Frame-by-Frame Animation techniques

OR

- Q6)** a) Explain in detail with diagram Bezier curve generation using midpoint subdivision method. [9]  
b) What is interpolation? Explain the process of curves Approximation. [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) What is kinematic modeling in a Virtual Reality? [5]

OR

- Q8)** a) What is graphics rendering pipeline in a Virtual Reality system. [6]  
b) Explain gesture interfaces in Virtual Reality. [6]  
c) Explain 3D position trackers. [5]



Total No. of Questions : 8]

SEAT No. :

P-1605

[Total No. of Pages : 3

[6002]-235

S.E. (Robotics and Automation)

STRENGTH OF MATERIALS

(Semester-III) (2019 Pattern) (211082)

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) Use of calculator is allowed
- 4) Assume Suitable data if necessary

- Q1)** a) A timber beam of rectangular section carries a load of 2 kN at mid-span. The beam is simply supported over a span of 3.6 m. If the depth of section is to be twice the breadth, and the bending stress is not to exceed  $9 \text{ N/mm}^2$ , determine the cross-sectional dimensions. [8]
- b) What do you mean by Shear Stress in Beams? [5]
- c) What do you mean by Section modulus? State the formula for section modulus of rectangular and circular section. [4]

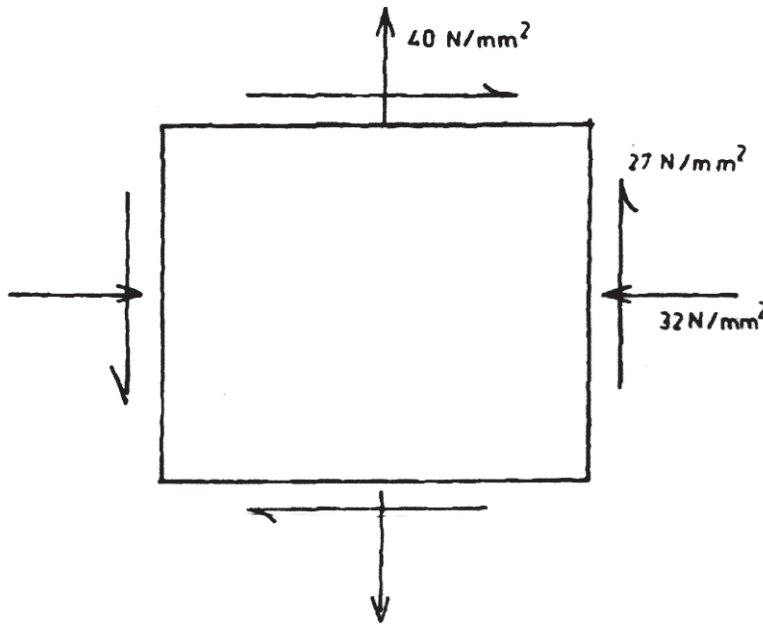
OR

- Q2)** a) A rectangular beam of breadth 100 mm and depth 200 mm is simply supported over a span of 4 m. The beam is loaded with a uniformly distributed load of 5 kN/m over the entire span. Find the maximum bending stresses. [8]
- b) An I section beam 350mm×200mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the stress distribution across the section. [9]
- Q3)** a) Using Mohr's circle, obtain the maximum shear stress in the body when it is subjected to direct tensile stress in one plane accompanied by a simple shear stress. [8]
- b) A steel bar 50 mm×50 mm in section and 3 m in length is subjected to a axial pull of 140 KN. Calculate the strain energy stored in the bar and also find extension of the bar. Assume modulus of elasticity as 200 GPa. [9]

P.T.O

OR

- Q4)** a) The radius of Mohr's circle of stress of strained element is 20 MPa and a minor tensile stress is 20 MPa. Determine the major principal stress. [7]
- b) Evaluate the principal stresses and principal planes for the state of stress shown in Figure. [10]



- Q5)** a) What must be the length of a 5mm diameter aluminium wire so that it can be twisted through 1 complete revolution without exceeding a shear of  $42\text{N/mm}^2$ . Take,  $G=27\text{ GPa}$ . [8]
- b) A closed cylinder 600mm diameter and 2 m long has shell thickness of 12 mm. It carries a fluid under pressure at 3 MPa. Calculate the longitudinal and hoop stress in the drum wall. Also determine the change in length, change in diameter and change in volume of the drum. Assume  $E=2\times 10^5\text{ MPa}$  and Poisson ration of 0.3. [10]

OR

**Q6) a)** A cylindrical compressed air drum is 2 m in diameter with plates 12.5 mm thick. The efficiencies of the longitudinal and circumferential joints are 85% and 45% respectively. If the tensile stress in the plating is to be limited to  $100 \text{ MN/m}^2$ , find the maximum safe air pressure. [10]

b) A cylindrical boiler is 2.5 m in diameter and 20 mm in thickness and it carries steam at a pressure of  $1.0 \text{ N/mm}^2$ : Find the stresses in the shell. [8]

**Q7) a)** A beam of length 5 m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of  $9 \text{ KN/m}$  run over the entire length. Calculate the width and depth of the beam if permissible bending stress is  $7 \text{ N/mm}^2$  and central deflection is not to exceed 1 cm. [9]

b) A cantilever of length 3 m is carrying a point load of 25 KN at the free end. If moment of inertia =  $108 \text{ mm}^4$  and  $E = 2.1 \times 10^5 \text{ N/mm}^2$  find the slope and deflection at the free end. [9]

OR

**Q8) a)** A cantilever of length 2.5 m carries a uniformly distributed load of  $16.4 \text{ KN}$  per meter length. If moment of inertia =  $7.95 \times 10^7 \text{ mm}^4$  and  $E = 2 \times 10^5 \text{ N/mm}^2$ , determine the deflection at the free end. [9]

b) A cantilever of length 3 m carries a uniformly distributed load over the entire length. If the deflection at the free end is 40 mm, find the slope at the free end. [9]





Total No. of Questions : 8]

SEAT No. :

**P1606**

[Total No. of Pages : 2

[6002]-236

**S.E. (Robotics and Automation Engineering)**

**INDUSTRIAL ELECTRONICS AND ELECTRICAL TECHNOLOGY**

**(2019 Pattern) (Semester - III) (211501)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Explain the concept of ADC in A Tmega 328P -based Arduino board. [4]
- b) Explain the concept of Pulse Width Modulation (PWM). [6]
- c) Draw a neat schematic showing the interfacing of temperature sensor LM 35 with AT mega 328P-based Arduino board. The output of LM 35 is connected to analog pin A4 of the Arduino board. Write the algorithm for the same. [8]
- i) What is the operating temperature range of LM 35?
  - ii) How many pins are available for the LM35 sensor?
  - iii) What is the output voltage of LM 35 per degree Celsius temperature?

OR

- Q2)** a) Draw the schematic showing the interfacing of an AT mega-based Arduino board to a DC motor with L293D. [4]
- b) Draw a neat diagram showing the interfacing of the strain gauge with an ATmega 328P-based Arduino board. Given that the output voltage from the strain gauge after signal conditioning is connected to analog pin A0 of the Arduino board. Write algorithmic steps to display strain on the serial monitor. [6]
- c) Draw and explain the interfacing of the Accelerometer with Arduino ATmega 328P. Write its algorithm. [8]

*P.T.O.*

- Q3)** a) Write any four industrial applications of the DC series and DC shunt motor. [4]  
b) State and explain the working principle of the DC generator along with a diagram. [6]  
c) Draw the schematic of the three-point starter used for the DC shunt motor. Indicate the following components of the three-point starter and write their functions during operation. [7]  
i) No volt coil:  
ii) Overload release.

OR

- Q4)** a) What is the back emf in the DC motor? Write the emf equation of the DC generator. [4]  
b) Draw and explain the Speed-armature current characteristics and torque-armature current characteristics of the DC shunt motor. [6]  
c) Derive the expression for the torque of the DC machine. [7]
- Q5)** a) Write any four industrial applications of the induction motor. [4]  
b) Explain constructional details of three-phase IM with its appropriate diagram. [6]  
c) Derive the expression for the torque developed in a three-phase induction motor under running conditions. [8]

OR

- Q6)** a) Distinguish between squirrel cage and slip ring induction motors. Write any four valid points. [4]  
b) The useful torque of the three-phase, 50 Hz, an 8-pole induction motor is 190 NM. The frequency of the rotor is 1.5 Hz. Calculate the rotor copper loss if the mechanical losses are 700 watts. [6]  
c) Explain the operation of star-delta 'starter used for three phase induction motor with the help of a neat schematic diagram. [8]
- Q7)** a) Differentiate AC and DC motors. Write any four valid points. [4]  
b) Describe the constructional details and operation of the capacitor start capacitor run induction motor with the help of diagrams. [6]  
c) Describe the construction and working of the Universal motor with the help of suitable diagrams and state its two applications. [7]

OR

- Q8)** a) What is a linear induction motor? Draw its diagram. [4]  
b) Explain the construction and working of the shaded pole induction motor with the help of a suitable diagram. [6]  
c) Describe the construction and working of Brushless DC (BLDC) motor with the help of a suitable diagram and state any two applications of it. [7]



Total No. of Questions : 8]

SEAT No. :

**P1607**

[Total No. of Pages : 2

[6002]-237

**S.E. (Robotics and Automation)**  
**MANUFACTURING TECHNOLOGY**  
**(2019 Pattern) (Semester-III) (211502)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.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 logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

**Q1) a)** Explain with neat sketch tube drawing process. **[9]**

b) Explain extrusion operation with its schematic diagram. **[8]**

OR

**Q2) a)** Explain any four extrusion process variables with sketch. **[9]**

b) Discuss forces required in drawing, multiple drawing and strip drawing. **[8]**

**Q3) a)** Explain the different types of welding electrodes used in arc welding process? **[9]**

b) Describe the flux materials used in TIG welding? **[8]**

OR

**Q4) a)** Explain the application of Alternating current (AC), Direct Current Straight Polarity (DCSP) and Direct Current Reverse Polarity (DCRP) in Shielded Metal Arc Welding (SMAW) process. **[9]**

b) How the heat balance is achieved in spot welding, explain the spot welding process? **[8]**

**P.T.O.**

- Q5)** a) Explain with neat diagram construction and working of Abrasive Jet Machining (AJM) process. [9]  
b) Draw schematic diagram of Water Jet Machining (WJM). Explain its construction and working. [9]

OR

- Q6)** a) Explain briefly EDM process characteristics. [9]  
b) Explain the construction and working principle of Plasma Arc Machining (PAM) with neat sketch. [9]

- Q7)** a) How to perform loading and unloading of parts in machining operations using robots. [9]  
b) Elaborate on repetitive work cycle operations. [9]

OR

- Q8)** a) Explain spray painting robots and its advantages. [9]  
b) Explain forging robots and press working robot [9]



Total No. of Questions : 8]

SEAT No. :

P-1608

[Total No. of Pages : 2

[6002]-238

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 powder Metallurgy? Give its application? [8]
- b) Explain Term : [8]
- i) Electrical Contact Materials
  - ii) Cemented carbide tipped tools.

OR

- Q2)** a) Why it is necessary to control atmosphere during sintering? And also write down advantages of powder metallurgy. [8]
- b) Write note on : [8]
- i) Diamond impregnated Cuffing Tools
  - ii) Self-lubricating bearings.

- Q3)** a) Define following. [10]
- i) Ferrite
  - ii) Austenite
  - iii) Pearlite
  - iv) Cementite
  - v) Bainite

P.T.O.

- b) What are stainless steel? Give typical composition and two uses of various types of stainless steel. [8]

OR

**Q4)** a) What is steel? What do you understand by eutectoid, hypereutectoid and hypoeutectoid steel? [10]

b) Classify C.I.? And give its application. [8]

**Q5)** a) What is retained austenite? Why it is not desirable? [10]

b) Explain terms : [8]

i) Quenching

ii) Annealing

OR

**Q6)** a) Explain the method of plotting TTT diagram and what information is obtained from this diagram? [9]

b) Write note on : [9]

i) Flame Hardening

ii) Nitriding

iii) Carbonitriding

**Q7)** a) What is equivalent zinc of a brass? Explain its significance and usefulness. [9]

b) Write note on : [9]

i) Composite materials.

ii) Nano-materials.

iii) Sports materials.

OR

**Q8)** a) Write Note on Copper and its Alloy. [9]

b) Give composition and properties of any three bearing materials. [9]



Total No. of Questions : 8]

SEAT No. :

P-1609

[Total No. of Pages : 2

[6002]-239

S.E. (Robotics and Automation)

INDUSTRIAL ENGINEERING AND MANAGEMENT

(2019 Pattern) (Semester - IV) (211508)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

Q1) a) Describe the entrepreneur's role and task. [8]

b) Describe factors impacting on entrepreneurship. [9]

OR

Q2) a) Describe the characteristics of an entrepreneurship. [5]

b) Following data is available for ABC company: [12]

Variable cost per unit = Rs.15

Selling Price per unit = Rs. 25

Total units sold = 75,000

Fixed cost = Rs.15,000

Calculate:

- i) PV ratio
- ii) BEP in units
- iii) BEP in sales
- iv) Total Profit
- v) 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). [10]

b) Define and explain with suitable illustration i) Total productivity ii) Labor productivity and iii) Material productivity. What are the benefits of increased productivity? [7]

**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) Describe MOST with suitable illustration. [8]

OR

**Q8)** a) Describe various types of allowances used in time study. [9]

b) Describe PMTS with suitable illustration. [9]





Total No. of Questions : 8]

SEAT No. :

P-1610

[Total No. of Pages : 2

[6002]-240

**S.E. (Robotics & Automation Engineering)**  
**CONTROL SYSTEM ENGINEERING**  
**(2019 Pattern) (Semester - IV) (211509)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q. 6. and Q.7 or Q.8.*
- 2) *Assume suitable data, if necessary.*
- 3) *Use of electronic pocket calculator is allowed.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1) a)** A feedback control system with loop gain

$$GH(S) = K (S+2) / S (S+1) (S^2+2S+5)$$

Determine value of K for critical stability of the system, also write the system is stable or unstable. [8]

- b) Explain Routh's stability criteria, state advantages and Necessity of Routh's criteria. [9]

OR

**Q2) a)** If  $G = K / S (S+6) (S+8)$  and  $H(S) = S+2$ . Comment on stability. [8]

- b) What is stability? Explain stable, unstable, marginally and conditionally stable system with locations of roots in s plane. [9]

**Q3) a)** Sketch root locus for  $G H(S) = K(S+4) (S+5) / (S+3) (S+1)$ . [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)** State Nyquist theorem and explain Nyquist stability criteria. [8]

- b) Define polar plot and draw the polar plot for  $G(S) = S$ . [9]

**P.T.O.**

- Q5)** a) Explain digital control system in detail. Enlist its advantages and Applications. [9]  
b) Explain the architecture of PLC with neat diagram. [9]

OR

- Q6)** a) Explain any four selection parameters of PLC also enlist functions of PLC. [9]  
b) What is sampling? Explain the process of sampling with waveform.[9]

- Q7)** a) Why compensation is needed? Explain series compensator with diagram. [9]  
b) Explain the feedback compensator with example. [9]

OR

- Q8)** a) Explain phase lead design steps using bode diagram with effects, advantages disadvantages of phase lead compensation. [9]  
b) What is phase lag compensation? Enlist effects, advantages, disadvantages of phase lag compensation. [9]



Total No. of Questions : 8]

SEAT No. :

**P-1611**

[Total No. of Pages : 3

**[6002]-241**

**S.E. (Robotics & Automation Engineering)  
DESIGN OF MACHINE ELEMENTS  
(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 indicate full marks.*

- Q1)** a) Discuss the different types of threads used in power screw. [6]
- b) Define lead angle, major diameter, lead, and pitch in terms of power screw. [4]
- c) The cutter of a broaching machine is pulled by square threaded screw of 55 mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 60 mm and 90 mm internal and external diameters respectively. If the coefficient of friction is 0.15 for all contact surfaces on the nut, determine the power required to rotate the operating nut when the cutting speed is 6 m/min. Also find the efficiency of the screw. [8]

OR

- Q2)** a) 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. [8]
- b) Define core diameter, minor diameter, left hand screw, and Multiple thread screw in terms of power screw. [4]
- c) What is meant by power screw? Give its advantages, disadvantages and applications. [6]

**P.T.O.**

- Q3)** a) What is meant by springs? Explain different types of springs. [6]
- b) A compression coil spring made of an alloy steel is having the following specifications :
- Mean diameter of coil = 50mm; Wire diameter = 5mm; Number of active coils = 20. If this spring is subjected to an axial load of 500N; calculate the maximum shear stress (neglect the curvature effect) to which the spring material is subjected. [4]
- c) c) 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/mm<sup>2</sup>, find the axial load which the spring can carry and the deflection per active turn. [8]

OR

- Q4)** a) Explain the Surge in Springs. [6]
- b) Give any 2 applications of springs and any 2 material required for manufacturing of springs. [4]
- c) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm<sup>2</sup>. Also calculate the maximum shear stress induced. [8]

- Q5)** a) What is spur gear? Enlist any 2 applications of spur gear and Give its detail classification. [9]
- b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. [8]

OR

- Q6)** a) Define the terms in respective of spur gears: Module, Addendum, Pitch circle diameter, and Backlash [4]
- b) Discuss the Causes of Gear Tooth Failure. [5]

- c) The following particulars of a single reduction spur gear are given :
- Gear ratio = 10:1; Distance between centres = 660 mm approximately; Pinion transmits 500 kW at 1800 r.p.m.: Involute teeth of standard proportions (addendum =  $m$ ) with pressure angle of  $22.5^\circ$ ; Permissible normal pressure between teeth = 175 N per mm of width, Find: [8]
- The nearest standard module if no interference is to occur;
  - The number of teeth on each wheel;
  - The necessary width of the pinion; and
  - The load on the bearings of the wheels due to power transmitted.

- Q7)** a) What are rolling contact bearings? Discuss their advantages over sliding contact bearings. [4]
- b) Write short note on classifications and different types of antifriction bearings. [5]
- c) 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 percent of time, 2 kN for 20 percent of time, 1 kN for 30 percent of time and no load for remaining time of cycle. If the total life expected for the bearing is  $20 \times 10^6$  revolutions at 95 percent reliability, calculate dynamic load rating of the ball bearing.[8]

OR

- Q8)** a) Where are the angular contact and self-aligning ball bearings used? Draw neat sketches of these bearings. [7]
- b) How do you express the life of a bearing? What is an average or median life? [6]
- c) Explain how the following factors influence the life of a bearing: [4]
- Load
  - Speed
  - Temperature
  - Reliability



Total No. of Questions : 8]

SEAT No. :

**P1612**

[Total No. of Pages : 2

[6002]-242

**S.E. (Robotics & Automation)**  
**Metrology and Quality Assurance**  
**(2019 Pattern) (Semester-IV) (211511)**

*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 Logarithmic Table, Slide rule is Electronic pocket calculator is allowed.*

**Q1) a)** With neat sketch explain the working principle of tool maker's microscope. **[8]**

b) Explain effective diameter measurement by three wire method. **[9]**

OR

**Q2) a)** Explain screw thread terminology. **[8]**

b) Explain the use of profile projector with neat sketch. **[9]**

**Q3) a)** Explain  $\bar{X}$ -Chart & R-Chart. **[8]**

b) Contrast between Acceptance Sampling Vs 100% Inspection. **[9]**

OR

**Q4) a)** Explain Operating Characteristic Curve (OC Curve). **[8]**

b) Following table gives the number of defects in a casting used for making crank case of diesel engine, construct c-chart and comment on it. **[9]**

Casting No.	1	2	3	4	5	6	7	8	9	10
No. of defects (c)	15	11	25	10	12	20	15	10	17	13

**P.T.O.**

- Q5)** a) Explain Juran's Trilogy with neat sketch. [9]  
b) Write a short note on: [9]  
i) Quality Circle  
ii) Six Sigma  
iii) TPM

OR

- Q6)** a) Explain in detail TQM and its importance. [9]  
b) Explain following QC tools. [9]  
i) Pareto Chart  
ii) Control Chart  
iii) Stratification

- Q7)** a) Explain the benefit if environment management system. [9]  
b) Explain ISO 9000 and its importance. [9]

OR

- Q8)** a) Explain the concept of Quality Management System (QMS). [9]  
b) Explain the concept of ISO 14000. [9]



Total No. of Questions : 8]

SEAT No. :

**P1613**

**[6002]-243**

[Total No. of Pages : 2

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

**Q1) a)** Use cubic spline interpolation to obtain  $y$  at  $x=5$  for the following data: **[12]**

X	3	4.5	7	9
Y	2.5	1	2.5	0.5

b) With suitable examples, explain the application of inverse distance weighting method for 3D surface generation. **[5]**

OR

**Q2) a)** A point  $(0,1,1)$  is rotated by  $90^\circ$  using a quaternion coincident with  $y$  axis. Determine the transformed position of the point. **[12]**

b) Explain 2D interpolation methods. **[5]**

**Q3) a)** Obtain  $x, y$  and  $z$  co - ordinate of a point on the Bazier surface patch at  $u = 0.5$  and  $v = 0.5$  using following control points: **[9]**

$$\begin{bmatrix} (0, 0, 0) & (1, 1, 0) & (2, 0, 0) \\ (0, 1, 1) & (1, 2, 1) & (2, 1, 1) \\ (0, 0, 2) & (1, 1, 2) & (2, 0, 2) \end{bmatrix}$$

b) Explain the applications of Bezier curves in robot path planning. **[8]**

OR

*P.T.O.*



**Q4) a)** What are B - spline curves? How the geometric continuity is determined for B - spline curves? [7]

b) Find the midpoint (i.e. point at parameter  $t = 0.5$ ) of a Hermite cubic spline with two end points as (1,1) and (6,5) and corresponding tangent vectors as (0,4) and (4,0). [10]

**Q5) a)** Determine the angle between a line  $a = i + j$  and a plane  $x + y + z - 1 = 0$ . [10]

b) Given  $y = 2x + 1$ , what is the Hessian normal form? [8]

OR

**Q6) a)** Obtain a point (P) in a plane parallel to XZ plane and containing point (1,1,1). Assume the values of arbitrary scalars for two vectors as 2 and 1 respectively. [12]

b) Write note on: Intersection of a circle with a straight line. [6]

**Q7) 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]

OR

**Q8) a)** Write short note on: Rotation and reflection. [9]

b) Explain the applications of applied geometric algebra for modelling of robotics physics. [9]

\* \* \*

Total No. of Questions : 8]

SEAT No. :

**P1614**

**[6002]- 244**

[Total No. of Pages : 3

**S.E. ( Mechanical & Automobile/ Mechanical SW)**

**THERMODYNAMICS**

**(2019 Pattern) (Semester - III) (202043)**

*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 electronic pocket calculator, steam table is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a)** Explain the concept of Available and Unavailable energy. When does the system become dead? **[8]**

b) 1 Kg of air at a pressure of 8 bar and a temperature of 100° C undergoes a reversible Polytropic process following the law  $pv^{1.2} = \text{constant}$ . If the final pressure is 1.8 bar determine the increase in entropy, work done and heat transfer of the system? **[9]**

OR

**Q2) a)** State Boyle's law and Charle's law and derive an equation of the state for a perfect gas? **[8]**

b) A system at 500 K receives 7200 KJ/min from a source at 1000 K. The temperature of atmosphere is 300 K. Assuming that the temperature of system and source remain constant during heat transfer, Determine: **[9]**

i) The entropy produced during heat transfer.

ii) The decrease in available energy after heat transfer.

**Q3) a)** Explain the constructional details & working of Separating & Throttling calorimeter? **[10]**

b) Explain the following terms: (i) Saturated steam, (ii) Dry saturated steam, (iii) Wet steam, (iv) superheated steam, (v) Dryness fraction of steam, (vi) Specific volume of steam, and (vii) Saturated water. **[8]**

OR

**P.T.O.**

- Q4) a)** A Rankine cycle operates between pressure of 80 bar and 0.1 bar. The maximum cycle temperature is 600°C. If the steam turbine and condensate pump efficiencies are 0.9 and 0.8 respectively. Calculate specific work and thermal efficiency? [12]

P bar	T°C	Specific Volume m <sup>3</sup> /kg		Specific EnthapyKJ/Kg			Specific Entropy KJKg K		
		v <sub>f</sub>	V <sub>g</sub>	h <sub>f</sub>	h <sub>fg</sub>	h <sub>g</sub>	S <sub>f</sub>	S <sub>fg</sub>	S <sub>g</sub>
0.1	45.84	0.0010103	14.68	191.9	2392.3	2584.2	0.6488	7.5006	8.1494
80	295.1	0.001385	0.0235	1317	1440.5	2757.5	3.2073	2.5351	5.7424

At 80 bar, 600°C:  $V_{sup} = 0.486 \text{ m}^3/\text{kg}$ ;  $h_{sup} = 3642 \text{ KJ/Kg}$ ;  $S_{sup} = 7.0206 \text{ KJ/Kg K}$ .

- b) Find the external work done during evaporation, internal latent enthalpy and internal energy per kg of steam at a pressure of 15 bar (1,500 kPa) when the steam is [6]

- i) 0.9 dry, and
- ii) dry saturated

- Q5) a)** Describe with the help of neat sketch (any one) the following calorimeters used for the determination of heating values [11]

- i) Bomb Calorimeter
- ii) Junker gas calorimeter

- b) What do you mean by Stoichiometric Air Fuel ratio (A/F ratio) and explain the advantages/disadvantages of excess air supplied for the combustion? [6]

OR

- Q6) a)** What are the advantages of using Liquid fuels over Solid fuels? List out minimum six advantages with justification? [6]

- b) Percentage volumetric analysis of a sample of flue gases of a coal fired boiler gave  $\text{CO}_2 = 10.4\%$ ,  $\text{CO} = 0.2\%$ ,  $\text{O}_2 = 7.8\%$ , and  $\text{N}_2 = 81.6\%$  (by difference). Gravimetric Percentage analysis of coal was  $\text{C} = 78\%$ ,  $\text{H}_2 = 6\%$ ,  $\text{O}_2 = 3\%$  and incombustible = 13%. Estimate: [11]

- i) Weight of dry flue gases per Kg of fuel
- ii) Weight of excess air per Kg of fuel.

**Q7) a)** What is the function of Boiler Mountings? Explain with neat sketches any three of the mountings? [8]

b) A steam generator evaporates 18000 Kg/hr of steam at 12.5 bar and a quality of 0.97 from feed water at 105°C, when coal is fired at the rate of 2040 Kg/hr. If the HCV of the coal is 27400 KJ/Kg, Determine: [10]

- i) The heat rate of boiler in KJ/Hr;
- ii) The Equivalent Evaporation;
- iii) The thermal efficiency of the Boiler.

OR

**Q8) a)** What do you mean by Boiler Draught and how are they classified. Enumerate the advantages of Mechanical Draught? [6]

b) A steam generator delivers steam at 100 bar, 500°C (Enthalpy,  $h=3373.7$  KJ/Kg). The feed water inlet temperature is 160°C ( $h=677$  KJ/Kg). The enthalpies of saturated liquid and saturated vapour at 100 bar are 1407.65 KJ/Kg and 2724.7 KJ/Kg respectively. The steam generation rate is 100000 Kg/hr and the steam generator efficiency is 88%. Estimate: [12]

- i) The fuel burning rate in Kg/hr, if the calorific value of fuel is 21 MJ/Kg;
- ii) The percentage of total heat absorbed in the economizer, evaporator and superheater.

*Assume that only latent heat is absorbed in the Evaporator (Boiler drum) and neglect any pressure drop.*



Total No. of Questions : 8]

SEAT No. :

P-1615

[Total No. of Pages : 3

[6002]-245

**S.E. (Automobile & Mechanical/Mechanical SW)  
Electrical and Electronics Engineering  
(2019 Pattern) (Semester - III) (203156)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) Derive the emf equation of a DC machine and hence write the voltage equation of a DC shunt motor. [6]
- b) A 200 V, 4 pole lap wound DC shunt motor has 800 conductors on its armature. The resistance of armature winding is  $0.5 \Omega$  and that of shunt field winding is  $200 \Omega$ . The motor takes current of 21 A and flux per pole is 30 mWb. Find the speed and gross torque developed in motor. [6]
- c) What is braking in a motor? Explain regenerative braking of DC shunt motor with the help of neat diagrams. [6]

OR

- Q2)** a) Mention the factors on which speed of a DC motor depends. Explain any one method of speed control of DC shunt motor. [6]
- b) A 250 V DC shunt motor runs at 1000 rpm at no load and takes 8 A. The armature and shunt field resistances are 0.2 Ohm and 250 Ohm respectively. Calculate the speed of motor while taking 50 A current from supply under certain load. Assume the flux and brush contact drops to be constant. [6]
- c) Draw and explain the characteristics of a DC shunt motor. [6]

*P.T.O.*

- Q3)** a) Derive the expression for torque developed in a three phase induction motor under running conditions. Hence state the equation for maximum torque developed. [6]
- b) The power input to a 500V, 50Hz, 6-pole, 3-phase induction motor running at 975 rpm is 40 kW. The stator losses are 1kW and the friction windage losses are 2 kW. Calculate : [6]
- i) Rotor copper loss
  - ii) Shaft output
  - iii) Efficiency of motor
- c) Draw the torque-slip characteristic curve for a slip ring induction motor. Hence show the effect of increase in rotor resistance value on this curve. [5]

OR

- Q4)** a) Distinguish between squirrel cage and slip ring induction motors. [6]
- b) A 3300V, 10 pole, 50 Hz three phase star connected slip ring induction motor has rotor resistance per phase as  $0.015 \Omega$  and rotor reactance per phase at standstill as  $0.25 \Omega$ . If the motor runs at 2.5 % slip on full load, find : [6]
- i) speed of the motor
  - ii) speed at which the torque will be maximum
  - iii) ratio of maximum torque to full load torque.
- c) Explain V/f control method for controlling speed of three phase induction motor. [5]

- Q5)** a) Define Electric Vehicle (EV). Draw the block diagram of EV structure and explain the function of components in it. [6]
- b) Differentiate between Hybrid EV and Plug-in EV. [6]
- c) Elaborate the impact of usage of EV on power grid. [6]

OR

- Q6)** a) State and explain the components and subsystems of Hybrid Electric Vehicle (HEV). [6]
- b) Explain the configuration of a Series-Parallel Hybrid EV. [6]
- c) Draw and explain Vehicle to Grid (V2G) technology with the help of suitable block diagram. [6]

- Q7)** a) Write voltage, specific energy, C-rate, cycle life, thermal runaway and applications of NMC battery. [6]
- b) Draw the block diagram of Battery Management System (BMS) and explain the working of it. [6]
- c) What is a supercapacitor? How can it be useful in the making of Electric Vehicles? [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) State merits and demerits of LMO Battery. [6]
- c) Explain the working of hydrogen fuel cell. [5]



Total No. of Questions : 8]

SEAT No. :

P-1616

[Total No. of Pages : 3

[6002]-246

**S.E. (Automobile & Mechanical Engg.)**  
**APPLIED THERMODYNAMICS**  
**(2019 Pattern) (Semester - IV) (202048)**

*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) *Use of an electronic calculator is allowed.*
- 4) *Assume Suitable data if necessary.*

**Q1) a)** Draw P -  $\theta$  diagram and explain the different stages of combustion in SI engine. **[8]**

b) List down the various sensors used in the Electronic Fuel Injection system. Draw and explain D-MPFI system. **[9]**

OR

**Q2) a)** What is knocking in CI Engine? Differentiate knock in SI and CI engines. **[8]**

b) What is ignition delay in CI engines? Explain any three factors affecting the ignition delay. **[9]**

**Q3) a)** What are the different methods used to measure friction power? Explain anyone method with a neat sketch. **[9]**

b) In a test of four cylinder, four stroke Petrol engine 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a particular constant speed and with a fixed setting of fuel supply 6.0 kg/hr. **[9]**

BP with all cylinders = 15.24 kW

BP with cylinder no. 1 cut out = 11. kW

BP with cylinder no. 2 cut out = 11.03 kW

BP with cylinder no. 3 cut out = 10.88 kW

BP with cylinder no. 4 cut out = 10.66 kW

Calorific value of the fuel = 43600 kJ/kg

Clearance volume = 0.0001 m<sup>3</sup>.

**P.T.O.**



Calculate :

- i) Mechanical efficiency
- ii) Indicated thermal efficiency
- iii) Air standard efficiency

OR

**Q4) a)** Define the following terms with their formula (any four) : **[9]**

- i) Indicated power
- ii) Friction power
- iii) Mean effective pressure
- iv) Volumetric efficiency
- v) Brake specific fuel consumption
- vi) Brake thermal efficiency

b) During the trial of a single cylinder, four stroke oil engine, the following results were obtained : **[9]**

Cylinder diameter = 20 cm,

Stroke = 40 cm,

Mean effective pressure = 6 bar,

Torque = 407 Nm,

Speed = 250 rpm,

Fuel consumption = 4 kg/hr,

C.V. of fuel = 43 MJ/kg,

Cooling water flow rate = 4.5 kg/min,

Air used per kg of fuel = 30 kg of air/kg of fuel,

Rise in cooling water temperature = 45 °C,

Temperature of exhaust gases = 420 °C,

Room temperature = 20 °C,

Mean specific heat of exhaust gas = 1 kJ/kg-K,

Specific heat of water = 4.18 kJ/kg-K.

Calculate :

- i) Indicated power
- ii) Brake power
- iii) Also, draw a heat balance sheet for the test.

- Q5) a)** Explain with neat sketch pump assisted thermo-syphon water-cooling systems. Differentiate between air-cooling and water-cooling system. [8]
- b) Draw neat sketch wet sump lubrication system. Differentiate between wet sump and dry sump lubrication system. [9]

OR

- Q6) a)** Explain magneto ignition system and state its advantages and disadvantages. [8]
- b) What is supercharging? Differentiate between supercharging and turbocharging. [9]

- Q7) a)** Write a short note on capacity control of compressors. [9]
- b) A single acting reciprocating air compressor has cylinder diameter and stroke of 200 mm and 300 mm respectively. The compressor sucks air at 1 bar and 27 °C and delivers at 8 bar while running at 100 rpm. Find : [9]

- i) Indicated power of the compressor
- ii) Mass of air delivered by the compressor per minute and
- iii) Temperature of the delivered by the compressor.

The compression follows the law  $PV^{1.25} = C$ . Take  $R = 287 \text{ J/kg K}$ .

OR

- Q8) a)** What is multi-stage compression? Justify it save power required for compression as compared to single stage compression. [9]
- b) A two-stage reciprocating air compressor takes in air at 1 bar and 27 °C. Air is delivered at 10 bar. The intermediate pressure is ideal, and intercooling is perfect. The law of compression is:  $PV^{1.35} = C$ . The rate of discharge is 0.1 kg/s,  $R = 0.287 \text{ kJ/kgK}$  and  $C_p = 1 \text{ kJ/kgK}$ . Calculate : [9]
- i) Power required to drive the compressor
- ii) Power required to compress the air in single compression
- iii) Isothermal efficiency for multistage



Total No. of Questions : 8]

SEAT No. :

P-1617

[Total No. of Pages : 3

[6002]-247

S.E. (Mechanical / Automobile)

FLUID MECHANICS

(2019 Pattern) (Semester - IV) (202049)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

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

- Q1)** a) Define path line, streak line and stream tube and give examples of each. [4]
- b) Derive general equation for continuity for a 3D flow in Cartesian coordinates for a steady incompressible flow. [6]
- c) Find acceleration and vorticity components at a point (1, 1, 1) for following flow field. Find Velocity potential. [7]

$$u = 2x^2 + 3y, v = 2xy + 3y^2 + 3zy \quad w = \frac{-3z^2}{2} + 2xz - 9y^2z$$

OR

- Q2)** a) Differentiate between Convective and local Accelerations. [4]
- b) Discuss various types of flow with suitable example and mathematical expression. [4]
- c) The velocity component of 2D flow field are as follows. [7]

$$u = \frac{y^3}{3} + 2x - 2x^2y \quad v = xy^2 - 2y - \frac{x^3}{3}$$

- i) Whether flow is possible
- ii) Obtain expression for stream function
- iii) Obtain an expression for potential function

P.T.O.

- Q3)** a) Show that for a steady laminar flow through a circular pipe mean velocity of flow occurs at radial distance of  $0.707 R$  from center of pipe where  $R$  is radius of pipe. [4]
- b) Derive Bernoulli's equation from Euler's equation along a stream line. [6]
- c) A lubricating oil of viscosity of 10 poise and specific gravity 0.8 is pumped through a 50 mm diameter pipe. If the pressure drop per meter length of pipe is  $20 \text{ kN/m}^2$ , determine : [8]
- Discharge of oil in liter /sec
  - Shear stress of pipe wall
  - Total friction drag
- Power required per 50m, length of pipe to maintain flow.

OR

- Q4)** a) Derive an expression of velocity and shear stress distribution for laminar flow through pipe. [6]
- b) With neat sketch explain the HGL and TEL. [4]
- c) Differentiate between venturimeter and Orificemeter.
- Determine the flow rate of oil with specific gravity 0.7 flows through pipe of diameter 400 mm inclined at  $30^\circ$  with horizontal connected with mercury differential manometer, Venturi meter of throat 200 mm gives deflection of 500 mm. Take throat to mouth distance of 600 mm and flow meter coefficient as 0.98. [8]

- Q5)** a) What is drag and Lift? Explain different types of drag on an immersed body. [4]
- b) What is boundary layer? Explain with neat sketch the development of boundary layer over smooth flat plate. [6]
- c) A pipeline of length 2km is used for power transmission. If 110.3625 kW power is to be transmitted through the pipe in which water having a pressure of  $490.5 \text{ N/cm}^2$  at inlet is flowing. Find the diameter of the pipe and efficiency of transmission if the pressure drop over the length of pipe is  $98.1 \text{ N/cm}^2$ . Take  $f = 0.0065$ . [8]

OR

- Q6)** a) Explain with neat sketches, hydrodynamically smooth and rough boundaries. [4]  
b) Explain the concept of equivalent pipe and derive Dupit's equation. [6]  
c) Derive an expression for displacement, momentum and energy thicknesses. [8]
- Q7)** a) Explain Reynolds Number with example. [4]  
b) In a geometrically similar model of weir the discharge is 0.15 m<sup>3</sup>/s. If the scale of the model is 1/50, find the discharge of the prototype. [4]  
c) Frictional torque T of a propeller in a turbulent flow depends on density of liquid  $\rho$ , viscosity of liquid  $\mu$ , speed N rpm, diameter of propeller shaft D. Using Buckingham's pi theorem show that : [9]

$$T = \rho N^2 D^5 f \left[ \frac{\rho N D^2}{\mu} \right]$$

OR

- Q8)** a) Explain the Weber's model law. [4]  
b) Find the scale ratio of a model, by using the following data:  
For model, velocity of water through the circular pipe is 1 m/s.  
For prototype, velocity of oil 0.14 m/s through pipe of diameter 50mm.  
Assume  $V_{\text{water}} = 0.01 \text{ cm}^2/\text{sec}$ ,  $v_{\text{oil}} = 0.007 \text{ cm}^2/\text{sec}$ . For Dynamic similarity also find the diameter of pipe for model. [4]  
c) Using Buckingham's pi theorem show that the discharge Q consumed by oil ring is given by:

$$Q = D^3 N f \left( \frac{\mu}{\rho N D^2}, \frac{\sigma}{\rho D^3 N^2}, \frac{\gamma}{\rho D N^2} \right)$$

Where, D = diameter of the ring, N = rotational speed of the shaft,  $\rho$  = density,  $\mu$  = viscosity,  $\sigma$  = surface tension,  $\gamma$  = specific weight of the oil. [9]



Total No. of Questions : 8]

SEAT No. :

P-1618

[Total No. of Pages : 3

[6002]-248

S.E. (Mechanical Sandwich)

FLUID MECHANICS AND MACHINERY

(2019 Pattern) (Semester - IV) (202062)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q. 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, and electronic pocket calculator is allowed.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

- Q1)** a) Derive Darcy-Weisbach formula for calculating loss of head due to friction in pipe. [8]
- b) Explain Pipes in series, Pipes in parallel and concept of Equivalent Pipe with fig and formula. [8]

OR

- Q2)** a) A 0.2 m diameter pipe carries liquid in laminar regime. A pitot tube placed in the flow at a radial distance of 20 mm from the axis of the pipe indicates velocity of 0.5m/s. Calculate : (i) The maximum velocity (ii) The mean velocity, and (iii) The discharge in the pipe. [8]
- b) Torque T of a propeller depends on density of liquid  $\rho$ , viscosity of liquid  $\mu$ , speed N rpm, linear velocity V, diameter of propeller shaft D. Using Buckingham's It Theorem. Show that : [8]

$$T = \rho N^2 D^5 \phi \left( \frac{ND}{V}, \frac{\rho ND^2}{\mu} \right)$$

- Q3)** a) A jet of water of diameter 40 mm moving with a velocity of 30 m/s strikes normally to a flat plate moving at 10m/s Determine (i) the force exerted by the jet on the pate, (ii) power of the jet, (iii) efficiency of the jet and (iv) max efficiency. [10]

P.T.O.

- b) Prove that the condition for maximum efficiency ( $V = 2u$ ) for a jet of water strikes at centre of series of curved vane also finds an expression for maximum efficiency. [8]

OR

- Q4)** a) Double Jet Pelton Wheel has a specific speed of 14 and is required to deliver 1000 kW. The turbine is supplied through pipeline from a reservoir whose level is 400 m above the nozzles. Allowing 5% for frictional loss in the pipe, Calculate : i) Speed in RPM ii) Diameter of jets. iii) Mean Diameter of Bucket circle. (iv) Number of buckets Take  $C_v = 0.98$ , speed ratio = 0.46 and overall efficiency = 85%, the specific speed is based on power output per jet. [10]
- b) Define Gross Head, Net Head, Jet Ratio, Run Away Speed, Volumetric efficiency, Hydraulic Efficiency, Mechanical Efficiency and Overall Efficiency related to Pelton wheel. [8]

- Q5)** a) A Kaplan turbine operates at a discharge of  $77 \text{ m}^3/\text{s}$ . The runner diameter and hub diameter are 4.2 m and 1.5 m respectively. Taking the speed ratio of 2.1. Determine i) The net head, ii) The power developed and iii) The specific speed.

Assume the mechanical and hydraulic efficiency of 88% and 92% respectively and no whirl at outlet. [10]

- b) Define Draft tube. What is its type? Write its function and find out expression for pressure head at inlet of draft tube with fig. [8]

OR

- Q6)** a) Design a Francis turbine runner with the following data.

Net Head = 68 m; Speed = 750RPM Power output = 330 kW; Hydraulic efficiency = 94 %; Overall Efficiency = 85%; Flow ratio = 0.15: Ratio of breadth to diameter = 0.1; Inner diameter of the runner is half of outer diameter of the runner. 6% of circumferential area of the runner is occupied by the thickness of the vanes. Assume velocity of flow remains constant and flow is radial at exit. [8]

- b) Explain the working principle of turbine which is suitable for low head. [6]
- c) Explain the following for hydraulic turbine. [4]
- Hydraulic Efficiency
  - Mechanical Efficiency

- Q7)** a) Derive the expression for rise in pressure in the impeller of a centrifugal pump. [6]
- b) Find the rise in pressure in the impeller of a centrifugal pump through which water is flowing at the rate 15 litre/s. The internal and external diameters of the impeller are 20 cm and 40 cm respectively. Widths of impeller at inlet and outlet are 1.6 cm and 0.8 cm .The pump is running at 1200 r.p.m. The water enters the impeller radially at inlet and impeller vane angle at outlet is  $30^\circ$ . Neglect losses through the impeller. [7]
- c) What is Priming? Explain methods of priming in pump. [5]

OR

- Q8)** a) Derive the expression for minimum starting speed of a centrifugal pump. [7]
- b) The diameter of an impeller of a centrifugal pump at inlet and outlet are 300 mm and 600 mm respectively. The velocity of flow at outlet is 2.5 m/s and vanes are set back at an angle of  $45^\circ$  at outlet. Determine the minimum starting speed of the pump if the manometric efficiency is 75%. [6]
- c) Explain cavitation and NPSH in pump. [5]





Total No. of Questions : 8]

SEAT No. :

P-1619

[Total No. of Pages : 2

[6002]-249

S.E. (Mechanical - Sandwich)

MANUFACTURING ENGINEERING  
(2021 Pattern) (Semester - IV) (202063)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right indicate full marks.
- 3) Assume Suitable data if necessary and mention it clearly.
- 4) All questions are compulsory i.e. Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

- Q1) a) Give any two examples of homogeneous, heterogeneous and autogeneous welding processes. [5]
- b) Demonstrate the principle of Spot Welding process in brief. How 'Heat Balance' to be obtained in resistance welding? Explain. [6]
- c) Explain MIG welding processes with a neat sketch. [6]

OR

- Q2) a) Illustrate with neat sketches common types of welded joints along-with their symbols. [5]
- b) Explain TIG (Tungsten Inert Gas) welding with neat sketch. [6]
- c) Demonstrate the different types of flames used in oxyacetylene welding. Give application of each flame. [6]

- Q3) a) Enlist the factors affecting tool life. State Taylors' Tool life equation.[6]
- b) Explain cutting variables. Find machining time required for machining a work-piece of 100 mm diameter, 350 mm length, turn all over in 5 passes. Approach length is 2 mm, Over-travel = 2 mm, the feed = 0.5 mm/rev and cutting speed is 50 m/min. [6]
- c) Explain the geometry of a single point cutting tool with suitable sketches. [6]

OR

P.T.O.

- Q4)** a) Demonstrate the various types of chips formed during metal cutting. [6]  
b) Prove the relationship between chip thickness ratio ( $r$ ), rake angle ( $\alpha$ ) and shear angle ( $\phi$ ). [6]  
c) Explain any six operations performed on lathe machine with neat sketch. [6]

- Q5)** a) Compare gang drilling and multispindle drilling machines. [5]  
b) Explain following Milling operations with suitable sketch : [6]  
i) Face milling  
ii) V-slot Milling  
c) Compare Up milling and Down milling operations with sketch. [6]

OR

- Q6)** a) Construct a Radial Drilling Machine and Explain. Show various motions of tool head. [5]  
b) Draw a labelled sketch of twist drill and explain its terminology. [6]  
c) Explain mechanism of universal indexing head. [6]

- Q7)** a) Explain the Standard Marking System of a grinding wheels. [6]  
b) Explain any three grinding operations. [6]  
c) Differentiate between pull and push broaching and mention types of broaches. [6]

OR

- Q8)** a) Explain the followings in relation to grinding wheel [6]  
i) Loading  
ii) Glazing &  
iii) Dressing  
b) Draw a neat sketch of broach and name its different parts. [6]  
c) Write a note on lapping process. [6]



Total No. of Questions : 8]

SEAT No. :

**P1620**

[Total No. of Pages : 3

[6002]-250

**S.E. (Mechanical Sandwich)**

**THERMAL ENGINEERING**

**(2019 Pattern) (Semester-IV) (202061)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume Suitable data if necessary.*
- 5) *Use of logarithmic tables, slide rule, Steam table, Psychrometric Chart. And electronic pocket calculator is allowed.*

**Q1) a) Define the following terms. [8]**

- i) Moist air;
- ii) Saturated air;
- iii) Dew point depression
- vi) Relative humidity

**b) Explain on the Psychrometric Chart following Processes. [9]**

- i) Cooling and Dehumidification,
- ii) Heating and Humidification

OR

**Q2) a) How the air conditioning systems are classified and explain the summer air conditioning system with neat sketch. [8]**

**b) A quantity of air having a volume of 400 m<sup>3</sup> at 30°C DBT and 25°C WBT is heated to 50 °C DBT. Calculate the amount of heat added, and relative humidity at both the states. [9]**

**P.T.O.**

- Q3)** a) Explain Briefly Diesel Cycle with the help of P-V & T-S diagram, and derive an expression for ideal efficiency of diesel cycle. [10]  
b) Explain closed cycle gas turbine with neat sketch, and show the cycle P-V & T-S Diagram. [8]

OR

- Q4)** a) Compare the Gas Turbines with I.C. Engine. [9]  
b) Calculate the ideal air-standard cycle efficiency of petrol engine operating on Otto cycle. The cylinder bore is 50 mm, a stroke is of 75 mm and the clearance volume is of 21.3 cm<sup>3</sup>. [9]

- Q5)** a) Explain the supercharging with neat sketch. [8]  
b) Explain with neat sketch battery ignition system. [9]

OR

- Q6)** a) Explain Air cooling system of engine and what are its advantages and disadvantages? [8]  
b) What are the different types wet sump lubrication system and explain any one of them. [9]

- Q7)** a) What are Sources of Pollutants from SI engine? [9]  
b) Explain Normal combustion and abnormal combustion Phenomena in SI engine. [9]

OR

- Q8)** a) Explain stages of combustion in SI engine with p- $\theta$  diagram. [9]  
b) In a test of a single-cylinder, four-stroke [9]

Diesel engine, the following data were recorded

Indicated mean effective pressure=755 kPa

cylinder diameter = 10 cm

piston stroke=15 cm

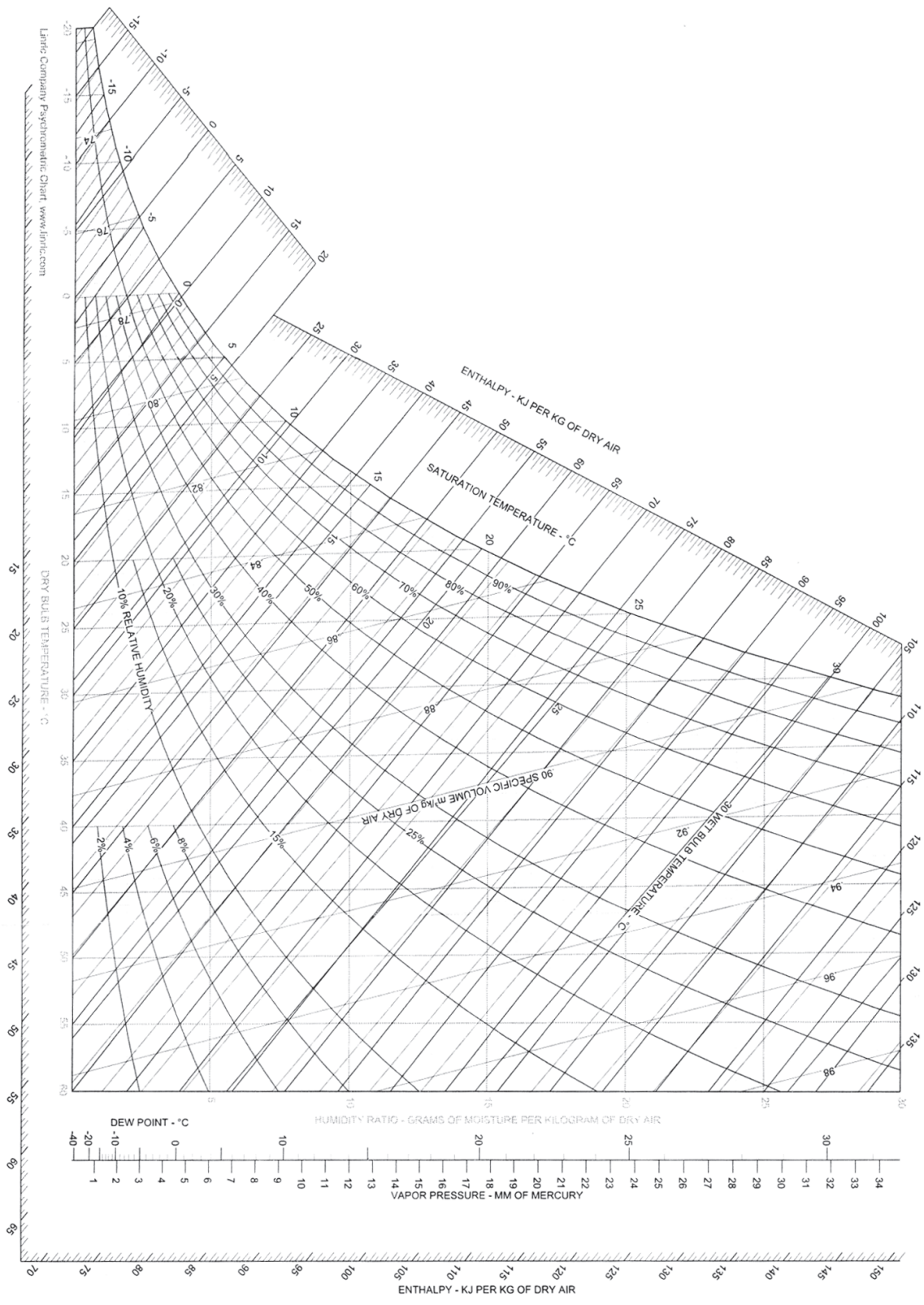
engine speed = 480 rpm

brake wheel diameter=62.5 cm

net load on the brake wheel = 170 N

Calculate

- i) indicated power,
- ii) brake power, and
- iii) the mechanical efficiency of the engine



Total No. of Questions : 8]

SEAT No. :

P-1621

[Total No. of Pages : 3

[6002]-251

S.E. (CSD)

**DATA STRUCTURES & ALGORITHMS (Theory)**

**(2021 Pattern) (Semester - III) (218242)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates :*

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Draw neat and clean diagram.
- 3) Assume suitable data if necessary.

**Q1)** a) Explain insertion sort algorithm and sort the given list in ascending order using insertion sort: State it's time complexity and space complexity. 7, 4, 10, 6, 3, 12, 1, 8, 2, 15, 9, 5. [5]

- b) Define following terms with respect to sorting with suitable example: [6]
- i) Sort stability
  - ii) Efficiency
  - iii) Passes •

- c) Write an algorithm for searching an element using Fibonacci search method. Search Key=20 from following list [6]
- Arr[] = 10,20,30,40,50,60,70

OR

**Q2)** a) Explain Selection sort in ascending order using the following array. State it's time complexity. [5]

70,30,20,50,60,10,40. Clearly show all passes.

- b) Explain sequential search and binary search with appropriate example. Comment on their data organization, time complexity and space complexity. [6]

*P.T.O.*

- c) Sort following unsorted array in non-decreasing order using Radix sort method. 45,37,05,09,06,11,18,27. [6]

- Q3)** a) Write C/C++ pseudo code to represent Singly linked list as an ADT. [7]  
b) Write a C/C++ pseudo code to delete alternate elements from Singly Linked List. [7]  
c) Enlist the advantages and disadvantages of DLL over SLL. [4]

OR

- Q4)** a) Write a pseudo code to Represent Doubly Link list as an ADT. [7]  
b) Define Linked List & explain following types with suitable Example. [7]  
i) Singly Linked List  
ii) Doubly Linked List  
iii) Circular Linked List  
c) Explain Generalised linked list with suitable Example. [4]

- Q5)** a) List the applications of STACK? Explain STACK as an ADT. [4]  
b) What is recursion? Write a recursive function to compute factorial of a number num =4 simulate the working of this function using stack. [6]  
c) Write an algorithm to convert infix expression to postfix expression and convert following infix expression to postfix expression. Clearly indicate the contents of stack. [7]  
 $(A+B) * D + E / (F+A*D) + C$

OR

- Q6)** a) What is backtracking? Explain the use of stack in backtracking. [4]  
b) Discuss the various exceptional conditions that should be handled while using stack operations. [6]

- c) Write an algorithm to evaluate postfix expression. Evaluate and find the value of following postflx expression [7]

5 6 2 + \*1 2 4/-

Show the contents of the stack? List Different Applications of Stack.

- Q7)** a) What are the disadvantages of Linear queue? Discuss how they can be overcome. [4]
- b) Define following with example : [6]
- (i) Circular queue
  - (ii) Multi-queue
  - (iii) Dequeue
- c) Explain circular queue using an array and write a pseudo code for [8]
- i) enqueue
  - ii) dequeue
  - iii) display operations

OR

- Q8)** a) Write C/C++ pseudo code to implement linear queue using an array perform the following operations. [4]
- i) Addition of an element to queue
  - ii) Deletion of element from queue
- b) Write pseudo code to implement a circular queue using arrays. [6]
- c) Explain Dequeue with the insert and delete operations performed on it.[8]





Total No. of Questions : 8]

SEAT No. :

P-1622

[Total No. of Pages : 2

[6002]-252

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

LOGIC DESIGN & COMPUTER ARCHITECTURE

(2021 Pattern) (Semester - III) (218245)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Total number of questions are 8.
- 2) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 3) Assume suitable data, if necessary.
- 4) Neat sketches must be drawn wherever necessary.

- Q1)** a) Draw basic internal structures of Decade counter IC 7490 and explain its operation. [6]
- b) Design and implement 3 bit synchronous up counter using JK flip flop. [6]
- c) Draw and explain Ring Counter. [6]

OR

- Q2)** a) Draw 3 bit asynchronous up counter using JK flip flops and explain its operation using output waveforms. [6]
- b) Convert JK flip flop into T and D flip flop. [6]
- c) Draw and explain bidirectional shift register. [6]

- Q3)** a) Explain functional units of computer. [5]
- b) Draw and explain the Von Neumann architecture. [6]
- c) Draw the neat diagram of single bus organization of the CPU. [6]

OR

- Q4)** a) What is system bus? Explain its basic types. [5]
- b) Draw block diagram of Harvard architecture and explain each block. [6]
- c) Explain micro operations of CPU. [6]

P.T.O.

- Q5)** a) Describe the elements of machine instructions. [5]  
b) Explain the concept of instruction pipelining with diagram. [6]  
c) Explain any 3 addressing modes with example. [6]

OR

- Q6)** a) Write a note on assembly language elements. [6]  
b) Explain the RISC and CISC characteristics. [6]  
c) How does CPU recognizes an interrupt? What is the response of the CPU after recognition of the interrupt? [5]

- Q7)** a) Write a note on SRAM. [6]  
b) Explain the need of Cache memory. [6]  
c) Explain I/O interfacing techniques. [6]

OR

- Q8)** a) Write a note on memory hierarchy. [6]  
b) What are the different cache replacement policies? [6]  
c) Draw and explain DMA block diagram. [6]



[6002]-253

**S.E. (Computer Science and Design)**  
**DATA STRUCTURES AND FILES**  
**(2019 Pattern) (Semester - IV) (218253)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

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

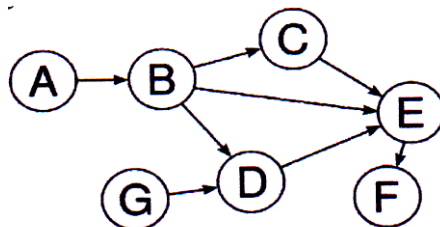
- Q1)** a) Write an algorithm for DFS State the time complexity of the algorithm.[6]  
 b) Apply Prim's algorithm to generate a minimum spanning tree for the following graph stored using adjacency matrix: [6]

	A	B	C	D	E
A	0	5	0	6	4
B	5	0	8	0	7
C	0	8	0	0	9
D	6	0	0	0	5
E	4	7	9	5	0

- c) What are connected components of a graph? Explain with example. State the applications of graph. [6]

OR

- Q2)** a) Explain with suitable example the three storage structures for the graph.[6]  
 b) What is topological sorting? Apply topological sorting for the following graph: [6]



- c) Write pseudo code for BFS of a graph and explain it with suitable example.[6]

P.T.O.

- Q3)** a) Construct a AVL tree for the following data: [6]  
 15, 20, 24, 10, 13, 7, 30, 36, 25
- b) Explain the double rotations in AVL tree with examples. [6]
- c) Explain Splay tree with an example. [5]

OR

- Q4)** a) Static and dynamic tree tables with suitable example. [6]
- b) Find the optimal binary search tree for the following: [6]  
 $n = 3$   
 $\{a_1, a_2, a_3\} = \{\text{do, if, while}\}$   
 $\{p_1, p_2, p_3\} = \{0.5, 0.1, 0.05\}$   
 $\{q_0, q_1, q_2, q_3\} = \{0.15, 0.1, 0.15, 0.15\}$
- c) Explain with example [5]
- i) Red - Black Tree
- ii) K-dimensional Tree

- Q5)** a) CreateMaxheap for Data 15, 19, 10, 7, 17, 16  
 After Construction max heap delete element 17 and rebuild heap [6]
- b) Construct a B+ Tree of order 5 for the following data : [6]  
 30, 31, 23, 32, 22, 28, 24, 29, 15, 26, 27, 34, 39, 36
- c) Explain with example trie tree. Give advantage and applications of trie tree. [6]

OR

- Q6)** a) Construct a B-tree of order 3 for the following data: [6]  
 5, 3, 21, 9, 1, 13, 2, 7, 10, 12, 4, 8
- b) Write an algorithm to delete a node from B-Tree. [6]
- c) Write pseudo code to search the data stored in a B-Tree. [6]

- Q7)** a) Explain any three operations on sequential file organization with example. [6]
- b) Explain advantages of indexing over sequential file. Explain two types of indices. [6]
- c) What is File? What are types of files? Explain the concept of Inverted file. [5]

OR

- Q8)** a) Explain linked organization with respect to file handling. [6]
- b) Explain K-way merge algorithm. [6]
- c) Compare index sequential file and direct access file. [5]



Total No. of Questions : 8]

SEAT No. :

P-1624

[Total No. of Pages : 2

[6002]-254

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

OPERATING SYSTEM DESIGN

(2021 Pattern) (Semester - IV) (218254)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn whenever necessary.

- Q1)** a) What is Semaphore? Explain wait and signal operations. [6]  
b) What is Readers-Writers problem? Give a solution to Readers-Writers problem using Semaphores. [6]  
c) What is deadlock? What are the necessary conditions for Deadlock?[5]

OR

- Q2)** a) Explain Producer and consumer problem in Classical Synchronization. Give Solution using Semaphores. [6]  
b) Discuss following terms. i) Critical Section ii) Monitor Hi) Pipes in IPC [6]  
c) What are the methods used to handle Deadlocks. Explain Deadlock prevention and Avoidance in detail. [5]

- Q3)** a) Explain Memory management and it's requirement. Explain two types of memory allocation. [6]  
b) Write Short note on : [6]  
i) Paging  
ii) Segmentation  
iii) Demand Paging  
c) Explain Memory Partitioning in memory management. [6]

OR

P.T.O.

- Q4)** a) Explain concept of Virtual Memory. How implementing virtual memory through demand paging is done. [6]  
b) What is the Difference between Paging and Segmentation? [6]  
c) How memory partitioning is done with buddy system? What is Relocation in Memory management? [6]

- Q5)** a) Explain and compare the SCAN and C-SCAN disk scheduling algorithms. [6]  
b) Discuss the different file allocation methods with suitable example.[6]  
c) What are the different buffering ways in I/O buffering? [5]

OR

- Q6)** a) Consider the disk access request given as 55, 58, 39, 18, 90, 160, 150, 38, 184, where starting head position is -100. Calculate average seek time using FCFS, SSTF, SCAN, C-SCAN disk scheduling policies and show which policy performs better. [6]  
b) Explain Free space management and Directory Structure in File management. [6]  
c) What are the various file accessing methods? [5]

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

OR

- Q8)** a) Explain Linux thread management in detail. [6]  
b) Explain Process management system calls in Linux. [6]  
c) Explain Interfaces in Linux. [6]



Total No. of Questions : 8]

SEAT No. :

**P1625**

[Total No. of Pages : 2

[6002]-255

S.E. (CSD)

**COMPUTER NETWORKS**

**(2019 Pattern) (Semester-IV) (Theory) (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) Draw Neat and Clean Diagram.
- 3) Assume Suitable Data if Necessary.

- Q1)** a) Differentiate between distance vector and link state routing. [4]  
b) Write short notes on: [8]  
i) Mobile IP  
ii) Border Gateway Protocol  
c) Draw and explain IPV4 header format. [6]

OR

- Q2)** a) Write short notes on: [6]  
i) OSPE  
ii) IPV6 header format  
b) 17.63.110.114/24 for given address find out the [6]  
i) Subnet mask?  
ii) What is first IP address for address block?  
iii) What is last IP address for address block?  
c) Explain in detail ARP and RARP. [6]

- Q3)** a) Explain UDP header format? Given a DUMP of a UDP header in hexadecimal format 03 61 10 1A 10 4C Y2 42. Find the following: [8]  
i) Source port number?  
ii) Destination port number?  
iii) Length of user datagram?  
iv) Length of the data?  
b) What causes Silly Window syndrome? How it is avoided? Explain. [5]  
c) What is socket? Explain different types of sockets. [4]

OR

*P.T.O.*



- Q4)** a) What do you mean by congestion? Discuss the open-loop and closed loop congestion control mechanism. [8]  
b) Explain SCTP protocol in detail. [5]  
c) Explain the QoS parameters in computer network. [4]

- Q5)** a) Why we need DHCP? Explain components of DHCP? Write advantages of DHCP. [8]  
b) Why HTTP is called stateless protocol? Explain HTTP request and reply message format. [6]  
c) Explain working of the SMTP and POP3/IMAP protocols in Email System. [4]

OR

- Q6)** a) What is domain name system? How does it work? Explain resolution process. [8]  
b) Explain working of the POP3 protocol with advantages and disadvantages. [6]  
c) Compare SMTP and HTTP. [4]

- Q7)** a) Differentiate between Symmetric and Asymmetric Key Cryptography. [5]  
b) Explain model for network security. [6]  
c) Discuss the working of IPSec? What are the different security services offered by IPSec? [6]

OR

- Q8)** a) Explain SSL in detail. [5]  
b) Draw and explain operational model of network security. [6]  
c) Explain Intrusion Detection System with merits and demerits. [6]



Total No. of Questions : 8]

SEAT No. :

**P1626**

[Total No. of Pages : 2

[6002]-256

**S.E. (Computer Science and Design Engg.)**

**DESIGN THINKING**

**(2021 Pattern) (Semester - IV) (218256)**

*Time : 2½ Hours]*

*[Max. Marks : 70*

*Instructions to the candidates:*

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

- Q1)** a) What is called idea generation? How do you determine the feasibility of ideas? [5]
- b) What is brainstorming? What are different variants of brainstorming. [6]
- c) What is inclusion? Why it is important in design process. [6]

OR

- Q2)** a) When do designers think in shapes and signs. Explain with example [5]
- b) How to use story telling in design process? what are the elements of good story telling? How to reach the users through story. [6]
- c) What are visual metaphor? Design a logo which shows a visual of unification. [6]

- Q3)** a) What is meant by lean start up method? How to lean start up? [7]
- b) Why Visualization techniques are useful for design Thinking? Elaborate on any three visualization techniques. [7]
- c) What is done in a prototype phase? How can you develop an efficient prototype. [4]

OR

- Q4)** a) Explain the importance of presentation technique in design thinking process? Explain the different presentation types. [7]
- b) What is story boarding? Why it is important? How to create a story board? [7]
- c) What is a quick and dirty prototype? State its advantage and disadvantage [4]

*P.T.O.*

- Q5)** a) What are the steps of testing a prototype? [4]  
b) How to test idea's desirability from the customer's perspective? [6]  
c) Explain in-depth design thinking case study which details how design thinking helped a company to save its product. [8]

OR

- Q6)** a) How do you test ergonomics of a design? [4]  
b) Explain different Test phase-techniques of interviews and surveys. [6]  
c) What is a user test? Is user testing really needed? What is a best time to conduct user testing? [8]

- Q7)** a) Write short note on design activism. [4]  
b) How do you create an innovation portfolio? [6]  
c) How to intruduce design thinking into your organization? [7]

OR

- Q8)** a) How design thinking helps in innovation? [4]  
b) Explain the role of technology in innovation. Cite examples [6]  
c) What are the innovation challenges in design thinking. [7]



Total No. of Questions: 8]

SEAT No. :

**P2755**

**[6002]-271**

[Total No. of Pages : 4

**S.E. (Civil)**

**ENGINEERING MATHEMATICS-III  
(2015 Pattern) (Semester-I) (207001)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logorthmic tables, electrotic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Solve any two of the following. **[8]**

i)  $(D^2 - 4D + 3)y = x^3 e^{2x}$

ii)  $\frac{d^2 y}{dx^2} + y = \tan x$  (by method of variation of Parameters).

iii)  $x^3 \frac{d^3 y}{dx^3} + 2x^2 \frac{d^2 y}{dx^2} + 2y = 10 \left( x + \frac{1}{x} \right)$ .

**b)** Apply Gauss - elimination method to solve. **[4]**

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

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

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

OR

**Q2) a)** Find the elastic curve of a uniform cantilever beam of length  $l$ , having a constant weight  $w$ kg per foot and determine the deflection of the free end. **[4]**

**b)** Apply Runge-kutta method of fourth order to solve

$$\frac{dy}{dx} = xy + y^2; y(0) = 1 \text{ for } x = 0.1 \text{ taking } h = 0.1 \quad \text{[4]}$$

**P.T.O.**

- c) Solve the following System by Cholesky's method: [4]

$$4x_1 - 2x_2 = 0$$

$$-2x_1 + 4x_2 - x_3 = 1$$

$$-x_2 + 4x_3 = 0$$

- Q3) a) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. obtain the first four central moments [4]

- b) Probability of man aged 60 years will live for 70 years is  $\frac{1}{10}$ . Find the probability of 5 men selected at random, 2 will live for 70 years. [4]

- c) Find the directional derivative of  $\phi = x^2 + y^2 + z^2$  at  $(1, -1, 1)$  along the vector  $\bar{i} + 2\bar{j} + 2\bar{k}$  [4]

OR

- Q4) a) Assuming that the diameters of 1000 brass plugs taken consecutively from a machine form a normal distribution with mean 0.7515 cm and standard deviation 0.0020 cm. How many of the plugs are likely to be approved if the acceptable diameter is  $0.752 \pm 0.004$  cm? [Area for 2.25 is 0.4878 and Area for 1.75 is 0.4599] [4]

- b) Prove the following (any one) [4]

i) 
$$\nabla \left( \frac{\bar{a} \cdot \bar{r}}{r^2} \right) = \frac{\bar{a}}{r^2} - \frac{2(\bar{a} \cdot \bar{r})}{r^4} \bar{r}$$

ii) 
$$\nabla^2 \left( \frac{1}{r^2} \right) = \frac{2}{r^4}$$

- c) Show that the vector field  $\bar{F} = (y^2 \cos x + z^2)\bar{i} + (2y \sin x)\bar{j} + 2xz\bar{k}$  is irrotational. Find scalar potential associated with it. [4]

Q5) Solve any two.

- a) Verify Green's theorem for the field  $\bar{F} = x^2\hat{i} + xy\hat{j}$  over the region R enclosed by  $y = x^2$  and the line  $y = x$  [7]

- b) Evaluate  $\iint_S (x\hat{i} + y\hat{j} + z\hat{k}) \cdot d\vec{s}$ , where S is the curved surface of the cylinder  $x^2 + y^2 = 4$ , boundary by the planer  $z = 0$  and  $z = 2$  [6]
- c) Evaluate  $\iint_S (\nabla \times \vec{F}) \cdot d\vec{s}$ , where  $\vec{F} = (x^3 - y^3)\hat{i} - xyz\hat{j} + y^3\hat{k}$  and S is the surface  $x^2 + 4y^2 + z^2 - 2x = 4$  above the plane  $x = 0$  [6]

OR

**Q6)** Solve any two.

- a) Find the Work done by the force  $(x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$  in taking a particle from (1, 1, 1) to (3, -5, 7) [7]
- b) Show that  $\iiint_V \frac{dv}{r^2} = \iint_S \frac{\vec{r} \cdot \hat{n}}{r^2} ds$ . [6]
- c) Apply stocke's theorem to calculate  $\int_C 4ydx + 2zdy + 6ydz$ , [6]

where c is the curve of intersection of  $x^2 + y^2 + z^2 = 6z$  and  $z = x + 3$

**Q7)** Solve any two of the following.

- a) Solve  $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 y}{\partial x^2}$ , under the condition [7]
- i)  $y(0, t) = 0$
- ii)  $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$
- iii)  $y(\pi, t) = 0$
- iv)  $y(x, 0) = x, 0 \leq x \leq \pi$

- b) The temperature at any point of the insulated metal rod of one meter length is governed by the differential equation [6]

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

Find  $u(x,t)$  subject to the following condition.

- i)  $u(0,t) = 0$   
 ii)  $u(1,t) = 0$   
 iii)  $u(x,0) = 50$
- c) An infinitely long uniform metal plate is enclosed between line  $y = 0$  and  $y = l$  for  $x > 0$ . The Temperature is zero along the edges  $y = 0$ ,  $y = l$  and at infinity. If the edge  $x = 0$  is kept at constant temperature  $u_0$ , find the temperature distribution  $u(x, y)$ . [6]

OR

Q8) Solve any two of the following.

- a) A String is stretched and fastened to two points  $l$  apart, motion is started by displacing the string in the form of  $y = a \sin \left( \frac{\pi x}{l} \right)$  from which it is released at time  $t = 0$ . Find the displacement  $y(x,t)$  from one end. [7]

- b) Solve  $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$  if [6]

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

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

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

iv)  $u(x,0) = \frac{u_0 x}{l}, 0 < x < l, u_0$  is constant

- c) An infinitely long uniform plate is bounded by two Parallel edges in the  $y$ -direction and an end at right angles to them. The breadth of the plate is  $\pi$ . This end is maintained at temperature  $u_0$  at all points, other edges as zero temperature. Find steady state temperature  $u(x, y)$  if it satisfies

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0. \quad [6]$$



Total No. of Questions : 8]

SEAT No. :

**P-2756**

[Total No. of Pages : 2

**[6002]-272**

**S.E. (Civil)**

**BUILDING TECHNOLOGY AND MATERIALS**

**(2015 Pattern) (Semester - I) (201001)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*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 foundation. Differentiate between English and Flemish bond with neat sketches. **[2+4]**

b) Explain composite masonry. State types and applications of composite masonry. **[1+5]**

OR

**Q2)** a) What do you understand by substructure. Explain shallow foundation with neat sketch. **[2+4]**

b) Define formwork. Enlist types of materials used for formwork. Enlist advantages of steel formwork. **[6]**

**Q3)** a) Write the requirements of roof. Explain king-post roof truss. **[6]**

b) Classify with the help of sketches, any two types of windows. **[6]**

OR

**Q4)** a) Enlist any four types of flooring. Explain with neat sketch terrazzo flooring. **[6]**

b) Explain casement window in detail. **[6]**

**P.T.O.**



- Q5)** a) Write the requirements of good stair. Explain dog-legged staircase. [6]  
b) Write short note on varnishing. [7]

OR

- Q6)** a) Explain with sketches the following terms : [6]  
i) Landing  
ii) Handrail  
iii) Nosing  
b) State the circumstances under which you will use the following types of stairs. [7]  
i) Dog legged stair  
ii) Open newel stair  
iii) Half turn geometric stair  
iv) Spiral stair

- Q7)** a) Explain objectives of cladding. Enlist various methods of cladding. [6]  
b) Enlist the safety precautions you will take on construction site. [7]

OR

- Q8)** a) Discuss Eco-friendly materials. Enlist various types of eco-friendly materials. [7]  
b) Enlist different ceramic materials used in building construction. Explain any two ceramic materials. [6]

**x x x**

Total No. of Questions : 8]

SEAT No. :

P-2757

[Total No. of Pages : 4

[6002]-273

S.E. (Civil)

**STRENGTH OF MATERIAL**

**(2015 Pattern) (Semester - I) (201002) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Q.Nos.1 or 2, Q.Nos.3 or 4, Q.Nos.5 or 6 and Q.Nos.7 or 8.*
- 2) *Neat sketches must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

- Q1)** a) A steel bar  $3.2 \text{ m} \times 50 \text{ mm} \times 50 \text{ mm}$  is subjected to an axial pull of 22 kN. If  $E = 210 \text{ GN/m}^2$  and  $\mu = 0.32$ , calculate the change in each side and change in the volume of the bar. [6]
- b) A symmetrical I section with flanges each  $300 \text{ mm} \times 20 \text{ mm}$  and web  $560 \text{ mm} \times 12 \text{ mm}$  is subjected to a sagging bending moment of 100 kNm. Show the bending stress distribution diagram indicating all the salient values. [6]

OR

- Q2)** a) A steam pipeline measures 20 m at temperature of  $20^\circ\text{C}$ . The pipe carries superheated steam at a temperature of  $300^\circ\text{C}$ . If 80% of the possible expansion of pipe is prevented find the stresses induced in the material of pipe having  $E = 210 \text{ kN/mm}^2$  and  $\alpha = 11.2 \times 10^{-6} /^\circ\text{C}$ . [6]
- b) A symmetrical I section with flanges each  $300 \text{ mm} \times 20 \text{ mm}$  and web  $560 \text{ mm} \times 12 \text{ mm}$  is subjected to shear force of 100 kN. Show the shear stress distribution diagram indicating all the salient values. [6]

**P.T.O.**

**Q3) a)** A solid cylindrical shaft is required to transmit 600 kW at 110 rpm. Shear stress is not to exceed 60 N/mm<sup>2</sup> and the twist in length of 3 m is not to exceed 1°. Calculate the minimum diameter required. Take  $G = 8 \times 10^4$  MPa. [6]

b) At a point in a loaded member, normal stress along X-direction is 80 N/mm<sup>2</sup> along Y-direction is 50 N/mm<sup>2</sup> and shear stress is 20 N/mm<sup>2</sup>. Find the stresses on a plane whose normal is inclined at 30° to the longitudinal axis. Also find the principal stresses. [6]

OR

**Q4) a)** A solid circular shaft 8 m long is securely fixed at both the ends. A torque of 100 Nm is applied to the shaft at a section of 3 m from one end. Find the reactive torques set up at the ends of the shaft. If the diameter of the shaft is 40 mm, find the maximum shear stress in the shaft. Assume shear modulus for the shaft as  $0.84 \times 10^5$  MPa. [6]

b) Draw Mohr's circle for the following cases : [6]

- Pure shear
- Uniaxial compression
- Uniaxial tension.

**Q5) a)** A beam is loaded and supported as shown in Fig. 5-a. Determine the value of W so that the reactions at A and D are equal. Draw SFD and BMD indicating important points. [6]

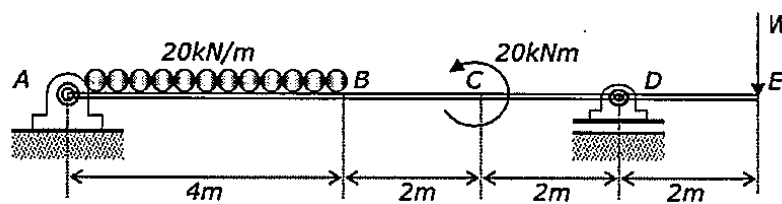


Fig. 5-a

b) Define shear force at a section and bending moment at a section. Hence prove that  $\frac{dF}{dx} = w$  and  $\frac{dM}{dx} = F$  in standard notations. [6]

OR

- Q6) a) Draw SFD and BMD for the beam loaded and supported as shown in Fig. 6-a. [6]

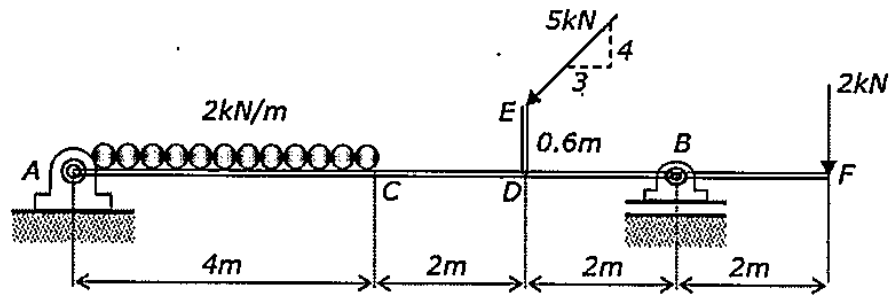


Fig. 6-a

- b) The shear force diagram for a beam is shown in figure 6-b. Construct the load diagram and bending moment diagram. Take  $AB = 2\text{m}$ ,  $BC = CD = DE = 1\text{m}$ . [6]

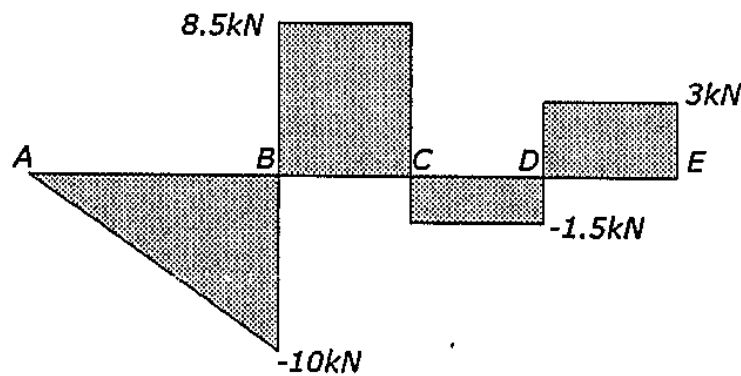


Fig. 6-b

- Q7) a) Find the greatest length for which a mild steel strut of T shaped c/s with area  $3 \times 10^3 \text{ mm}^2$  and the least moment of inertia  $4 \times 10^6 \text{ mm}^4$  may be used with both ends hinged, in order to carry a crippling load that will produce an axial stress of  $70 \text{ N/mm}^2$ . Rankine constants for the mild steel are  $\alpha = 1/7500$  and  $f_c = 320 \text{ MN/m}^2$ . [7]
- b) Explain the term; core of a section. Obtain core section for a hollow rectangular column of external dimensions  $B \times D$  and internal dimensions  $b \times d$ . [7]

OR

- Q8) a) A column  $1200 \text{ mm} \times 900 \text{ mm}$  in cross-section supports a load of  $600 \text{ kN}$  at an eccentricity of  $200 \text{ mm}$  and  $100 \text{ mm}$  as shown in figure 8-a. Find the stresses at the corner of the column at its base. [7]

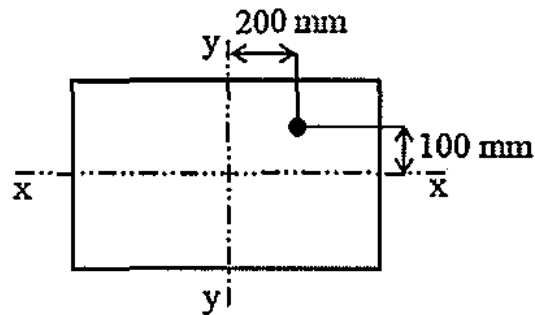


Fig. 8-a

- b) Find Euler's critical load for a hollow cylindrical column of  $50 \text{ mm}$  external diameter and  $5 \text{ mm}$  thick. The column is of length  $2.5 \text{ m}$  and both ends of the column are hinged. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ . Also determine Rankine's crippling load for the same column. Take  $f_c = 350 \text{ N/mm}^2$  and  $\alpha = 1/7500$ . [7]

x x x

Total No. of Questions : 8]

SEAT No. :

P-2758

[Total No. of Pages : 2

**[6002]-274**  
**S.E. (Civil Engg.)**  
**GEOTECHNICAL ENGINEERING**  
**(2015 Pattern) (Semester - I) (201003)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

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

- Q1) a)** A sand sample has a porosity of 30% and specific gravity of solids as 2.7. Calculate, **[6]**
- i) Dry unit weight of sand.
  - ii) Unit weight of sand if degree of saturation is 0.56.
  - iii) Degree of saturation at water content of 4%.
  - iv) Unit weight of submerged sand when  $n$  is 0.30.
- b) Explain with neat sketch variable head permeability test. Derive the expression for coefficient of permeability of soil for the variable head method. **[6]**

OR

- Q2) a)** To find out coefficient of permeability of clay the permeability test was carried out in a variable head permeameter having the diameter of the sample container to be 100 mm. The initial head of water in the stand pipe was found to be 450 mm and it was observed to drop 300mm in 3 minutes 15 seconds. If the sample be 150mm high and the diameter of the stand pipe be 19mm, determine the coefficient of permeability of the clay in meter per day. **[6]**
- b) Derive the relation between  $\gamma_d$ ,  $G$  and  $e$ . **[6]**

*P.T.O.*

**Q3) a)** A cohesive soil has an angle of shearing of  $15^\circ$  and cohesion of  $35 \text{ KN/m}^2$ . if the specimen of soil is subjected to a triaxial compression test, find the value of the lateral pressure in the cell for failure to occur at total stress of  $300 \text{ KN/m}^2$ . [6]

b) What is significant depth and pressure bulb? Explain with neat sketch.[6]

OR

**Q4) a)** A water tower is supported only on three pillars forming an equilateral triangle with 10m side. The total weight of tower is 1200 KN. Calculate vertical stress 10m below the ground level under any one of the pillar.[6]

b) Explain the procedure for unconfined compression test with neat sketches. [6]

**Q5) a)** Explain step by step procedure for determination of lateral earth pressure graphically by Rebhann's method with neat sketch. [6]

b) Determine the active resultant thrust at a depth of 7m in sand whose angle of friction is  $25^\circ$  and density of  $17 \text{ kN/m}^3$  in dry state. [7]

OR

**Q6) a)** Explain how surcharge will affect earth pressure for cohesionless and cohesion soils in active state with pressure diagrams. [6]

b) A soil mass is retained by a smooth backed vertical wall of 6 m height. The soil has a bulk unit weight of  $20 \text{ KN/m}^3$  and  $\phi = 16^\circ$ . The top of the soil is level with the top of the wall and is horizontal, if the soil surface carries a uniformly distributed load of  $4.5 \text{ KN/m}^2$ , determine the total active thrust on the wall per linear metre of the wall and its point of application. [7]

**Q7) a)** State methods of remediation for soil contamination and explain any two of them. [6]

b) Explain the factor of safety with respect to shear strength. cohesion and friction. [7]

OR

**Q8) a)** Explain how soil acts as a geochemical trap and state the various remediation techniques. [6]

b) Write a short note on causes and remedial measures of landslides. [7]



Total No. of Questions : 8]

SEAT No. :

**P2759**

[Total No. of Pages : 3

**[6002]-275**  
**S.E. (Civil)**  
**SURVEYING**  
**(2015 Pattern) (Semester - I) (201006)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat sketches must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data if necessary.
- 5) Use of electronic pocket calculator is allowed.
- 6) Use of cell phone is prohibited in examination hall.

**Q1) a)** Explain the following terms with its type. **[6]**

- a) Meridian
- b) Bearing

**b)** Following notes refer to reciprocal levels taken with one level- **[6]**

Instrument Station	Staff readings on		Remark
	A	B	
A	1.425	2.725	Distance AB=1150 m
B	1.430	2.505	R.L. of A = 100 m Collimation Error = 0.003/150m

Find :

- i) True R.L. of point B,
- ii) Correction for collimation,
- iii) Correction for refraction,
- iv) Combined correction for curvature and refraction

OR

**Q2) a)** State uses and characteristics of contour lines. **[6]**

**P.T.O.**



- b) Give the corrected bearing of the following traverse taken from compass survey. [6]

Line	Fore Bearing	Back Bearing
AB	191°30'	13°00'
BC	69°30'	246°30'
CD	32°15'	210°30'
DE	262°45'	80°45'
EA	230°15'	53°00'

- Q3) a) An incomplete travers table is obtained as follows. [6]

Line	Length (m)	Bearing
AB	100.00	?
BC	80.50	140°30'
CD	60.00	220°30'
DA	?	310°15'

Calculate length of DA and bearing of AB.

- b) Explain theory of stadia tacheometry. [6]

OR

- Q4) a) Explain in detail procedure of measurement of horizontal angle by repetition method using 20 vernier theodolite. [6]

- b) The following observation were made using a tacheometer fitted with an anallatic lens, multiplying constant being 100. [6]

Instrn. Station	Instrn. Height.	Staff Station	W.C.B.	Vertical Angle	Hair Reading	Remark
O	1.550	A	30°30'	+4°30'	1.155,1.755,2.355	RL of O
		B	75°30'	+10°15'	1.250,2.000,2.750	=150 m

Find R.L. of point A and B also Find Distance AB.

**Q5) a)** Draw a neat sketch of curve and write equation for the following in terms of radius of curve (R) and deflection angle ( $\phi$ ). [7]

- i) Long Chord
- ii) Versed sine
- iii) Apex distance

**b)** Two straight road intersects at a chainage of 2550.50m. The angle of intersection being  $110^\circ$ . Taking chord length of 30 m, calculate - [7]

- i) Radius of curve
- ii) Length of curve
- iii) Tangent length
- iv) Length of long chord
- v) Chainage at starting point ( $T_1$ ) and end point ( $T_2$ ) of Curve

OR

**Q6) a)** State various obstacles in setting out curves. Explain the procedure of setting out simple curve when point of intersection is inaccessible. [6]

**b)** Two straights PI and QI meet at chainage of 3450 m. A right handed simple circular curve of 250 m radius joins them. The deflection angle between two straights is  $50^\circ$ . Tabulate the necessary data to layout the curve by Rankine's method of deflection angle. Take chord interval as 20 m. [7]

**Q7) a)** State segments and uses of Space Based Positioning System (SBPS)[6]

**b)** Explain the procedure of establishing horizontal control for setting of a tunnel. [7]

OR

**Q8) a)** Describe the procedure of setting out drainage line. [6]

**b)** Explain in brief procedure of setting out of a building on ground. [7]



Total No. of Questions : 8]

SEAT No. :

**P2760**

**[6002]-276**

[Total No. of Pages : 3

**S.E. (Civil)**

**FLUID MECHANICS - I**  
**(2015 Pattern) (Semester - II) (201004)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
- 2) *Answers to the all questions should be written in single answer-book.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator (non programmable) and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

**Q1) a) Differentiate: [6]**  
i) Real fluid and Ideal fluid and  
ii) Newtonian fluid and Non-Newtonian fluid.

b) The right limb of a Simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of the fluid in the pipe if the difference of mercury level in the two limbs is 21 cm. [6]

OR

**Q2) a) Derive the expression with usual notations for total pressure and centre of pressure for vertical plane surface submerged in liquid. [6]**  
b) In the model test of a spillway the discharge and velocity of flow over the model were 2.1 m<sup>3</sup>/s and 1.6 m/s respectively. Calculate the velocity and discharge over the prototype which is 25 times the model size. [6]

**Q3) a) Derive the continuity equation with usual notations for three dimensional flow. [6]**  
b) In a two-dimensional incompressible flow, the fluid velocity components are given by:  $u = x - 4y$  and  $v = -y - 4x$ . Show that velocity potential  $\phi$  exists and determine its form. [6]

OR

*P.T.O.*

- Q4) a)** Derive the Euler's equation of motion along a stream line and integrate it to find the Bernoulli's equation. [6]
- b)** A 30 cm × 15 cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.94, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 31 cm. The differential U-tube mercury manometer shows gauge deflection of 26 cm. Calculate : i) the discharge of oil, and ii) the pressure difference between the entrance section and the throat section. Take coefficient of discharge as 0.98 and specific gravity of mercury as 13.6. [6]
- Q5) a)** Explain with neat sketches: [6]
- i) Boundary Layer Separation and
- ii) Controlling methods of Boundary Layer Separation
- b)** A laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.6 m/s. Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 4 cm from the wall of the pipe. [7]

OR

- Q6) a)** Show that average velocity is one half of the maximum velocity for flow of viscous fluid through circular pipe. [6]
- b)** In the boundary layer over the face of a high spillway, the velocity distribution was observed to have the following form:  $\frac{u}{U} = \left(\frac{y}{\delta}\right)^{0.22}$ .
- The free stream velocity U at a certain section was observed to be 30 m/s and boundary layer thickness of 60 mm was estimated from the velocity distribution measured at the section. The discharge passing over the spillway was 6 m<sup>3</sup>/s per meter length of spillway. [7]
- Calculate:
- i) The displacement thickness in 'mm' and
- ii) The energy thickness in 'mm'
- Q7) a)** A pipe line carrying water has average height of irregularities projecting from the surface of the boundary of the pipe as 0.16 mm. What type of boundary is it? The shear stress developed is 4.95 N/m<sup>2</sup>. The kinematic viscosity of water is 0.01 stokes. [6]

- b) Derive the following expression of Darcy's Weisbach Equation. [7]

$$h_f = \frac{4f.l.v^2}{2.g.d}$$

OR

- Q8) a) Explain the "Prandtl's mixing length theory" for turbulent shear stress. [6]

- b) i) The diameter of horizontal pipe suddenly changes from 20 cm to 25 cm. The discharge from the pipe is 350 lps. Calculate the head loss when [4]

1) Water flows from smaller dia. Pipe to larger dia. Pipe and.

2) Flow is reversed with same discharge.

- ii) Three pipes A, B, C are connected in series with following details:

pipe	Diameter (Cm)	Length (m)
A	45.0	800
B	37.5	500
C	30.0	250

Find the diameter of equivalent pipe to replace the compound pipe, Keeping the total length unchanged. [3]



Total No. of Questions : 8]

SEAT No. :

**P2761**

**[6002]-277**

[Total No. of Pages :3

**S.E. (Civil)**

**ARCHITECTURAL PLANNING & DESIGN OF BUILDING  
(2015 Pattern) (Semester - II) (201005)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve Q.1 or Q.2, Q.3 or Q.4, in the answer book.*
- 2) *Solve Q.5 or Q.6, Q.7 or Q.8 on drawing sheet only.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data , if required.*

**Q1) a)** Explain the following planning considerations while designing green building: **[7]**

- i) Site selection
- ii) Orientation
- iii) Sun path.

b) Write a short note on “TDR and its utility”. **[6]**

OR

**Q2) a)** Explain the various rating systems related to Green Building. **[6]**

b) Enlist the documents to be submitted for seeking commencement certificate and occupancy certificate. **[7]**

**Q3) a)** Define: **[6]**

- i) Vanishing point
- ii) Eye level
- iii) Picture plane

b) What do you mean by term Evacuation time ? Also correlate it with disaster management. **[6]**

OR

**Q4) a)** Write a note on Rain Water Harvesting and its importance. **[6]**

b) Enlist various traps including its functions. **[6]**

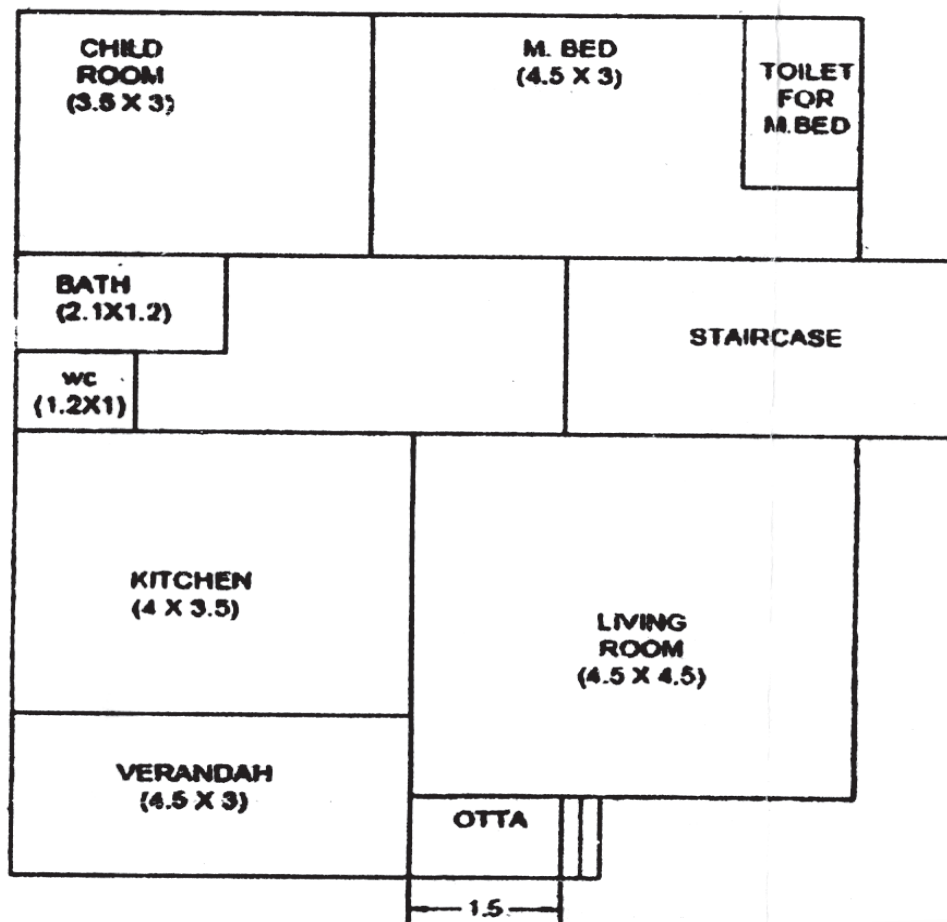
**P.T.O.**

Q5) A line plan for a residential building is shown in the following Fig. [13]  
 Draw detailed floor plan with 1:50 or suitable.

Use the following data :

- All external walls are of 230 mm thick.
- All partition walls are of 150 mm thick.
- RCC frame structure.
- Floor to floor height = 3.2 m.
- Plinth height = 0.48 m.
- Toilet for M.Bed = 1.2×2.1.

Staircase Rise = 0.16 m & Tread=0.27 m, Width of each flight = 1.2 m  
 All dimensions are in meters. Show proper north direction.



Room dimensions in m.

Child room: 3.5x3    M. Bed: 4.5x3    Kitchen: 4x3.5    Living room: 4.5x4.5

Verandah: 4.5x3    Bath: 2.1x1.2    WC: 1.2X1

Assume suitable data if required. Show proper north direction

OR

**Q6)** Draw to a suitable scale developed plan of a single storey framed residential building with schedule of openings having the following units [13]

- a) Living room - 3.5m×5.2m
- b) Bedroom - 3.0m× 3.0m
- c) Kitchen - 3.2m× 3.0m
- d) W.C - 1.0m×1.2m
- e) Bath - 1.2m×2.1m
- f) Staircase Rise = 0.16 m& Tread = 0.27 m,Width of each flight = 1.2m
- g) Wall thickness 0.23 m (outer) & 0.15 m (inner)
- h) Floor to floor height 3.2 m

Assume suitable data if required.Show proper north direction

**Q7)** Draw a line plan of a hostel building with 80 bed capacity using suitable scale with schedule of openings [12]

- a) 30 rooms, two seated with 7.5 m<sup>2</sup>/ student and 20 single seated room with 9m<sup>2</sup> area.
- b) Recreation room - 35 m<sup>2</sup>
- c) Gymnasium - 15 m<sup>2</sup>
- d) Office area 20 m<sup>2</sup>,

Assume suitable data if required

OR

**Q8)** It is proposed to construct a Executive Engineer's office with the following data :

- a) Entrance+ Waiting :16m<sup>2</sup>
- b) Administrative office : 20m<sup>2</sup>
- c) E.E. office (with attached toilet) : 18m<sup>2</sup>
- d) Technical Session : 18m<sup>2</sup>
- e) Record room:15 m<sup>2</sup>
- f) PA to Executive : 12 m<sup>2</sup>
- g) Sanitary block (Ladies and Gents) - suitable
- h) Passage : 1.5m wide

Draw to a scale of 1 : 50 or suitable :

- i) Line plan showing locations of doors, windows. [10]
- ii) Schedule of openings. [2]





Total No. of Questions : 8]

SEAT No. :

**P2762**

[Total No. of Pages : 3

**[6002]-278**

**S.E. (Civil Engineering)**

**CONCRETE TECHNOLOGY**

**(2015 Pattern) (Semester - II) (201007)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer Q.Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Your answers will be valued as a whole.*
- 5) *Use of electronic packet calculator is allowed.*
- 6) *Assume suitable data, if necessary.*
- 7) *Use of IS code 10262, 456 is not allowed.*

**Q1) a)** Explain hydration of cement? Which chemical compounds are responsible for hydration of cement? **[6]**

b) Elaborate Compaction factor test. **[6]**

OR

**Q2) a)** Write short note on; **[6]**

i) Super plasticizers

ii) Types of cements

b) Differentiate following; **[6]**

i) Coarse and fine aggregate

ii) Hand mixing and Machine mixing of concrete

**Q3) a)** Explain RMC with their advantages and disadvantages. **[6]**

b) Explain in brief the relationship in tension and compression of concrete in hardened state. **[6]**

OR

**Q4) Write short note on:** **[12]**

a) Types of shrinkage in concrete.

b) Polymer Modified Concrete,

c) High strength concrete

d) Ultrasonic Pulse velocity tester

**P.T.O.**

- Q5) a)** Explain the difference between standard concrete and special concrete. Which parameters affect the strength of concrete. [6]
- b)** Find out the cement and fly ash content for M35 grade of concrete using DOE method for the following data; [7]
- W/(C + F) ratio 0.40,
  - Quantity of water required = 195 kg/m<sup>3</sup>,
  - Correction in water required due to fly ash addition is considered as 20%, Fly ash conforming to IS 3812 (Part I), specific gravity of fly ash = 2.25, consider Fly ash content 30%.

OR

- Q6)** Design a concrete for grade of M35 using IS code method for following data; [13]

- Standard deviation,  $S = 5$ ,
- Cement : OPC 53 grade, Specific gravity : 3.15,  
Maximum cement content : 450 kg/m<sup>3</sup>
- Workability : 50 mm (slump)
- Exposure conditions : Moderate (For RCC work)
- Degree of quality control : Good
- Coarse aggregate :- crushed stone, Angular, maximum size : 20mm,  
Specific gravity : 2.7,  
Water absorption : 0.85%, water content : Nil
- Find aggregate : Natural river sand conforming to grading zone II, Specific gravity : 2.56,  
Water absorption : 3.5%, water content : Nil

Table : 1 :- 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 <sup>3</sup> )	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

Table : 2 :- Water Content per m<sup>3</sup> of concrete for 50 mm slump:

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

Table 3 : - Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate <sup>1)</sup> per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.50	0.48	0.46	0.44
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.75	0.73	0.71	0.69

<sup>1)</sup> Volumes are based on aggregates in saturated surface dry condition.

- Q7)** a) Explain in brief the durability of concrete. How to check the durability of concrete? [6]
- b) Explain in brief various retrofitting techniques used to strengthening RCC column and beams. [7]

OR

- Q8)** a) How to protect the reinforcement from corrosion in RCC element like slab, beam and column? [6]
- b) What are the common types of defects present in concrete? How it will be eliminate / reduce? [7]



[6002]-279

S.E. (Civil)

**STRUCTURAL ANALYSIS - I**  
**(2015 Pattern) (Semester - II) (201008)**

Time : 2 Hours]

[Max. Marks : 50

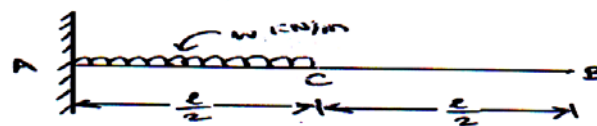
Instructions to the candidates :

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat sketches must 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 during examination.

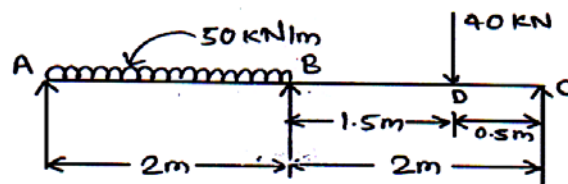
- Q1)** a) State and explain classification of structure based on structural forms with example [6]
- b) A simply supported beam of span 5m subjected to eccentric point load 20 KN at 2m from left support; determine maximum slope and deflection in term of EI. [6]

OR

- Q2)** a) Using castigliano's first theorem, find vertical and horizontal deflection of 'A' as shown in figure below. [6]



- b) Analyse the continuous beam ABC as shown in figure below using three moment theorem. Also draw BMD assuming EI = Constant. [6]



P.T.O.

- Q3) a) Determine the vertical displacement of the joint C of the pin jointed frame as shown in figure below. The cross section area of AB is  $500 \text{ mm}^2$  and that of AC and BC is  $750 \text{ mm}^2$ . Assume  $E = 200 \text{ kN/mm}^2$ . [6]

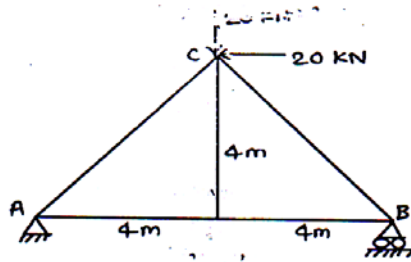


Fig. 03

- b) Four wheel loads of 10 kN, 20 kN, 30 kN and 40 kN respectively spaced at 2 m apart cross a girder of span 20 m from right to left. Calculate the max shear force and bending moment at 8 m from right support. [6]

OR

- Q4) a) Draw Influence Line Diagram for the members  $U_1U_2$ ,  $U_2L_3$  and  $L_2U_3$  of a truss as shown in figure below. [6]

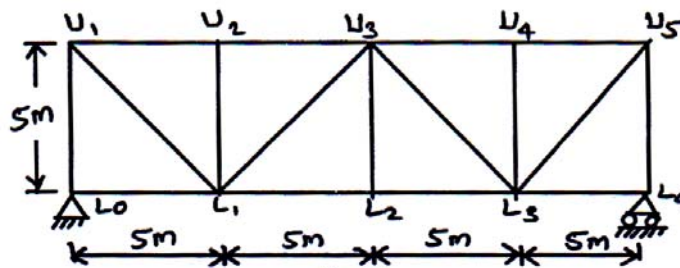


Fig. 04

- b) Find the vertical deflection of the joint c of truss as shown in fig. The area of the inclined tie is  $2000 \text{ mm}^2$  and area of the horizontal member is  $1600 \text{ mm}^2$ . Take  $E = 200 \text{ GPa}$ . [6]

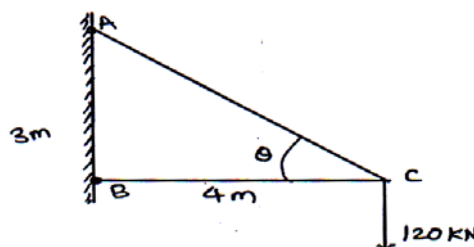


Fig. 05

- Q5) a) A three hinged parabolic arch having supports at different levels as shown in figure 6. Determine horizontal thrust developed. Also find bending moment, normal thrust and radial shear force developed at section 15 m from left support. [7]

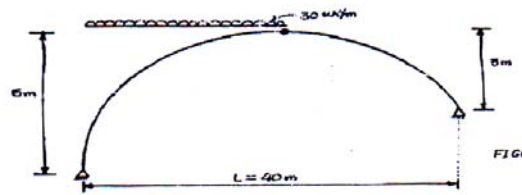


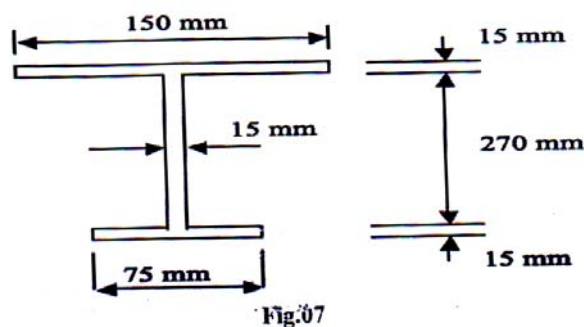
Fig.6

- b) Two hinged parabolic arch of span 30 m and rise 6 m carries two point loads, each of 60 kN, acting at 7.5 m and 15 m from left end respectively. Determine the horizontal thrust and bending moments below the point Loads. [6]

OR

- Q6) a) A three hinged parabolic arch of span 30 m and rise 4 m carries a load whose intensity uniformly varies from 20kN/m at the crown to 40 kN/m at the end. Find the bending moment, Normal thrust and radial shear at a section 7.5 m from left support. [7]
- b) A two hinged parabolic arch of span 'L' and rise 'h' carries a concentrated load 'W' at the crown. Determine the expression for horizontal thrust developed at springings. [6]

- Q7) a) Determine the shape factor for unsymmetrical I-section. [7]



- b) Write a note on Elastic-plastic behaviour of beam. [6]

OR

- Q8) a) Determine the plastic moment at collapse for the continuous beam ABCD loaded with ultimate load as shown in figure with constant  $M_p$ . [7]

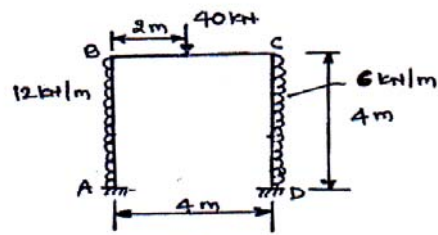


Fig. 08

- b) Determine shape factor for Circular section having diameter  $d$  in m. [6]



Total No. of Questions : 8]

SEAT No. :

P-2764

[Total No. of Pages : 2

[6002]-280

S.E. (Civil Engineering)

Engineering Geology

(2015 Pattern) (Semester - II) (207009)

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams should be drawn wherever necessary.*

- Q1)** a) What is Igneous rocks ? Describe classification of Igneous rocks. [6]  
b) What is meant by Metamorphism? Explain GNEISSOSE and SCHISTOSE structure with neat diagram. [6]

OR

- Q2)** a) What are extrusive and intrusive Igneous bodies? Describe various CONCORDANT Igneous intrusive bodies with neat diagrams. [6]  
b) Define Mineral. Explain classification of MINERALS with suitable examples. [6]

- Q3)** a) What are JOINTS? Describe classification of Joints and their Civil Engineering Significance. [6]  
b) What is Fault? Give nomenclature of the Fault. Describe types of Fault. [6]

OR

- Q4)** a) Write in detail mineral wealth of GONDWANA. [6]  
b) What is REJUVENATION? Explain two features resulting due to rejuvenation. [6]

*P.T.O.*



- Q5)** a) Discuss in detail with a case history how geological investigations have helped for proper site of Dam. [6]  
b) What are the geological requirements for the foundation of Bridge?[7]

OR

- Q6)** a) Explain with appropriate example the feasibility of dam alignment which is crossing a DYKE. [6]  
b) A site is proposed for excavation of tunnel is A-B and M-N, which is passing through axis and limb region of fold respectively. Justify the suitability of tunnel in such conditions. [7]

- Q7)** a) What observations and precautions are necessary during Core Drilling for Preliminary Geological Exploration? [7]  
b) Discuss feasibility of DAM in folded areas. Draw neat diagrams. [6]

OR

- Q8)** a) Explain the Geological conditions favorable for natural springs and artesian wells. [7]  
b) What is LANDSLIDE? What are the causes of it? [6]



Total No. of Questions: 8]

SEAT No. :

**P2765**

**[6002]-281**

[Total No. of Pages : 3

**S.E. (Computer Engineering)**

**DISCRETE MATHEMATICS**

**(2015 Pattern) (Semester-I) (210241)**

*Time : 2 Hours]*

*[Max. Marks : 50*

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

**Q1) a)** What do you mean by equality of sets. Prove the following equalities.

[3]

i)  $A = \{1, 2, 3, 4\}$ ,  $B = \{x : x \text{ is a positive integer } < 5 \text{ and } x^2 < 18\}$

ii)  $A = \{3, 6\}$ ,  $B = \{x : x^2 + 3x - 18 = 0\}$

b) How many integers from 1 to 100 are multiple of 2 or 3 [3]

c) Differentiate between Relation and functions. Discuss the following types of function with proper mathematical notations: [6]

- i) Identity function
- ii) Injective function
- iii) Surjective function
- iv) Bijective function

OR

**Q2) a)** There are two restaurants next to each other. One has a sign that says "Good Food is not CHEAP" and the other has a sign "CHEAP Food is not Good". Are the signs conveying the same thing. Justify your answer with truth table. [3]

b) Define the following with examples. [3]

- i) Uncountable infinite set
- ii) Countable infinite set

c) Discuss the following terms: (Any three) [6]

- i) Partial ordering
- ii) Hasse Diagram
- iii) Transitive closure
- iv) Chains and Antichains

**P.T.O.**

- Q3) a)** Solve the following:
- Find out how many 5-digit number greater than 30,000 can be formed from the digits 1,2,3,4,5. [2]
  - Find the number of permutations which can be made with the letters of the word "ENGINEERING". [2]
  - If  ${}^n C_x = 56$  and  ${}^n P_x = 336$ . Find  $n$  and  $x$  where  $c$  is for combination and  $P$  is for permutations. [4]
- b) Explain the concept of Graph coloring. Identify the chromatic number for the following: [4]

<u>Type of Graph</u>	<u>Chromatic Number</u>
Complete Graph, $k_n$	
Star Graph $s_n$ , $n > 1$	
Cycle Graph $c_n$ , $n > 1$	
Wheel Graph $w_n$ , $n > 2$	

OR

- Q4) a)** Write an algorithm for generating Permutation of  $\{1,2,\dots,n\}$  Apply it for  $n = 3$  case [4]
- b) Explain the following terms: [8]
- Graph Isomorphism
  - Case study on Google Map
  - Euler and Hamilton Graph

- Q5) a)** Define Tree, Spanning Tree and Minimum Spanning tree with some example. [6]
- b) Find maximum flow in the transport network using Labelling procedure. Determine the corresponding min cut [7]

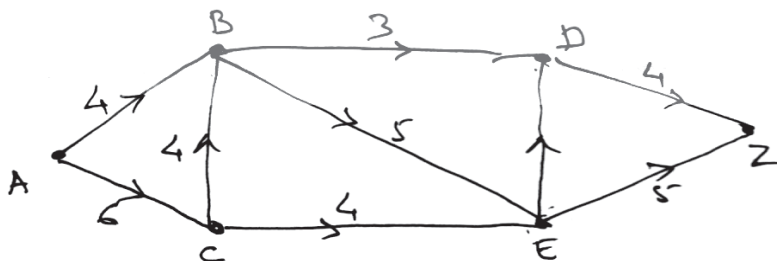


fig 5.6. Transport Network.

OR

- Q6) a)** Illustrate the steps used in Kruskal's Algorithm to construct the minimum spanning tree for the following graph. Obtain the total cost of minimum spanning tree. [7]

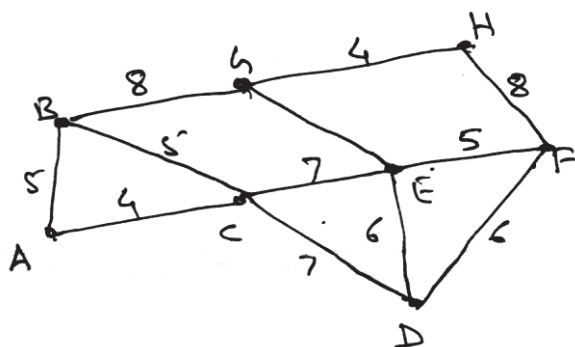


fig 6.a) Graph.

- b) Discuss the following terms: [6]
- i) Max-flow-min cut theorem
  - ii) Game Tree
- Q7) a)** Define Algebraic system and n-ary operations. Discuss the Properties of n-ary operations where  $n=2$  [6]
- i) Closure
  - ii) Commutative
  - iii) Associative
  - iv) Identify
- b) Define semi groups. Determine whether the following is a semi group or not [7]
- i)  $(A,*)$  where  $A = \{2,4,6,8,\dots\}$
  - ii)  $(\{0,1\},*)$  where  $*$  is a multiplication operators

OR

- Q8)** What are Groups and Rings. Explain the following terms with examples: (Any three) [13]
- i) Abelian Group
  - ii) Integral domain
  - iii) Field
  - iv) Group Codes



Total No. of Questions : 8]

SEAT No. :

**P2766**

**[6002]-282**

[Total No. of Pages : 2

**S.E. (Computer Engineering)**  
**DIGITAL ELECTRONICS AND LOGIC DESIGN**  
**(2015 Pattern) (Semester - I) (210242)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1)** a) Minimize the following logic function using K-map and implement it using logic gates [4]

$$F(A,B,C,D) = \sum m(0,1,2,3,4,7,8,9,10,11,12,14)$$

- b) Write the rules for BCD addition and give example. [2]
- c) Draw and explain the look - ahead carry generator [6]

OR

**Q2)** a) Implement the following combinational logic circuits using multiplexer [6]  
i) Half-adder  
ii) Half-Subtractor

- b) Compare Moore and Mealy model [2]
- c) What is race-around condition? How does it get eliminated in a Master-Slave J-K flip flop? Explain [4]

**Q3)** a) Draw the ASM chart for the following state machine. A 2-bit up counter is to be designed with output AB and enable 'X'. if 'X' = 0, then counter changes the state as 00-01-10-11-00. If 'X' = 1, then counter should remain in current state. Design the circuit using J-K FF and suitable Mux. [6]

- b) Draw the Block diagram of PLD & explain [6]

OR

*P.T.O.*

- Q4)** a) What is VHDL? Explain the three modeling styles in VHDL [4]  
 b) List the Various VHDL operators. [2]  
 c) Implement the following output functions using a suitable PLA. [6]

$$F1 (A,B,C,D) = \sum m(3,7,8,9,11,15)$$

$$F2 (A,B,C,D) = \sum m(1,5,7,11,15)$$

- Q5)** a) Compare TTL and CMOS logic family and also draw CMOS-NOR gate [7]  
 b) Draw three input standard TTL NAND gate with totem-pole output and explain its operation [6]

OR

- Q6)** a) Define the following parameters of digital IC families and give their typical values for TTL [6]  
 i) Propagation delay  
 ii) Fan-out  
 iii) Figure of merit  
 b) What is logic family? Give the classification of logic family in detail.[7]

- Q7)** a) Compare microprocessor and microcontroller [7]  
 b) Explain any three addressing modes of 8051 with example [6]

OR

- Q8)** a) Draw and explain Timer control register (TCON) [7]  
 b) Explain the following instructions with respective to 8051 and also give example of each [6]  
 i) RETI  
 ii) SET B  
 iii) SWAPA



Total No. of Questions : 8]

SEAT No. :

P-2767

[Total No. of Pages : 2

[6002]-283

S.E. (Computer Engineering)

DATA STRUCTURES AND ALGORITHMS

(2015 Pattern) (Semester - I) (210243)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer to the questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Assume Suitable data, if necessary.
- 3) Draw neat labelled diagram wherever necessary.
- 4) Figures to the right indicate full marks.

Q1) a) Differentiate between following. [6]

- i) Linear and Non linear Data Structures
- ii) Static and Dynamic Data Structures

b) Write pseudo C/C++ code to implement polynomial multiplication using array. [6]

OR

Q2) a) Explain fast transpose of sparse matrix with suitable example. Discuss the time complexity of fast transpose. [6]

b) Explain asymptotic notations Big Oh, Omega and Theta with suitable example of each. [6]

Q3) a) Write pseudo C/C++ code to insert element in singly linked list. [6]

b) Explain the stepwise conversion using stack for the given infix expression to the postfix expression : [6]

$(A+B) * D+E/(F+A*D)+C$

P.T.O.

OR

- Q4)** a) What are the advantages and disadvantages of doubly linked list over single linked list? Explain node structure of doubly linked list. [6]  
b) Write pseudo C/C++ code to implement stack using linked list. [6]
- Q5)** a) Define the following terms with examples [6]  
i) Input restricted deque  
ii) Output restricted deque  
b) Write pseudo c/c++ code to implement following operations on circular queue [7]  
i) Create  
ii) delete  
iii) display

OR

- Q6)** a) Explain Linear queue and Circular queue with suitable example. Give advantages of Circular queue over Linear queue. [7]  
b) Write pseudo C/C++ code to implement double ended queue using arrays. [6]
- Q7)** a) Sort the following numbers using Quick sort. [7]  
55, 85, 45, 11, 34, 05, 89, 99, 67  
Discuss its time complexity and space complexity  
b) Explain sequential search and binary search with appropriate example. Comment on their data organization, time complexity and space complexity [6]

OR

- Q8)** a) Sort the following numbers using insertion sort: [7]  
18, 13, 12,22, 15,24, 10,16,19,14,30  
b) Write an algorithm for Fibonacci search. Find out time complexity. [6]

**x x x**



Total No. of Questions : 8]

SEAT No. :

**P2768**

[Total No. of Pages : 2

**[6002]-284**

**S.E. (Computer)**

**COMPUTER ORGANIZATION AND ARCHITECTURE**

**(2015 Pattern) (Semester - I) (Theory) (210244)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Divide the following using non-restoring division algorithm **[6]**

Dividend = 1100

Divisor = 0011

b) Explain cache updating policies in detail. **[6]**

OR

**Q2) a)** Explain in details IEEE Standards for Representing floating point Numbers in following formats. **[6]**

i) Single Precision

ii) Double Precision

b) Explain in brief RAID levels in detail. **[6]**

**Q3) a)** What is machine instruction? Explain any three types of operations. **[6]**

b) What is the use of DMA? Explain cycle stealing in DMA. **[6]**

OR

**Q4) a)** Compare memory mapped I/O and I/O mapped I/O. **[6]**

b) Explain following addressing modes with one example each **[6]**

i) Displacement Addressing

ii) Register Indirect

**P.T.O.**

- Q5)** a) Draw and explain architecture of 8086. [7]  
b) Explain instruction pipelining in detail. [6]

OR

- Q6)** a) Compare superscalar and super pipelined approaches. [6]  
b) List the features of 8086 microprocessor. [7]

- Q7)** a) Write a control sequence for the following instruction for single bus organization : ADD (R3), R1. [6]  
b) Explain in detail state table design method for hardwired control design. [7]

OR

- Q8)** a) Draw and explain detail block diagram of hardwired control unit. [7]  
b) List the application of microprogramming. [6]



Total No. of Questions : 8]

SEAT No. :

P-3625

[Total No. of Pages : 2

[6002]-285

**S.E. (Computer Engineering)**

**OBJECT ORIENTED PROGRAMMING**

**(2015 Pattern) (Semester - I) (210245)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Differentiate constructor and destructor? [5]  
b) Compare abstraction and encapsulation in C++? [4]  
c) What are the main features of OOPs? Explain two in detail? [3]

OR

- Q2)** a) Explain inheritance and its different types with suitable syntax in C++. [5]  
b) Define Inline function? Explain with suitable program in C++. [4]  
c) What is abstract class? Give suitable example. [3]

- Q3)** a) What is the Friend function? Write syntax to declare in C++. Discuss different features of friend function in C++. [7]  
b) What does template mean in C++? Write a program to handle multiplication of two numbers using template. [6]

OR

- Q4)** a) What is an exception? How is exception handled in C++ explain with example. [7]  
b) Explain type casting, implicit type casting and explicit type casting. [6]

**P.T.O.**

- Q5) a)** Describe file handling in C++? Explain different file handling functions in C++ with suitable syntax. [6]
- b) Explain error handling in file I/O with suitable program. [6]

OR

- Q6) a)** What is a Stream? Explain types of streams available in C++. [6]
- b) Explain overloading the Extraction and Insertion operators in C++ with example. [6]

- Q7) a)** What is container? List the container classes in C++. Explain any one of them with suitable code. [7]
- b) Write a program in C++ using the open(), eof( ) & getline( ) functions to open & read file contents line by line. [6]

OR

- Q8) a)** Use minimum 8 functions of vector STL. Write a program to explain the same. [7]
- b) What is STL? List different types of STL containers. [6]



Total No. of Questions: 8]

SEAT No. :

**P2769**

**[6002]-286**

[Total No. of Pages : 3

**S.E. (Computer Engineering/IT)  
ENGINEERING MATHEMATICS-III  
(2015 Pattern) (Semester-II) (207003)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q.No.1 OR Q.No. 2, Q.No. 3 Or Q.No. 4, Q.5 or Q.No.6, Q.No. 7 Or Q.No. 8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Your answer will be valued as a Whole.
- 4) Figures to the right indicate full marks.
- 5) Assume suitable data, if necessary.

**Q1) a) Solve any two of the following: [8]**

i)  $\frac{d^2y}{dx^2} + y = \tan x$  (use method of variation of parameters)

ii)  $(D^2 + 3D + 2)y = e^{4x} + 5x$

iii)  $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)$

**b) Solve the following integral equation using Fourier transform [4]**

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

OR

**Q2) a)** An electrical circuit consists of an inductance 0.1 henry, a resistance R of 20 ohms & a condenser of capacitance C of 25 microfarads. If the diff

eq<sup>n</sup> of electric circuit  $L \frac{d^2q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = 0$ . Then find the charge q and current i at any time t, given that when t = 0, q = 0.05 coulombs and

$$i = \frac{dq}{dt} = 0. \quad [4]$$

**P.T.O.**

b) Solve any one [4]

i) Find  $Z^{-1} \left\{ \frac{1}{(z - \frac{1}{2})(z - \frac{1}{3})} \right\}$

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

c) Using Z transform solve the difference eq<sup>n</sup> [4]

$$12f(k + 2) - 7f(k + 1) + f(x) = 0 \text{ where } f(0) = 0, f(1) = 3, k \geq 0$$

**Q3)** a) The first four moments of a distribution about the value 4 are  $-2, 0, 1$  and  $3$  obtain the first four central moments  $\beta_1$  and  $\beta_2$  [4]

b) Fit a straight line of the form  $y = ax + b$  to the following data by the least squares method. [4]

$x$	$-2$	$-1$	$1$	$3$	$4$	$6$
$y$	$3$	$4$	$-1$	$2$	$-2$	$0$

c) A die is thrown 8 times and it is required to find the probability that 3 will show [4]

- i) Exacty 2 times
- ii) At least seven times
- iii) at least once

OR

**Q4)** a) The life of army shoes is normally distributed with mean 8 months and standard deviation 2 months. If 5000 pairs are issued how many pairs would be expected to need replacement after 12 months? [Given :  $P(z \geq 2) = 0.0228$ ] [4]

b) Suppose that a book of 600 pages contains 40 printing mistakes. Assume that these errors are randomly distributed throughout the book and  $x$ , the number of errors per page has a poisson distribution. What is the probability that 10 pages selected at random will be free of errors? [4]

c) The regression equations calculated from a given set of observations for two random variables are [4]

$$x = -0.4y + 6.4$$

$$y = -0.6x + 4.6$$

calculate  $\bar{x}, \bar{y}$  and  $\epsilon$ .

- Q5)** a) Find the directional derivative of  $\phi = xy^2 + yz^3$  at  $(1,-1,1)$  in the direction of vector  $\bar{i} + 2\bar{j} + 2\bar{k}$ . [4]
- b) Show that  $\text{curl curl curl curl } \bar{E} = \nabla^4 \bar{E}$ , if  $\bar{E}$  is solenoidal vector field. [4]
- c) Evaluate the line integral of vector point function  $\bar{F} = (x^2 - y^2)\bar{i} + 2xy\bar{j}$  along the curve  $y^2 = x$  from point  $(0,0)$  to  $(1,1)$  in  $xy$  plane. [5]

OR

- Q6)** a) If directional derivative of  $\phi = ax^2y + by^2z + cz^2x$  at  $(1,1,1)$  has maximum magnitude 15 in the direction parallel to line  $\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}$  find  $a, b, c$ . [4]
- b) Show that (any one) [4]
- i)  $\nabla(\bar{a} \cdot \bar{r}) = \bar{a}$
- ii)  $\nabla \times (\bar{a} \times \bar{r}) = 2\bar{a}$
- c) Using Green's theorem, evaluate the integral  $\oint_c (xydx + y^2dy)$  over the area bounded by curves  $y = x^2$  & line  $y = x$  in first quadrant. [5]

- Q7)** a) If  $F(z) = u+iv$  is analytic, find  $f(z)$  if  $u+v = e^{-x}(\cos y - \sin y)$ . [4]

- b) Evaluate  $\oint_c \frac{e^z}{(z+1)^2(z+2)^2} dz$  where  $c$  is  $|z+1| = \frac{1}{2}$ . [5]

- c) Show that under transformation  $w = \frac{i-z}{i+z}$ ,  $x$  axis in  $z$  plane maps on to circle  $|w|=1$ . [4]

OR

- Q8)** a) Show that analytic Function with constant modulus is constant. [4]

- b) Evaluate  $\oint_c \frac{2z^2 + 2z + 1}{(z+1)^2(z-3)} dz$  where  $C$  is  $|z+1|=2$ . [5]

- c) Find bilinear transformation which maps  $-i, 0, 2+i$  of  $z$  plane onto  $0, -2i, 4$  of  $w$ -plane. [4]



Total No. of Questions : 8]

SEAT No. :

P-2770

[Total No. of Pages : 2

[6002]-288

S.E. (Computer Engineering)

COMPUTER GRAPHICS

(2015 Pattern) (Semester - II) (210251)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

**Q1)** a) Explain winding number method. Investigate whether the method supports intersection polygons? [6]

b) Explain Bresenham's line generation algorithm by deriving the steps. [6]

OR

**Q2)** a) Explain midpoint circle generation algorithm by deriving the steps. [6]

b) Explain Boundary fill algorithm for polygon. [6]

**Q3)** a) Explain 2D transformation (Scaling, Rotation and Translation about an arbitrary point) along with matrices. [6]

b) What is a segment? How do we create it? Why do we need segments? Why to do segment renaming operation. [6]

OR

**Q4)** a) What is homogeneous coordinate system? Derive transformation matrix for rotation about arbitrary point. [6]

b) Why colour models are used? Enlist different colour models. Explain any two colour models with diagram. [6]

P.T.O.



- Q5)** a) Explain Area subdivision (Warnock) algorithm with the help of the diagram and its applications. [7]
- b) Explain Diffuse reflection and Specular Reflection. [6]

OR

- Q6)** a) Explain how Binary space partition algorithm is used to remove hidden surfaces. [7]
- b) What is shading? What steps are required to shade an object using Gourauds shading algorithms? [6]

- Q7)** a) Explain B-Spline curve. Draw relevant diagrams. [7]
- b) Define Fractals, Fractals dimension and illustrate Hilberts curve. [6]

OR

- Q8)** a) Explain 1860 with block diagram. [7]
- b) Define Fractals, Topological dimension and illustrate Triadic Koch curve. [6]

**x x x**

**[6002]-289**  
**S.E. (Computer)**  
**ADVANCED DATA STRUCTURES**  
**(2015 Pattern) (Semester - II) (210252)**

Time : 2 Hours]

[Max. Marks : 50

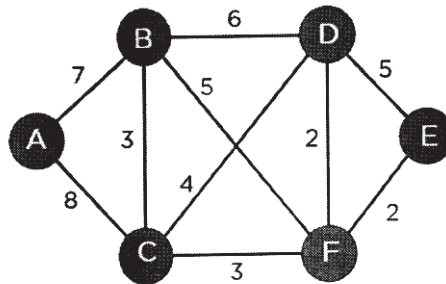
Instructions to the candidates :

- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6 and Q.No.7 or Q.No.8.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.

- Q1)** a) Write a pseudo code for non-recursive post-order traversal of binary search tree. [6]
- b) What are the methods used for traversing the graph? Explain each with an example. [6]

OR

- Q2)** a) Write pseudo-code for performing level order traversal of a binary tree.[6]
- b) What is a Minimum Spanning Tree? Explain Kruskal's Algorithm with following example to construct Minimum Spanning Tree. [6]



- Q3)** a) Obtain AVL tree from the following data. [6]  
30 50 110 80 40 10 120 60 20 70 100 90
- b) What is a collision in Hashing? What are different Collision Resolution Strategies? Explain any one with example. [6]

OR

P.T.O.

- Q4) a)** Explain the following AVL tree rotations with example. [6]  
i) LL ii) RR iii) LR iv) RL
- b) Find the Optimal Binary Search Tree for the Identifier set {a1, a2, a3} = {10, 20, 30} with Probabilities of successful search as {p1, p2, p3} = {0.5, 0.1, 0.05} and Probability of unsuccessful search as {q0, q1, q2, q3} = {0.15, 0.1, 0.05, 0.05}. [6]

- Q5) a)** What is B+ tree? Explain the delete operation in B+ tree with example. [8]  
b) What is Red-Black Tree? How it differs from AVL and AA trees. [6]

OR

- Q6) a)** Construct B tree of order 5 for the following data. [7]  
1 12 8 2 25 5 14 28 17 7 52 16 48 68 3 26 29 53 55 45
- b) What is Splay Tree? Explain all rotations in Splay Tree with example. [7]

- Q7) a)** Explain following terms : [6]  
i) Multi List Files  
ii) Coral Rings  
iii) Enverted Files
- b) Explain sequential file and random access file organization. [6]

OR

- Q8) a)** What is a file? List different modes of File. Explain any four functions related to File handling in CPP. [6]  
b) Explain the drawback of Sequential File Organization. Compare Index Sequential and Direct Access File. [6]



Total No. of Questions : 8]

SEAT No. :

**P2772**

[Total No. of Pages : 2

**[6002]-290**

**S.E. (Computer Engineering)**

**MICROPROCESSOR**

**(2015 Pattern) (Semester - II) (210253)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1) a)** What is the use of following instructions? **[4]**
- i) Wait
  - ii) Lock
- b) Explain segment address translation in detail. **[6]**
- c) Explain segment descriptor. **[2]**

OR

- Q2) a)** Explain the following instructions, mention flag affected: **[4]**
- i) CWD
  - ii) BT
  - iii) LAHF
- b) Explain the system address and system segment registers. **[6]**
- c) What is the use of direction flag? **[2]**

OR

- Q3) a)** Difference between memory mapped I/O and I/O mapped I/O. **[6]**
- b) List the register and data structure that are uses in Multitasking. **[6]**
- Q4) a)** Explain the difference exception conditions - Faults, Traps and Aborts? **[6]**
- b) What is IDT and how to locate IDT? **[6]**

*P.T.O.*

- Q5)** a) Explain various debugging feature of 80386. [6]  
b) Write short on “Task Switch Break Point”. [6]

OR

- Q6)** a) Which bit of EFLAGS indicates V86 mode? Explain how hardware and software co-operator with each other to emulate V86 mode? [6]  
b) Explain, how test registers are used in testing TLB? [6]

- Q7)** a) Which data types are supported by 80387? [8]  
b) Write note on CLK2 and Internal processor clock. [6]

OR

- Q8)** a) Draw read cycle with pipeline address timing. [8]  
b) Explain the following Signals. [6]  
i) PEREQ  
ii) BUSY#  
iii) ERROR#



Total No. of Questions : 8]

SEAT No. :

P-2773

[Total No. of Pages : 2

[6002]-291

S.E. (Computer Engineering)

**PRINCIPLES OF PROGRAMMING LANGUAGES**

**(2015 Pattern) (Semester - II) (210254)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1)** a) What is an Activation Record? What are the attributes of Activation Record? Explain with example how it plays an important role in execution of recursive function. [6]

b) What is quality attributes? What are the quality attributes related to Software? Explain [6]

OR

**Q2)** a) Explain the following with example with respect to data types : [6]

- i) User-defined types and abstract data types
- ii) Static versus dynamic program checking
- iii) Monomorphic versus polymorphic type systems

b) Explain the following with example in various structure of programming languages : [6]

- i) Routines,
- ii) Style issues : side effects and aliasing
- iii) Exceptions

**Q3)** a) Explain the following with example in program : [6]

- i) Modularity,
- ii) Encapsulation,
- iii) Interface and implementation,

b) Demonstrate through a program in Java how constructors can be used for Initializing the elements of matrix with '0' in the example on Addition of 2 Matrices. [7]

**P.T.O.**

OR

- Q4)** a) Explain with respect to a java : [6]
- i) An object reference
  - ii) An object and a class
  - iii) An Object and Methods
- b) Write a description about the following String methods in Java with suitable example. [7]
- i) toCharArray()
  - ii) isEmpty()
  - iii) length()
  - iv) trim()

- Q5)** a) Describe Inheritance. List and explain the different types of inheritance. Demonstrate how Java supports Multiple Inheritance. [6]
- b) What is a Constructor? What are its different types? Demonstrate with suitable example the different types of constructors used. [6]

OR

- Q6)** a) Explain the following with Java Programming with example declaring objects, assigning object reference variables, constructors, this keyword, garbage collection, finalize() method. [6]
- b) What are Packages and Interface in Java. Write the syntax for creating a package and interface in Java. [6]
- Q7)** a) What is an Exception? What are the different types of Exceptions ? Illustrate how exceptions are handled in Java. [6]
- b) Illustrate use of methods in PrintStream Class to implement Student Information system. [7]

OR

- Q8)** a) Explain one example try block with multiple catch statements. [6]
- b) How the JavaScript is used for creating web based applications? Explain its frameworks in detail. [7]



Total No. of Questions: 8]

SEAT No. :

**P2774**

**[6002]-292**

[Total No. of Pages : 3

**S.E. (Electrical)/(Instrumentation and control)  
ENGINEERING MATHEMATICS-III  
(2015 Pattern) (Semester-I) (207006)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a) Solve any two: [8]**

i)  $(D^2 - 5D + 6)y = 4e^{6x}$ .

ii)  $(D^2 + 4)y = \sec 2x$  by variation of parameters method.

iii)  $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 3y = \cos(\sqrt{3} \log x)$ .

b) Solve by Laplace transform method  $y'' + y = t$ ,  $y(0) = 1$ ,  $y'(0) = -2$ . [4]

OR

**Q2) a) An electric current consists of an inductance 0.1 henry a resistance R of 20 ohms and a condenser of capacitance C of  $25 \times 10^{-6}$  farads. If the differential equation of electric circuit is:  $L \frac{d^2 q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = 0$  then find the charge q at any time t. [4]**

b) Solve any one. [4]

i) Find  $L(e^{-2t} t \cos t)$

ii) Find  $L^{-1} \left[ \frac{1}{s(s^2 + 4)} \right]$

c) Evaluate the following integral using Laplace transform: [4]

$$\int_0^{\infty} e^{-2t} \frac{(e^{-at} - e^{-bt})}{t} dt$$

**P.T.O.**



**Q3) a)** Solve the integral equation  $\int_0^{\infty} f(x) \sin(\lambda x) dx = \begin{cases} 1 - \lambda, & 0 \leq \lambda \leq 1 \\ 0, & \lambda \geq 1 \end{cases}$  [4]

b) Attempt any one [4]

i) Find the z-transform of  $f(k) = (k+1)5^k, k \geq 0$

ii) Find inverse z-transform of

$$F(z) = \frac{10z}{(z-1)(z-2)} \text{ by using inversion integral method.}$$

c) If the directional derivative of  $\phi = axy + byz + czx$  at  $(1,1,1)$  has maximum magnitude 2 in a direction parallel to x-axis, Find values of a,b,c. [4]

OR

**Q4) a)** Attempt any one [4]

i) Show that  $\nabla \cdot \left( r \nabla \left( \frac{1}{r^3} \right) \right) = \frac{3}{r^4}$

ii) Show that  $\nabla \times \left( \frac{\bar{a} \times \bar{r}}{r^3} \right) = -\frac{\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$

b) Show that the vector field  $\bar{F} = (y^2 \cos(x) + z^2) \bar{i} + (2y \sin(x)) \bar{j} + 2xz \bar{k}$  is conservative and find scalar field  $\phi$  such that  $\bar{F} = \nabla \phi$  [4]

c) Obtain  $f(k)$ , given that [4]

$$12f(k+2) - 7f(k+1) + f(k) = 0, \quad k \geq 0, \quad f(0) = 0, \quad f(1) = 3.$$

**Q5) Attempt any two [6]**

a) Use Green's theorem to evaluate  $\int_C \bar{F} \cdot d\bar{r}$  where

$$\bar{F} = (2x - \cos y) \bar{i} + x(4 + \sin y) \bar{j}, \quad C \text{ is the ellipse } \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, z = 0$$

b) Use divergence theorem to evaluate  $\iiint_S (x^3 \bar{i} + y^3 \bar{j} + z^3 \bar{j}) \cdot d\bar{s}$  where s is

the surface of the sphere  $x^2 + y^2 + z^2 = 1$ . [6]

- c) Use stoke's theorem to evaluate  $\int_c 4ydx + 2zdy + 6ydz$  where c is the curve of intersection of  $x^2 + y^2 + z^2 = 6z$  and  $z = x + 3$ . [7]

OR

**Q6)** Attempt any two

- a) Find the work done in moving a particle once round the ellipse  $x = 5 \cos \theta, y = 4 \sin \theta, z = 0$  under the field of force. [6]

$$\bar{F} = (2x - y + z)\mathbf{i} + (x + y - z^2)\mathbf{j} + (3x - 2y + z^2)\mathbf{k}$$

- b) Evaluate  $\iint_S \bar{r} \cdot \hat{n} ds$  over the surface of a sphere of radius 1 with centre at origin. [6]

- c) Apply stoke's theorem to evaluate  $\int_C (yi + zj + xk) \cdot d\bar{r}$  where C is the curve given by  $x^2 + y^2 + z^2 = a^2, x + z = a$ . [7]

- Q7)** a) If  $F(z) = u + iv$  is analytic and  $u = x^3 - 3xy^2$ . Find harmonic conjugate of u. [4]

- b) Evaluate:  $\oint_C \frac{3z^2 + 2}{(z-2)^2} dz$ , where 'c' is  $|z| = 3$ . [4]

- c) Find the bilinear transformation that maps the point  $z = 0, 1, 2$  into the points  $W = 1, \frac{1}{2}, \frac{1}{3}$  [5]

OR

- Q8)** a) If  $F(z) = u + iv$  is analytic and  $V = e^x \sin y$  Find harmonic conjugate of V. [4]

- b) Evaluate:  $\oint_C \frac{\sin^2 z}{(z - \frac{\pi}{6})^2} dz$  where C is  $|z| = \frac{3}{2}$  [4]

- c) Find image of  $y = x$  under the transformation  $W = \frac{z-1}{z+1}$ . [5]



Total No. of Questions : 8]

SEAT No. :

P-2775

[Total No. of Pages : 2

[6002]-293

S.E. (Electrical)

**Power Generation Technologies  
(2015 Pattern) (203141) (Semester - I)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right side indicate full marks.*

**Q1)** a) Explain coal handling system in thermal power plant with neat flow chart. [6]

b) Explain carnot cycle with PV and TS Diagram. [6]

OR

**Q2)** a) Explain working of Air-preheater and economiser in thermal power plant and show its location in layout. [6]

b) With the help of diagram explain the diesel power plant. [6]

**Q3)** a) Explain flow duration curve and hydrograph with example. [6]

b) Derive power in a wind and Environmental Impacts of Wind Turbines. [7]

OR

**Q4)** a) Explain the following terms with sketches : [6]

i) surge tank

ii) water hammer

iii) Spillways

b) Explain working of Horizontal axis type wind turbine with diagram.[7]

*P.T.O.*

- Q5)** a) Explain the process of municipal solid waste to energy conversion with diagram. [7]  
b) Explain the working of PV Cell and Simplest Equivalent Circuit for a Photovoltaic Cell. [6]

OR

- Q6)** a) Describe the fuel cells. How are they used for energy storage requirements. [6]  
b) With the help of diagram explain the main concept of solar thermal power plant. [7]

- Q7)** a) Define the terms in solar energy system :  
i) Solar constant  
ii) Cloudy index  
iii) Concentration ratio [6]  
b) Explain grid connected renewable systems and their requirements. [6]

OR

- Q8)** a) Explain the Shading Impacts on I-V curves of PV cells. [6]  
b) Explain the process Biomass energy conversion. [6]



Total No. of Questions : 8]

SEAT No. :

**P2776**

[Total No. of Pages : 3

**[6002]-294**  
**S.E. (Electrical)**  
**MATERIAL SCIENCE**  
**(2015 Pattern) (Semester - I) (203142)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

*Physical Constants:*

- 1) *Angstrom Unit (AU) =  $1 \times 10^{-10}$  metres*
- 2) *Boltzmann's Constant (k) =  $1.380 \times 10^{-23}$  joule. degree  $-1$*
- 3) *Charge on Electron (e) =  $1.601 \times 10^{-19}$  coulomb*
- 4) *Mass of Electron (m) =  $9.107 \times 10^{-31}$  kg*
- 5) *Electron volt (eV) =  $1.602 \times 10^{-19}$  joules*
- 6) *Mass of Proton ( $m_p$ ) =  $1.627 \times 10^{-27}$  kg*
- 7) *Velocity of Light (c) =  $2.998 \times 10^8$  m/sec*
- 8) *Dielectric Constant of free space ( $\epsilon_0$ ) =  $8.854 \times 10^{-12}$  F/m*
- 9) *Permeability of free space ( $\mu_0$ ) =  $4\pi \times 10^{-7}$  H/m*
- 10) *Debye Unit =  $3.33 \times 10^{-30}$  coulomb. metre*

*P.T.O.*

- Q1)** a) What is the difference between dielectric material and insulating material? Hence write the properties and application and ceramics. [6]
- b) What is different mechanism of polarization? Explain any two with diagram. [6]

OR

- Q2)** a) A parallel plate capacitor has a capacitance of  $2\mu\text{F}$ . The dielectric has a permittivity  $\epsilon_r = 100$ . For an applied voltage of 1000 volts, find the energy stored in the capacitor as well as the energy stored in polarizing the dielectric. [6]
- b) Explain the phenomenon of spontaneous polarization in ferroelectric materials. [6]
- Q3)** a) Explain the terms diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism and ferrimagnetism with the reference to magnetic dipoles of the atom. [6]
- b) Write materials used for super-capacitors, solders and super conductors. [6]

OR

- Q4)** a) Describe the properties and application of the following materials. [6]
- i) High conductive materials
- ii) Low conductive materials
- b) Define [6]
- i) Permeability
- ii) Magnetic susceptibility
- iii) Magnetic Moment
- iv) Magnetization

- Q5)** a) Explain electrical, mechanical and vibrational properties of carbon nano tubes. Give two applications of carbon nano tube. [7]
- b) Explain with neat diagram, chemical reaction and application of Lead acid battery. [6]

OR

- Q6)** a) What do you mean by molecular machine? [6]  
b) Explain with neat diagram, chemical reaction and application of Nickel Cadmium. [7]

- Q7)** a) With neat diagram, explain method of measurement of dielectric strength of solid insulating material. Name the solid insulating materials, which are tested in laboratory. [7]  
b) Describe measurement of flux density with Gauss meter. What is the principle of operation of Gauss meter? [6]

OR

- Q8)** a) With neat circuit diagram and phasor diagram, explain measurement of dielectric loss angle ( $\tan \delta$ ) by Schering Bridge as per IS 13585-1994. [7]  
b) How will you test transformer oil? Explain with neat diagram of the test set up. [6]



Total No. of Questions : 8]

SEAT No. :

P-2777

[Total No. of Pages : 2

[6002]-295

S.E. (Electrical)

ANALOG AND DIGITAL ELECTRONICS

(2015 Pattern) (Semester - I) (203143)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Attempt Q.No.1 or 2, Q.No.3 or 4, Q.No.5 or 6, Attempt Q.No.7 or 8.
- 2) Figures to the right indicates full marks.

**Q1)** a) Explain the operation of SR flip flop with truth table. [6]

b) Perform : [6]

i)  $(0110)_2 - (1000)_2$  using 1's complement.

ii)  $(-12)_{10} - (-7)_{10}$  using 2's complement.

OR

**Q2)** a) i) Write a short note on Gray code and Excess-3 code. [6]

ii) Use K-map to minimize the following standard SOP expression :

$$\bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C + \bar{A}\bar{B}C + ABC$$

b) Design Mod-5 synchronous up counter using JK flip flop. [6]

**Q3)** a) Draw and explain frequency response characteristics of ideal and practical low pass filter. [7]

b) Explain the working of OPAMP as comparator. Also draw the waveform. [6]

OR

P.T.O.



- Q4)** a) Explain the application of OPAMP as square wave generator. [7]  
b) Explain working of IC 555 astable multivibrator. [6]

- Q5)** a) Explain Darlington connection and explain how it improves the current gain. [6]  
b) Draw RC coupled amplifier. Also draw its frequency response. [6]

OR

- Q6)** a) Explain AC-DC load line analysis using CE configuration of BJT. [6]  
b) Draw and explain construction of FET with its characteristics. [6]

- Q7)** a) Explain the construction and working of three phase full wave bridge rectifier connected to R-load with neat diagram. [7]  
b) Compare diode rectifier with precision rectifier. [6]

OR

- Q8)** a) Explain the working of full wave precision rectifier with neat diagrams. [7]  
b) A 230 V, 50 Hz ac voltage is applied to the primary of 2:1 step down transformer which is used in bridge rectifier, having a load resistance of 500 Ohm. Assuming the diodes to be ideal, find: i) D.C. output voltage ii) PIV for each diode iii) output frequency. [6]



Total No. of Questions : 8]

SEAT No. :

P-2778

[Total No. of Pages : 2

[6002]-296

**S.E. (Electrical Engineering)**

**ELECTRICAL MEASUREMENTS AND  
INSTRUMENTATION**

**(2015 Pattern) (Semester - I) (203144)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logarithmic table, slide rule, Mollier chart, electronic pocket calculator and steam table is allowed.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Which three forces are required for satisfactory operation of an analog indicating instrument? State the function of each force. [7]
- b) Draw circuit diagram of Kelvin's double bridge. Derive expression for unknown resistance with usual notations. [6]

OR

- Q2)** a) Give detail classification of measuring instruments. Elaborate each type in brief. [6]
- b) With a circuit diagram derive the equation for an unknown self inductance measurement using Anderson's bridge. [7]

- Q3)** a) Draw a block diagram of electronic energy meter and explain how it operates. [6]
- b) Explain two wattmeter method for measuring power in a (R+L) load, draw the phasor diagram. [6]

OR

- Q4)** a) Draw diagram of single phase induction type energy meter and label all the parts. [6]
- b) Explain construction of dynamo meter type wattmeter with neat diagram. [6]

*P.T.O.*

- Q5) a)** Explain measurement of voltage, time period and frequency using CRO. [6]
- b) With neat diagram, explain Mcleod gauge for low pressure measurement. [6]

OR

- Q6) a)** Draw a neat diagram of DSO. State the functions of each part. [6]
- b) What do you mean by transducer? Give detail classification of transducers. [6]

- Q7) a)** What are the types of strain gauge? Explain wire strain gauge. [6]
- b) Explain construction and working of RVDT with neat diagram. Also list its applications. [7]

OR

- Q8) a)** Explain electrical method for level measurement with a suitable diagram. [6]
- b) Explain construction and working of LVDT with neat diagram. State the effect of frequency on performance of LVDT. [7]



Total No. of Questions : 08]

SEAT No. :

P-2779

[Total No. of Pages : 2

**[6002]-297**  
**S.E. (Electrical)**  
**POWER SYSTEMS-I**  
**(2015 Pattern) (Semester - II) (203145)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates :*

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

**Q1) a)** Define term base load and peak load plants . Explain the advantages of interconnected grid systems **[6]**

b) Explain various methods of improving string efficiency. **[6]**

OR

**Q2) a)** With neat diagram , explain the construction and advantages of following types of insulators. **[6]**

- i) Pin type Insulator                      ii) String Insulators

b) A generating station has a connected load of 43MW and maximum demand of 20MW. The units generated being  $61.5 \times 10^6$  per annum. Calculate **[6]**

- i) Demand factor                      ii) Average load  
iii) Load factor.

**Q3) a)** Derive the expression for loop inductance of single phase overhead lines. **[8]**

b) If the maximum permissible tension in the line of span 200 meter is 1450 kg. The weight of line is 0.684 kg/m. Calculate sag? **[5]**

OR

*P.T.O.*

- Q4) a)** Derive an expression for flux linkages [8]
- i) Due to single current carrying conductor
  - ii) In parallel current carrying conductors
- b) A 33 kV, single core cable has conductor diameter of 1 cm and a sheath inside diameter 4 cm. Find the maximum and minimum stress in the insulation. [5]

- Q5) a)** Derive an expression for capacitance of three phase line when conductors are unsymmetrically spaced but transposed. [6]
- b) A 16 km long transmission line consists of a pair of conductors 1.5 cm in diameter spaced 2 m apart. Calculate capacitance per km neglecting effect of earth. [6]

OR

- Q6) a)** Explain necessity of transposition of line conductors in three phase lines. [6]
- b) Determine capacitance per phase per km of three phase transmission line when conductors are arranged in horizontal plane and 4 meter apart. Diameter of each conductor is 2 cm. assume complete transposition. [6]

- Q7) a)** Define generalized circuit constants of transmission line hence prove that for any transmission line value of  $AD - BC = 1$  [6]
- b) The ABCD constants of three phase transmission line are  $A = D = 0.936 + j0.016$ ,  $B = 33.5 + j138 \Omega$  and  $C = (-0.9280 + j901.223) * 10^{-6}$  mho. The load at the receiving end is 40 MW at 200 kV with power factor of 0.86 lagging. Find sending end voltage, sending end current and sending end power factor. [7]

OR

- Q8) a)** Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for medium transmission line with nominal 'π' method. [7]
- b) Calculate ABCD constants for three phase 50 Hz transmission line with following line parameters. [6]

Use Nomial 'T' method

$$R = 24\Omega, \quad L=0.192 \quad C = 1.28*10^{-6}F \quad G = 0$$



Total No. of Questions: 8]

SEAT No. :

**P2780**

**[6002]-298**

[Total No. of Pages : 2

**S.E. (Electrical)**

**ELECTRICAL MACHINES-I**

**(2015 Pattern) (Semester-II) (203146)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Draw phasor diagram of transformer at lagging power factor condition, mark all parameters. **[6]**

b) With suitable diagram explain polarity test on transformer. **[6]**

OR

**Q2) a)** A 5 kVA, 250/500 volt, single phase transformer gave following test results.

Open circuit test (conducted from LV side)

250 volt, 0.75 Amp, 60 watt

Short circuit test (conducted from HV side)

9 volt, 6 Amp, 21.6 watt

Determine equivalent circuit parameters from above data. **[6]**

b) State the necessary conditions for parallel operation of transformers. **[6]**

**Q3) a)** Draw a neat sketch of 4 point starter of DC motor mark all parts in it Describe the working of it. **[7]**

b) Explain armature reaction in DC machine with suitable diagrams. **[6]**

OR

**Q4) a)** A 300 volt DC Shunt motor has armature resistance of 0.05 ohm and field resistance of 150 ohm. It runs at 750 rpm. Find the additional resistance required in the field circuit to increase the speed to 1150 rpm. Current taken by motor in both cases is 175 Amp. **[7]**

**P.T.O.**

- b) Draw powerflow diagram of DC motor write the respective expressions of Power and losses involved. [6]

**Q5) a)** Explain the concept of rotating magnetic field in case of 3 phase induction motor with suitable phasor diagrams and equations [6]

- b) Explain rotor resistance starter used for slipping induction motor with suitable diagram. [7]

OR

**Q6) a)** A 3phase, 50 Hz induction motor develops output of 15 kW at 950 rpm at power factor of 0.86 lagging. The mechanical losses are 730 watt and stator losses are 1500 watt. Determine-Slip, rotor copper loss, motor input current drawn by motor. [6]

- b) Describe no load and blocked rotor test conducted on 3 phase induction motor with suitable circuit diagram write down the calculations involved. [7]

**Q7) a)** Draw the phasor diagram of 3 phase induction motor. [6]

- b) Derive the condition for maximum starting torque for three phase induction motor. [6]

OR

**Q8) a)** With the help of torque speed characteristics explain effect of addition of external resistance in rotor circuit of 3 phase slipping induction motor. [6]

- b) Clearly explain why induction motor is known as generalized transformer. [6]



Total No. of Questions : 8]

SEAT No. :

P-2781

[Total No. of Pages : 4

[6002]-299

S.E. (Electrical Engineering)

NETWORK ANALYSIS

(2015 Pattern) (Semester - II) (203147)

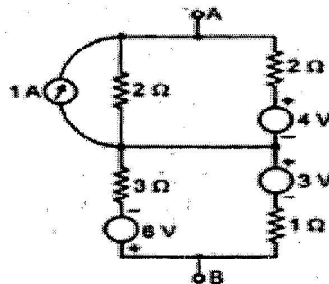
Time : 2 Hours]

[Max. Marks : 50

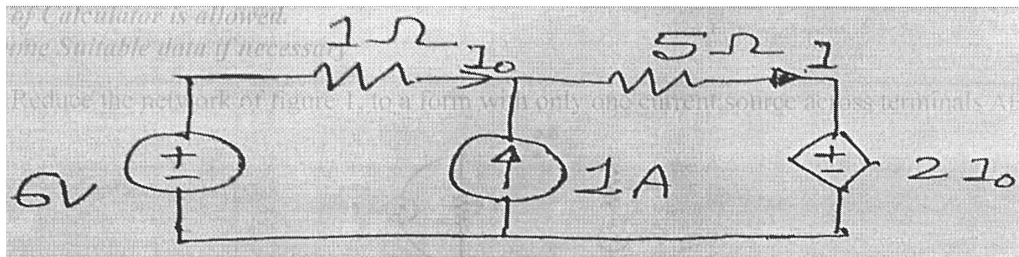
Instructions to the candidates:

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

- Q1) a) Reduce the network of figure 1, to a form with only one current source across terminals AB. [7]



- b) Find current through 5 ohm resistance by using Super Position Theorem as shown in fig. [6]

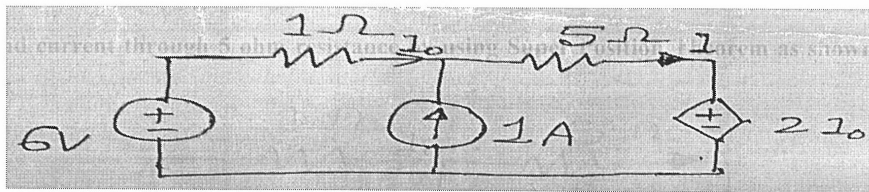


OR

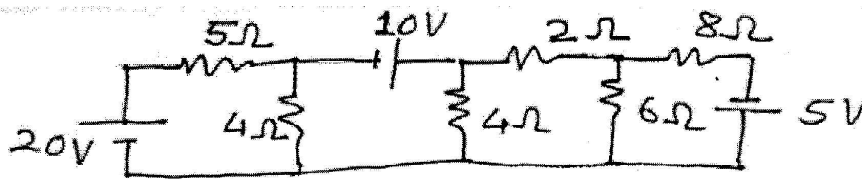
P.T.O.



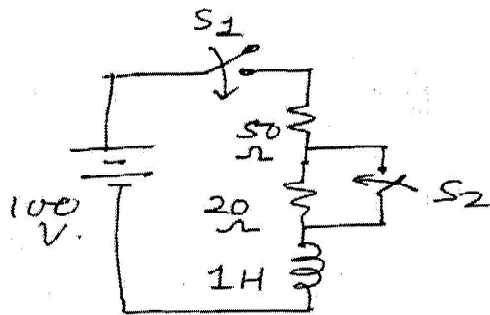
Q2) a) Find Current I using Thevenins Theorem. [7]



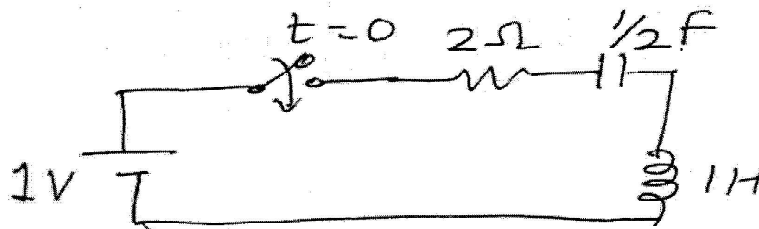
b) Find current through 6 ohm resistance by using Nodal Analysis technique as shown in fig [6]



Q3) a) In the circuit, the switch S1 is closed at time  $t = 0$  and switch S2 is closed at time  $t = 0.1$  sec find the transient current by using classical theory & also draw this current for two intervals. [7]

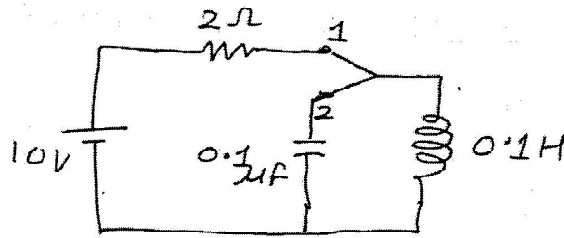


b) R-L-C circuit is excited by DC voltage source. Find Current  $i(t)$  using conventional method. The switch is closed at time  $t = 0$ . [6]

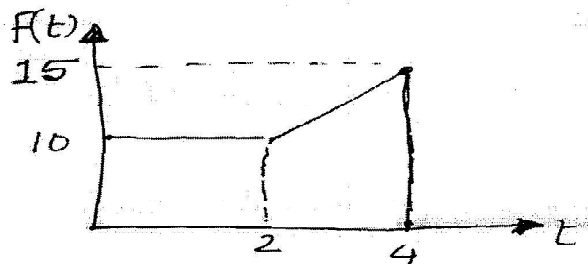


OR

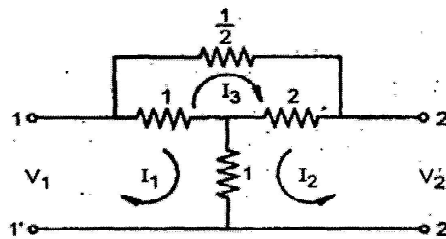
- Q4) a) After being on position 1 for long time, the switch is thrown on position 2 at time  $t = 0$ , find current using Laplace Transform technique. [7]



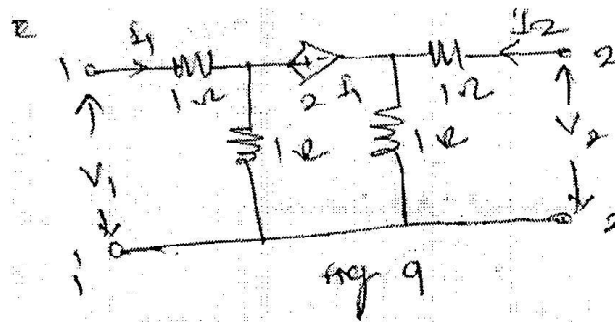
- b) Obtain  $F(S)$  for the wave shown in fig. [6]



- Q5) a) Find Z parameter for the circuit as shown in fig [6]

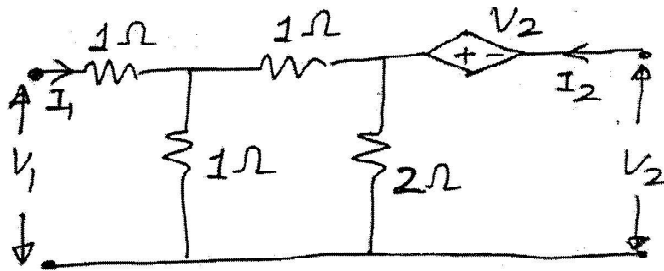


- b) Find Transmission parameter for the circuit as shown in fig. [6]



OR

- Q6) a)** Draw the time domain wave form for various types of transfer function & comment on stability of system. [6]
- b) For the network shown in fig , Find Hybrid Parameters. [6]



- Q7) a)** Derive the expression for attenuation constant and Phase shift of proto type constant K high pass filter. [6]
- b) A low pass filter is composed of symmetrical  $\pi$  section. Each series arm and shunt arm is 0.02 Henery and 2 microfarad. Find cutoff frequency and design Resistance. [6]

OR

- Q8) a)** A HPF section is constructed from two capacitors 1 microfarad each and 15 milli henery find cutoff frequency and design Resistance. [6]
- b) Design a T section constant K HPF having cut off frequency of 10 KHz and nominal Design Resistance  $R_0 = 600$  ohms Also find Character Impedance  $Z_0$  and phase constant at 25 KHz. [6]

x x x

Total No. of Questions : 8]

SEAT No. :

**P2782**

[Total No. of Pages : 2

**[6002]-300**

**S.E. (Electrical)**

**NUMERICAL METHODS AND COMPUTER PROGRAMMING**

**(2015 Pattern) (Semester - II) (203148)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Explain following instruction used in C languages. **[6]**

- i) printf
- ii) scanf
- iii) getch

b) State and explain Descarte's Rule of sign with example given as

$$x^4 + 2x^3 + 10x - 20 = 0. \quad [7]$$

OR

**Q2) a)** Write short notes on **[6]**

- i) Functions call by value
- ii) Functions call by reference

b) Explain truncation error and round off errors with example. **[7]**

**Q3) a)** Explain Bisection method for solution of transcendental equation with graphical representation. **[6]**

b) Use Newton's divided difference interpolation to find polynomial equation to fit following the data points (0, 2), (1, 3), (2, 12) and (5, 147). **[6]**

OR

**Q4) a)** Derive formula for Newton's backward interpolation with assumptions. **[6]**

b) Solve  $f(x) = x^3 - \sin(x) + 1$  using NR method with initial value  $x_0 = -2$  correct to three decimal places. **[6]**

*P.T.O.*

**Q5) a)** Derive Trapezoidal rule for numerical integration as a special case of Newton's Cote formula. [6]

b) Solve  $\frac{dy}{dx} = \sqrt{x^2 + y}$  for  $y = 0.2$  with  $y(0) = 0.8$  and  $h = 0.2$  using 4<sup>th</sup> order RK method. [7]

OR

**Q6) a)** Explain Taylor's series method for the solution of ordinary differential equation. [6]

b) Solve  $\int_1^2 \int_1^2 (x^2 + y^2) dx dy$  using Trapezoidal rule. Take  $h = k = \frac{1}{2}$ . [7]

**Q7) a)** Explain Gauss elimination method for solving simultaneous equations. [6]

b) Find inverse of matrix using Gauss Jordan method. [6]

$$A = \begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix}$$

OR

**Q8) a)** Explain Gauss Seidel method for solution of simultaneous equation. [6]

b) Find the largest Eigen value of matrix

$$A = \begin{bmatrix} 3 & -5 \\ -2 & 4 \end{bmatrix} \text{ using power method with initial value of } \begin{bmatrix} 1 \\ 1 \end{bmatrix}. \quad [6]$$



Total No. of Questions : 8]

SEAT No. :

P-2783

[Total No. of Pages : 2

[6002]-301

S.E. (Electrical)

**FUNDAMENTALS OF MICROCONTROLLER AND ITS  
APPLICATIONS**

**(2015 Pattern) (Semester - II) (203149)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** What are the functions of the following pins of 8051? **[6]**

- i) ALE
- ii)  $\overline{\text{PSEN}}$
- iii)  $\overline{\text{EA}}$

b) Explain the addressing modes of 8051 Microcontroller with examples. **[6]**

OR

**Q2) a)** With a neat diagram show interfacing of 8 KB of Data ROM memory to 8051. **[6]**

b) Explain the stack organization and enlist instructions related to stack. Where is the stack pointer initialized at power ON? **[6]**

**Q3) a)** Write a program to clear 10 RAM locations starting at RAM address 20H. **[6]**

b) Write note on interrupt structure of 8051. What are the steps taken by 8051 in response to an interrupt? **[7]**

OR

**Q4) a)** Write a program to create a square wave of 66% duty cycle on Port 1 bit 0. **[6]**

b) Explain the function of SBUF and SCON registers in detail. **[7]**

**P.T.O.**

- Q5)** a) Explain with diagram, 8255 Mode 1 Input mode and the handshake signals used. [6]
- b) Interface DAC 0808 with 8051 Microcontroller. Write a program to generate triangular waveform. [6]

OR

- Q6)** a) Explain with diagram, 8255 Mode 1 output mode and the handshake signals used. [6]
- b) Explain the use of BSR mode of 8255. Write a program to set  $PC_4$  and  $PC_0$  and reset it after some time. [6]
- Q7)** a) With the help of block diagram, show how power can be measured using 8051. [6]
- b) Draw an interfacing diagram and write program for control of a relay by using 8051. [7]

OR

- Q8)** a) With diagram, explain the  $4 \times 4$  matrix keyboard interfacing to 8051 microcontroller. [6]
- b) Draw an interfacing diagram and write program for speed control of a stepper motor using 8051. [7]







**Q5) a)** Find initial and final value of signal  $x(t)$  whose Laplace transform is

$$X(s) = \frac{(2s + 3)}{s^3 + 5s^2 + 6s} \quad [6]$$

b) Find the inverse Laplace transform of  $X(s) = \frac{10}{s^2 + 4s + 3}$ . [7]

Assume  $x(t)$  to be causal

OR

**Q6) a)** Evaluate the Laplace transform of  $x(t) = e^{at} u(t)$  and  $x(t) = e^{-at} u(-t)$ . Also draw ROC for both signals. [7]

b) State and prove time shifting and integration property of Laplace Transform. [6]

**Q7) a)** Define PDF and CDF. Also state their properties. [6]

b) A certain random variable has the CDF given by.

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

Then find  $K$ ,  $P(x \leq 5)$  and  $P(5 < x \leq 7)$ . Also plot the corresponding PDF.

OR

**Q8) a)** Given the PDF for different  $x$  values as [6]

$x = 1$ , PDF = 0.2,  $x = 2$  PDF = 0.1,  $x = 3$  PDF = 0.3.

$x = 4$ , PDF = 0.3,  $x = 5$  PDF = 0.1.

Draw PDF and corresponding CDF.

b) What are statistical properties of Random variables, state and explain. [7]



Total No. of Questions : 8]

SEAT No. :

P-2785

[Total No. Of Pages : 2

**[6002]-303**  
**S.E.(Eelectronics/E&TC)**  
**ELECTRONIC DEVICES AND CIRCUITS**  
**(204182) (2015 Pattern) (Semester-I)**

Time : 2 Hours]

[Max. Marks : 50

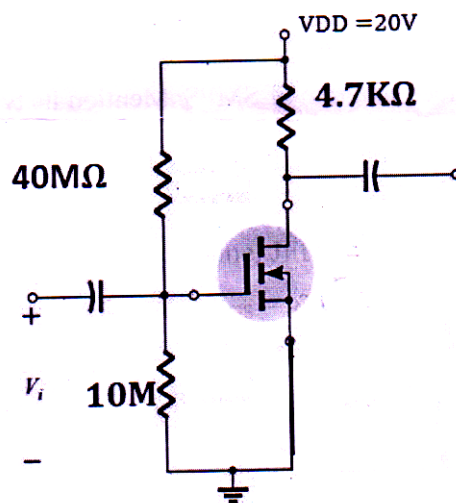
Instructions to the candidates :

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right indicate full marks.
- 3) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.

- Q1)** a) Draw and explain construction of n-channel FET with its V-I Characteristics. [6]
- b) Explain following non ideal V-I Characteristics of MOSFET draw respective diagrams. [6]
- i) Body Effect      ii) Finite Output Resistance

OR

- Q2)** a) Draw drain characteristics of for n channel JFET. If pinch off voltage is  $-4V$  and  $I_{DSS} = 9mA$ , calculate drain current if  $V_{GS} = -2V$  [6]
- b) Draw and explain constant current source biasing for MOSFET [6]
- Q3)** a) Determine  $g_m$ ,  $A_v$ ,  $R_i$ ,  $R_o$  for given E-NMOSFET if  $g_m = 1.6mA/V$ ,  $r_o = 40k$  [6]



P.T.O

- b) Draw and explain how CMOS inverter works as amplifier with active load configuration. [6]

OR

- Q4)** a) Explain how MOSFET works as a [6]  
i) Diode ii) Switch  
b) Write the short note on MOSFET scaling. What are small geometry effects? [6]

- Q5)** a) Draw the circuit diagram for Colpitts oscillator and calculate its output frequency if  $C_1 = C_2 = 500 \text{ pF}$  &  $L = 1 \text{ mH}$ . [8]

- b) Compare voltage series and current series FET feedback amplifiers with respect to D, transfer gain, input impedance, output impedance and B.W. [5]

OR

- Q6)** a) Draw and explain Wein Bridge oscillator. What are its advantages and disadvantages over phase shift oscillator? [8]  
b) What are the effects of negative feedback on terminal characteristics of 4 types amplifier? [5]

- Q7)** a) Draw and explain Block diagram of an adjustable three terminal positive voltage regulator. [6]  
b) For adjustable voltage regulator LM317 calculate output voltage with  $R_1 = 240 \ \Omega$ ,  $R_2 = 2 \text{K} \ \Omega$  and  $I_{\text{adj}} = 100 \mu \text{A}$ . Draw the block diagram. [7]

OR

- Q8)** a) What is Low drop out voltage regulator? Explain in detail with its block diagram. [6]  
b) Draw and explain block diagram of SMPS. Mention its type and output voltage equation respectively. [7]



Total No. of Questions : 8]

SEAT No. :

P-2786

[Total No. of Pages : 2

[6002]-304

S.E. (Electronic/E&TC)

**ELECTRICAL CIRCUITS AND MACHINES**

**(2015 Pattern) (Semester - I) (204183)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*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) Figures to the right indicate full marks.

**Q1)** a) State and explain superposition theorem. [6]

b) How O.C & S.C test are conducted on a transformer? Explain the procedure with diagram. [7]

OR

**Q2)** a) State the applications of auto transformer on which factor, the regulation of a transformer is dependent. [7]

b) Explain voltage to current source transformation. How it is useful in the circuit analysis. [6]

**Q3)** a) Differentiate between lap and wave type of armature windings used in the D.C. machines. [6]

b) What is the effect of slip on rotor parameters such as emf impedance, frequency, current and power factor in 3 phase I.m. [6]

OR

**Q4)** a) List Applications of : [6]

- i) 3 phase induction motor
- ii) Synchronous motor

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

*P.T.O.*

- Q5)** a) Explain the construction and working principle of BLDC motor. [6]  
b) Write a short note on Reluctance motor. List its applications. [7]

OR

- Q6)** a) Distinguish between Brushless D.C. motor and Conventional D.C. motor. [6]  
b) Explain the construction and working principle of universal motor. [7]

- Q7)** a) Write short note on shaded pole induction motor. [6]  
b) Explain the working of armature controlled D.C. servomotor. [6]

OR

- Q8)** a) Compare variable Reluctance and permanent magnet stepper motors. [6]  
b) Write short note on Permanent Magnet Stepper Motor. [6]



Total No. of Questions : 8]

SEAT No. :

**P2787**

[Total No. of Pages : 3

**[6002]-305**

**S.E. (Electronics/ E & TC)**

**DATA STRUCTURES & ALGORITHMS**

**(2015 Pattern) (Semester - I) (204184)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) Explain constants, variables and keywords in C with example. [6]  
b) Explain the following terms in short in C language? [6]  
i) Functions  
ii) Macros  
iii) Recursion

OR

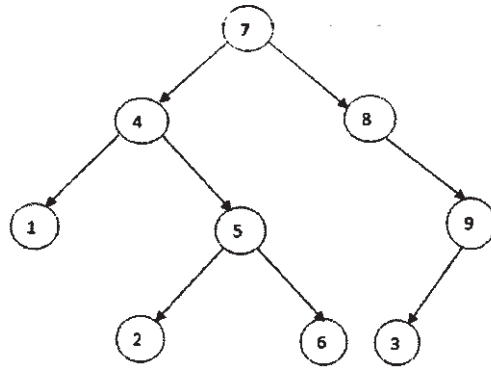
- Q2)** a) What is the time complexity of the algorithm? Write down the time complexity of each searching and sorting algorithm. [6]  
b) What is the selection sort? Sort the following data using selection sort algorithm: 9, 30, 26, 12, 32, 22, 8, 44. [6]
- Q3)** a) Convert the following infix expression to postfix using stack  $((A - (B + C) * D) / (E + F))$ . [4]  
b) Evaluate the following postfix expression [4]  
 $AB + C -$   
 $A = 6, B = 4, C = 3$
- c) What is the significance of ADT? Who uses ADT? Write ADT for stack. [5]

OR

- Q4)** a) Write C function to create a doubly circular linked list. [8]  
b) Draw single circular linked list with 5 nodes. Show proper pointers at respective positions. Explain each pointer need in detail. [5]

*P.T.O.*

Q5) a)



Write down inorder, preorder & post order sequences of traversing with proper explanation. [6]

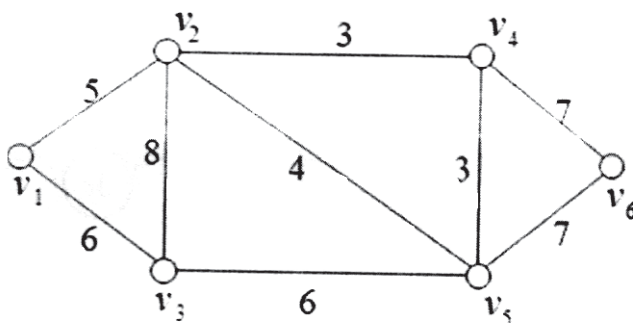
b) Represent above tree with link list & array. [6]

OR

Q6) a) Write down structures of general tree, binary search tree, & threaded binary tree. Explain each. [6]

b) What is Binary Search Tree? Draw BST for 35, 23, 1, 5, 26, 78, 222 [6]

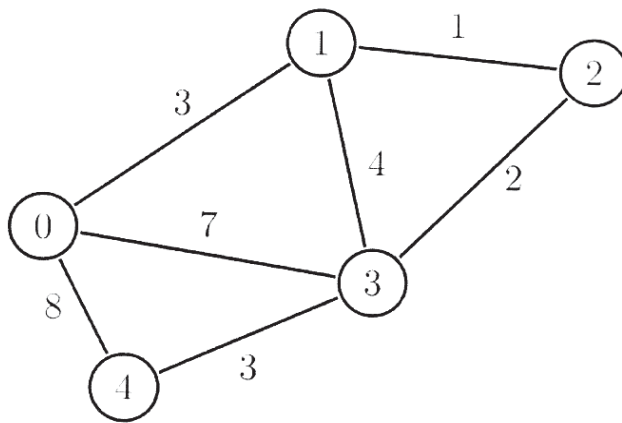
Q7) a) Find the minimum spanning tree cost and path using Kruskal's algorithm. [6]



- b) Explain following Graph Terminologies in Data Structure? [7]
- i) Vertex
  - ii) Edge (Arc)
  - iii) Degree
  - iv) Indegree
  - v) Outdegree
  - vi) Adjacency
  - vii) Weighted Edge

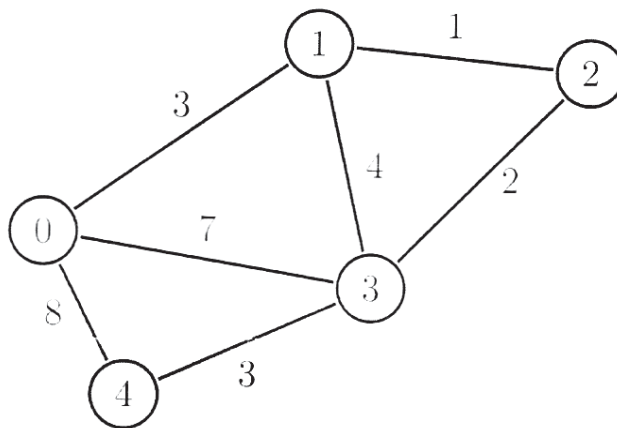
OR

Q8) a)



- i) Find the BFS sequence [6]
- ii) Find the DFS sequence
- iii) Which data structures are used for each of above sequences?

b)



Using Dijkstra's algorithm find the shortest paths from node 1 to all nodes. [7]





Total No. of Questions : 8]

SEAT No. :

**P2788**

[Total No. of Pages : 2

[6002]-306

S.E. (Electronics / E & TC)

DIGITALELECTRONICS

(2015 Pattern) (Semester - I) (204185)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

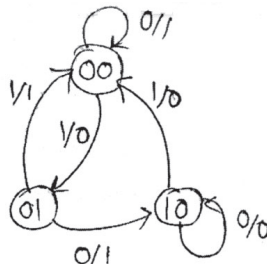
- 1) Answer Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.
- 2) Neat Diagram must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.
- 4) Use of Calculator is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Draw and Explain 4:1 MUX-block diagram, truth table, working and logic diagram using basic gates. [6]
- b) Explain JK Flip flop with neat Block diagram, truth table. [4]
- c) Compare Encoder and Decoder. [2]

OR

- Q2)** a) Define K-map with example. [4]
- b) Design 2 - bit comparator circuit. [4]
- c) Explain look ahead carry generator circuit. [4]

- Q3)** a) Design the sequential circuit for the given state diagram using D flip flop. [6]



- b) Explain with neat diagram 2 input CMOS NOR gate. [6]

OR

P.T.O.

- Q4)** a) Explain the following characteristics of digital IC's: [6]  
i) Figure of merit  
ii) Noise immunity  
iii) Input and Output Voltages  
b) Write short note on state diagram and state table with suitable example. [6]

- Q5)** a) Differentiate between ROM and RAM? [7]  
b) Compare SRAM and DRAM. [6]

OR

- Q6)** a) Design and implement 2-bit comparator using PAL? [7]  
b) Explain FPGA architecture. [6]

- Q7)** a) Explain working of Ports in 8051 microcontroller. [5]  
b) Draw and explain block diagram of 8051 in detail. [5]  
c) Explain following instructions of 8051. [3]  
i) AND  
ii) DIV AB  
iii) DJNZ

OR

- Q8)** a) Write short note on internal memory organization of 8051. [5]  
b) Draw and Explain Timer counter of 8051 in detail. [5]  
c) Explain following pins of 8051. [3]  
i) XTAL  
ii) T1  
iii) TXD



Total No. of Questions: 8]

SEAT No. :

**P2789**

**[6002]-307**

[Total No. of Pages : 4

**S.E.(Electronics/E&TC)**

**ENGINEERING MATHEMATICS-III  
(2015 Pattern) (Semester-II) (207005)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No 5 or Q.No. 6, Q.No. 7 or Q.No 8.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to right indicate full marks.*
- 4) *Use of electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

**Q1) a) Solve any two of the following. [8]**

i)  $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = e^{-3x} \cos 2x$

ii)  $\frac{d^2y}{dx^2} + y = \sec x$  (using method of variation of parameters)

iii)  $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^2$

**b) Find Fourier cosine transform of [4]**

$$f(x) = \cos x, \quad 0 < x < a$$
$$= 0, \quad x > a$$

OR

**Q2) a) An emf 200 V is in series with a. 10 Ω resistor, 1 henry inductor and 0.02 farad capacitor. At t=0 charge Q and current I are zero. Find charge Q and current I at any time t. [4]**

**b) Solve any one of the following [4]**

i) Find Z transform of :

$$f(k) = Ke^{-3k}, \quad K \geq 0$$

ii) Find inverse Z-transform of

$$F(z) = \frac{8z}{(z-1)(z-2)}, \quad |z| > 2$$

**P.T.O.**

- c) Solve the difference equation [4]

$$f(k+1) + \frac{1}{4}f(k) = \left(\frac{1}{4}\right)^k,$$

Where  $f(0) = 0, \quad k \geq 0$

- Q3) a) Find Lagrange's interpolating polynomial passing through set of points. [4]

x	0	1	2
y	1	0	1

Use it to find y at x = 4

- b) Use Runge - Kutta method of fourth order to obtain the numerical solutions of  $\frac{dy}{dx} = xy + y^2, y(0) = 1$  to find y at x = 0.1 with h = 0.1 [4]
- c) Find the values of a,b,c if the vector field  $\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$  is irrotational. [4]

OR

- Q4) a) Show that (any one): [4]

i)  $\nabla \cdot \left( r \nabla \frac{1}{r^n} \right) = \frac{n(n-2)}{r^{n+1}}$

ii)  $\nabla \left( \frac{\vec{a} \cdot \vec{r}}{r^4} \right) = \frac{\vec{a}}{r^4} - \frac{4(\vec{a} \cdot \vec{r})\vec{r}}{r^6}$

- b) Find the directional derivative of  $\phi = xy + z^2$  at (2,1,1) along the direction of  $\vec{i} + 2\vec{j} - 2\vec{k}$  [4]

- c) Evaluate  $I = \int_1^2 \frac{dx}{x^2}$  by dividing the integral into equally spaced intervals of width 0.25 by using Simpson's  $\frac{1}{3}rd$  rule [4]

**Q5) a)** Find the work done in moving the particle once round the circle  $x^2 + y^2 = 16, z = 0$  under the force field [4]

$$\vec{F} = (2xy + 3z^2)\vec{i} + (x^2 + 4yz)\vec{j} + (2y^2 + 6zx)\vec{k}.$$

b) Using Gauss - Divergence theorem, show that  $\iint_S \frac{\vec{r}}{r^3} \cdot \hat{n} \, ds = 0$  [4]

c) Using Stoke's theorem, 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]

OR

**Q6) a)** Evaluate  $\oint_C (\sin z \, dx - \cos x \, dy + \sin y \, dz)$  Where C is boundary of the rectangle  $0 \leq x \leq \pi, 0 \leq y \leq 1, z = 3$ . [4]

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

c) Using Stoke's theorem, evaluate  $\oint_C (2y\vec{i} + z\vec{j} + 3y\vec{k}) \cdot d\vec{r}$  where C is boundary of the rectangle  $0 \leq x \leq 2, 0 \leq y \leq 3, z = 1$ . [5]

**Q7) a)** Show that analytic function  $f(z)$  with constant amplitude is constant. [4]

b) Evaluate,  $\int_C f(z) \, dz$ , where  $f(z) = \frac{e^z}{(z+2)^2}$  & C is  $|z+2|=2$  [5]

c) Find the bilinear transformation which maps the points  $z = 1, i, -1$  from z-Plane into the points  $w = i, 0, -i$  in w-plane [4]

OR

**Q8)** a) If  $V = \frac{-y}{x^2 + y^2}$  find  $u$ , such that the function  $f(z) = u + iv$  is an analytic function. [4]

b) Evaluate,  $\oint_C \frac{2z+1}{(z+1)^2(z-3)} dz$ , where  $C$  is the contour  $|z+1|=2$  [5]

c) Show that the map of the straight line  $y = x$  under the transformation  $w = \frac{z-1}{z+1}$  is a circle in  $w$ -plane [4]



Total No. of Questions : 8]

SEAT No. :

P-2790

[Total No. of Pages : 2

[6002]-308

S.E. (E&TC/Electronics)

INTEGRATED CIRCUITS

(2015 Pattern) (Semester - II) (204187)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

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

- Q1)** a) Draw block diagram of op-amp and explain in detail. [6]  
b) Draw the circuit diagram of practical integrator and write equation for output voltage ( $V_o$ ). [6]

OR

- Q2)** a) An emitter biased Dual Input Balanced Output differential amplifier has the following specifications. [6]

$$V_{cc} = \pm 10V, R_{c1} = R_{c2} = 3.7 \text{ k}\Omega \text{ and } R_E = 4.2 \text{ k}\Omega, \beta_{ac} = \beta_{dc} = \beta = 100 \text{ \& } V_{BE} = 0.7V.$$

Calculate :

- i) Voltage gain ( $A_d$ )
  - ii) Input Resistance ( $R_i$ )
  - iii) Output Resistance ( $R_o$ )
- b) Draw neat circuit diagram and explain voltage follower. [6]

- Q3)** a) Draw V to I converter with grounded load and explain with its output equation. [6]  
b) Explain with neat circuit diagram working of inverting precision full wave rectifier with its waveform. [6]

P.T.O.

OR

- Q4)** a) Draw circuit diagram of inverting Schmitt trigger and plot hysteresis and explain in short. [6]  
b) Draw and explain successive approximation A/D converter. [6]

- Q5)** a) Explain the operation of Wien bridge oscillator with neat circuit diagram. [7]  
b) Design a first order low pass filter with higher cut-off frequency of 1KHz with pass gain is 2. Draw the designed circuit diagram. Assume  $C=0.1\mu\text{f}$  and  $R_f = 10 \text{ k}\Omega$ . [6]

OR

- Q6)** a) Define the term free running frequency, lock range & capture range in PLL. [6]  
b) Draw circuit diagram of first order high Pass Butterworth filter and derive gain ( $V_o/V_{in}$ ) of filter as a function of frequency. [7]

- Q7)** a) Design a wide bandpass filter having  $f_L = 400\text{Hz}$ ,  $f_H = 2\text{kHz}$  and passband gain 4. Also calculate the bandwidth. [7]  
b) Calculate output frequency  $f_o$ , lock range  $\Delta f_L$  and capture range  $\Delta f_c$  of PLL if the timing parameters are  $C_T = 0.1\mu\text{f}$ ,  $R_T = 1\text{k}\Omega$ . The filter capacitor  $C = 1\mu\text{f}$  and internal resistance =  $3.6 \text{ k}\Omega$ , Assume  $\pm V = \pm 10\text{V}$ . [6]

OR

- Q8)** a) Draw circuit diagram of first order wide band stop filter with its frequency response. [7]  
b) Explain with neat circuit diagram RC phase shift oscillator. [6]





[6002]-309

S.E. (Electronics/E & TC)

CONTROL SYSTEMS

(2015 Pattern) (Semester - II) (204188)

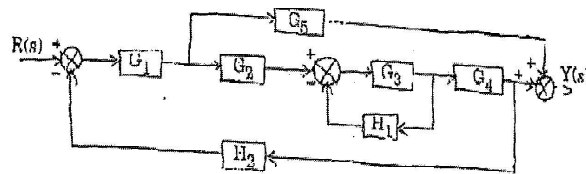
Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of logarithmic tables, slide rule, electronic pocket calculator is allowed.
- 5) Assume suitable data required.

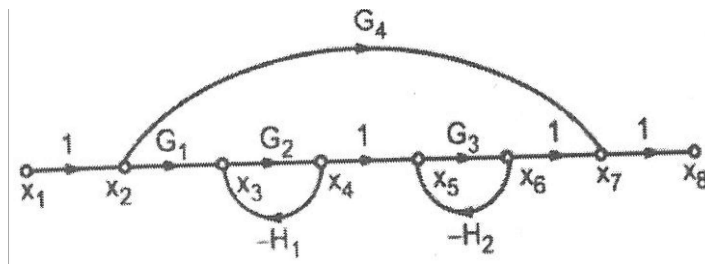
Q1) a) For the given block diagram find the transfer function  $Y(s) / R(s)$  [6]



b) Second order system is given by  $\frac{C(s)}{R(s)} = \frac{25}{s^2 + 6s + 25}$ ; calculate rise time, peak time, peak overshoot, settling time if subjected to unit step input. [6]

OR

Q2) a) For the signal flow graph find the transfer function using Mason's gain formula [6]



P.T.O.

- b) The open loop transfer function of unity feedback system is given by

$$G(s) = \frac{50}{(1 + 0 - 5s)(s + 10)}$$

Calculate static error coefficients  $K_{p1}$ ,  $K_V$  and  $K_a$ . [6]

- Q3) a)** Estimate the stability of system with the characteristics equation  $Q(s) s^5 + 5 s^4 + 10 s^3 + 10 s^2 + 5s + 1 = 0$ . [4]

- b) Sketch Bode plot of the system with open loop transfer function  $G(s) = 10/s(s+2)(s+3)$ . Comment on stability of the system. [8]

OR

- Q4) a)** Determine the resonant peak, resonant frequency for the system with closed loop transfer function  $G(s) = 25/s^2 + 4s + 25$ . [4]

- b) Sketch the root locus of unity feedback system with open loop transfer function  $G(s) = K/s(s+1)(s+4)$  [8]

- Q5) a)** Determine the state transition matrix of:  $A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}$  and obtain solution

of  $x(t)$  of state equation  $\dot{x} = Ax$  if initial state is  $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ . [8]

- b) Define terms : [5]

- i) State
- ii) State Variable
- iii) State Vector
- iv) State Space

OR

**Q6) a)** For a system with transfer function:  $G(s) = \frac{2s^2 + 3s + 1}{s^3 + 5s^2 + 7s + 4}$ . Determine the state model in controllable canonical and observable canonical form. **[8]**

b) Derive the expression for state transition matrix by Laplace transform method. **[5]**

**Q7) a)** Obtain the ladder diagram for Ex-OR gate, NOR, and NAND gate. **[7]**

b) What is Pulse transfer function? Explain pulse transfer function from block diagram. **[6]**

OR

**Q8) a)** Obtain the tuning or transfer function of PID controller for a plant having open loop transfer function as, using Ziegler-Nichol's method.  $G_p(S) = 10 / (S+1) (S+3) (S+4)$ . **[8]**

b) Draw and explain block diagram of PLC. **[5]**

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P2792**

[Total No. of Pages : 2

**[6002]-310**

**S.E. (Electronics/ Electronics and Telecommunication)**

**ANALOG COMMUNICATIONS**

**(2015 Pattern) (Semester - II) (204189)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** Explain the working principle of superhetrodyne receiver. **[6]**

b) Compare SSB and VSB. **[6]**

OR

**Q2) a)** List the advantages and disadvantages of FM over AM. **[6]**

b) With the help of waveforms and spectrum, describe the concept of Amplitude modulation both in time domain and frequency domain. **[6]**

**Q3) a)** With necessary circuit diagram and waveforms, explain how DSBSC wave is generated using Ring Modulator. **[6]**

b) Explain the Performance Characteristics of Sensitivity, Selectivity and image frequency. **[6]**

OR

**Q4) a)** An FM wave with modulation index  $\beta = 1$  is transmitted through an ideal band pass filter with mid band frequency  $f_c$  and bandwidth is  $5f_m$ , where  $f_c$  is the carrier frequency and  $f_m$  is the frequency of the sinusoidal modulating wave. Determine the amplitude spectrum of the filter output. **[6]**

b) Draw the block diagram of FM receiver and explain each block, briefly. **[6]**

**P.T.O.**

- Q5)** a) Explain the noise performance of SSBSC receiver and prove its S/N ratio is unity. [6]
- b) What is thermal noise? Derive the expression for the thermal noise voltage across a resistor. [7]

OR

- Q6)** a) What is meant by Noise? State the different types of Noise. [7]
- b) Compare PAM, PWM and PPM pulse modulation techniques. [6]

- Q7)** a) State sampling theorem and discuss its types. [6]
- b) What is meant by “Aperture Effect”? How can it be reduced? [7]

OR

- Q8)** a) Write short note on [6]
- i) Band limited & time limited signals
- ii) Narrowband signals and wide band signals.
- b) Explain pulse code modulation and write Differentiate between pulse analog modulation and pulse digital modulation. [7]



Total No. of Questions : 8]

SEAT No. :

**P2793**

[Total No. of Pages : 2

[6002]-311

**S.E. (Electronics / E & TC)**

**OBJECT ORIENTED PROGRAMMING**

**(2015 Pattern) (Semester - II) (204190)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*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 Diagram must be drawn wherever necessary.*
- 3) *Figure to the right indicates full marks.*
- 4) *Use of Calculator is allowed.*
- 5) *Assume suitable data, if necessary.*

- Q1)** a) What are the different benefits of object oriented programming? Enlist applications of OOP. [6]
- b) What is the use of constructor. State four types of constructor. Write a program in C++ for any one type. [6]

OR

- Q2)** a) Write a program in C++ to use Scope resolution operator. [6]
- b) What is operator overloading? Why it is necessary to overload an operator? [6]

- Q3)** a) What are distinct features of Java? [5]
- b) What is recursion in Java? Write factorial program using recursion. [6]

OR

- Q4)** a) Write a short note on Java tokens. What are different data types in Java?[5]
- b) What is the use of this keyword in Java? Explain with suitable example.[6]

*P.T.O.*

- Q5)** a) Differentiate between Method overloading and Method Overriding. [6]  
b) Explain how to use a particular package in a Java program. Give example. [7]

OR

- Q6)** a) What is an interface? How is it implemented? What is the major difference between an interface and a class? [6]  
b) Write a program in Java to create a player class. Inherit the classes Cricket \_player and Football\_player from player class. [7]
- Q7)** a) What is Exception handling? How to handle Exception in Java? [8]  
b) Write difference between throw and throws. [6]

OR

- Q8)** a) Explain reading character and string from input console with suitable examples. [8]  
b) What is applet? What is difference between applet and application? [6]

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Total No. of Questions : 8]

SEAT No. :

**P2794**

**[6002]-314**

[Total No. of Pages : 2

**S.E. (Information Technology)**

**ENGINEERING**

**Computer Organization & Architecture**

**(2015 Pattern) (Semester - I) (214442)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a)** State and Explain Marketing Metrics: MIPS, MFLOPS and Amdahl's Law. [6]

b) Describe the Non - Restoring Division Algorithm. [6]

OR

**Q2) a)** Compare Von - Neuman Architecture with Harvard Architecture. [6]

b) What is an Instruction Cycle. Explain with state diagram. [6]

**Q3) a)** Explain 'MESI' protocol with diagram. [7]

b) Explain any one type of Cache Mapping technique with diagram. [6]

OR

**Q4) a)** How virtual Memory is managed using paging. [7]

b) Draw and Explain Hardwired control unit. [6]

**Q5) a)** Explain dynamic branch prediction and delayed branch prediction for MIPS pipeline with suitable diagram and example. [6]

b) What are the hazards in pipeline architecture ? Explain its types. [6]

OR

**Q6) a)** What are the basic performance issues in pipelining. [6]

b) Explain events of Fetch cycle of MIPS pipeline. [6]

*P.T.O.*



**Q7) a)** Explain Closely Coupled and Loosly Coupled microprocessor systems. [7]

b) Write Short Note on Cluster Configuration. [6]

OR

**Q8) a)** Write short notes on . [7]

i) NUMA

ii) UMA

iii) CC - NUMA

b) Write about Flynn's Taxonomy for multiple processor organization. [6]



Total No. of Questions : 08]

SEAT No. :

P-3149

[Total No. of Pages : 4

[6002]-331

S.E. (Mechanical/Automobile/Mechanical SW)

ENGINEERING MATHEMATICS - III

(2015 Pattern) (Semester - I) (207002)

Time : 2 Hours]

[Max. Marks : 50

Instructions to the candidates :

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

Q1) a) Solve any two [8]

i)  $(D^3+1)y = e^{-x} + \sin(2x+3)+2^x$

ii)  $(D^2+3D+2)y = e^{e^x}$

iii)  $(2x+1)^2 \frac{d^2y}{dx^2} - 2(2x+1) \frac{dy}{dx} - 12y = 6x$

b) Find inverse fourier cosine transformation of  $F_c(\lambda) = \frac{\sin a\lambda}{\lambda}$ . [4]

OR

Q2) a) A body of weight 9.8N is suspended from a spring having constant 4N/m. Prove that motion is one of the resource; if a force  $16 \sin 2t$  is applied and damping force is negligible. Assume that initially the weight is at rest in the equilibrium position. [4]

b) Solve any one [4]

i) Find Laplace transform of  $\int_0^t \frac{1-e^{-x}}{x} dx$ .

ii) Find inverse laplace transform of  $\log \frac{s+b}{s+a}$

P.T.O.

- c) Using Laplace transform solve the D.E. [4]

$$y'' - 2y' + y = e^{-2t}, y(0) = 0, y'(0) = 0$$

- Q3) a) The first four moments about value 30.2 are 0.255, 6.222, 30.211 and 400.25 calculate the first four central moments. [4]

- b) 20% of bolts produced by machine are defective find the mean and standard deviation of defective bolts in total of 90. [4]

- c) Find the directional derivatives of  $\phi = e^{2x-y-z}$  at (1,1,1) in the direction tangent to the curve  $x = e^{-t}, y = 2\sin t + 1, z = t - \cos t$  at  $t=0$ . [4]

OR

- Q4) a) Obtain the line of Regression of  $y$  on  $x$  for the following data. [4]

x	2	4	5	6	8	11
y	18	12	10	08	07	05

- b) Prove the following (any one) [4]

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

ii)  $\nabla \cdot \left( r \nabla \left( \frac{1}{r^n} \right) \right) = \frac{n(n-2)}{r^{n+1}}$

- c) Show that vector field  $\vec{F} = (y^2 \cos x + z^2) \vec{i} + 2y \sin x \vec{j} + 2xz \vec{k}$  is irrotational and find scalar field  $\phi$  such that  $\vec{F} = \nabla \phi$ . [4]

- Q5) a) Find line integral for  $\vec{F} = (2x + y) \vec{i} + (3y - x) \vec{j}$  over C where C is a straight line joining (0,0) and (3,2). [4]

- b) Evaluate by Gauss divergence theorem  $\iiint_S (x^3 \vec{i} + y^3 \vec{j} + z^3 \vec{k}) \cdot \vec{ds}$  over the surface of the sphere  $x^2 + y^2 + z^2 = 1$ . [5]

- c) Use stoke's theorem to evaluate  $\int_C ydx + zdy + xdz$ , where C is the curve of intersection of  $x^2 + y^2 + z^2 = a^2$  and  $x + z = a$ . [4]

OR

- Q6) a) Find the workdone in moving a particle once round the ellipse

$$\frac{x^2}{25} + \frac{y^2}{16} = 1, z = 0 \text{ under the field of force given by}$$

$$\vec{F} = (2x - y + z)\vec{i} + (x + y - z^2)\vec{j} + (3x - 2y + 4z)\vec{k} \quad [5]$$

- b) By using stoke's theorem evaluate  $\int_C e^x dx + 2ydy - dz$ , where C is the curve  $x^2 + y^2 = 4, z = 2$ . [4]

- c) Prove that  $\iiint_s (\phi \nabla \psi - \psi \nabla \phi) \cdot d\vec{s} = \iiint_v (\phi \nabla^2 \psi - \psi \nabla^2 \phi) dv$ . [4]

- Q7) a) Solve  $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$  subject to the conditions [7]

i)  $u(0, t) = 0, \forall t$ ,                      ii)  $u(l, t) = 0, \forall t$

iii)  $\frac{\partial u}{\partial t} = 0$  for  $t = 0$                       iv)  $u(x, 0) = a \sin \frac{\pi x}{L}$

- b) Solve the heat equation. [6]

$$\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}, \text{ if}$$

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

Q8) a) Solve  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ , subject to conditions. [6]

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

ii)  $u(\pi, y) = 0$

iii)  $u(x, \infty) = 0$  for  $0 < x < \pi$  iv)  $u(x, 0) = u_0, 0 < x < \pi$

b) Using fouries transform, solve the equation. [7]

$\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ ,  $0 < x < \infty, t > 0$  subject to the following conditions

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

ii)  $u(x, 0) = e^{-x}, x > 0$

iii)  $u \rightarrow 0$  and  $\frac{\partial u}{\partial x} \rightarrow 0$  as  $x \rightarrow \infty$



Total No. of Questions : 8]

SEAT No. :

**P-2795**

[Total No. of Pages : 3

**[6002]-332**

**S.E. (Mechanical/Automobile/Mechanical SW)**

**THERMODYNAMICS**

**(2015 Pattern) (Semester - I) (202043)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Solve four questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
- 2) *All the four questions should be solved in one answer-book and attach extra supplements if required.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of scientific calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

- Q1)** a) Explain heat engine, heat pump and refrigerator with neat sketch. [6]  
b) What do you mean by the term Entropy? Explain the principle of increase of entropy. [6]

OR

- Q2)** a) Explain the following terms : [6]  
i) Thermodynamic Equilibrium  
ii) Intensive and Extensive Properties  
b) A gas undergoes a thermodynamic cycle consisting of three processes beginning at an initial state where  $p_1 = 1$  bar,  $V_1 = 1.5$  m<sup>3</sup> and  $U_1 = 512$  kJ. The processes are as follows:  
i) Process 1 - 2 : Compression with  $pV = \text{constant}$  to  $P_2 = 2$  bar,  $U_2 = 690$  kJ  
ii) Process 2 - 3 :  $W_{23} = 0$ ,  $Q_{23} = -150$  kJ, and  
iii) Process 3 - 1:  $W_{31} = +50$  kJ. Neglecting KE and PE changes, Determine the heat interactions  $Q_{12}$  and  $Q_{31}$ . [6]

**P.T.O.**

- Q3)** a) Define dryness fraction. Explain separating and throttling calorimeter with neat diagram for estimating the dryness fraction. [6]
- b) In a constant volume 'Otto cycle', the pressure at the end of compression is 15 times that at the start, the temperature of air at the beginning of compression is  $38^{\circ}\text{C}$  and maximum temperature attained in the cycle is  $1950^{\circ}\text{C}$ . Determine: [6]
- i) Compression ratio.
- ii) Thermal efficiency of the cycle.
- Take  $\gamma$  for air = 1.4.

OR

- Q4)** a) Explain the following: [6]
- i) Dead State
- ii) Available and Unavailable energy
- b) Represent the simple vapor compression cycle (VCR) on P-h and T-s diagram and write the main processes of VCR cycle. [6]

- Q5)** a) Define equivalent evaporation and boiler efficiency. Explain heat balance sheet for boiler. [6]
- b) In a boiler installation feed water enters at  $30^{\circ}\text{C}$  and leaves economizer section at  $110^{\circ}\text{C}$  for being fed into boiler. Steam generated in boiler at 20 bar, 0.98 dry and fed to super heater where it's temperature is raised up to  $300^{\circ}\text{C}$ . For the coal with calorific value of 30,500 kJ/kg and steam generation rate of 10kg/kg of coal burnt.

Determine the energy received per kg of water and steam in economizer, boiler and superheater section as fraction of energy supplied by coal. Take  $C_{p,\text{feed water}} = 4.18 \text{ kJ/kgK}$ ,  $C_{p,\text{superheated steam}} = 2.093 \text{ kJ/kg.K}$ . [7]

OR

- Q6)** a) A boiler house has natural draught chimney of 20 m height. Flue gases are at temperature of  $380^{\circ}\text{C}$  and ambient temperature is  $27^{\circ}\text{C}$ . Determine:[6]
- i) The draught in mm of water column for maximum discharge through chimney
  - ii) The air supplied per kg of fuel.
- b) Draw block diagram of a boiler plant showing location of air preheater, super heater, economizer clearly indicating the air and water circuit flow. Write the function of air preheater, super heater, economizer in boiler plant. [7]

- Q7)** a) List the different psychrometric processes and show them on the hand drawn psychrometric chart. [6]
- b) Consider a room that contains air at 1 atm,  $35^{\circ}\text{C}$ , and 40% relative humidity. Using the psychrometric chart. [7]

Determine :

- i) the specific humidity,
- ii) the enthalpy,
- iii) the wet-bulb temperature,
- iv) the dew-point temperature.

OR

- Q8)** a) Write a short note on “Thermodynamics of Human Body”. [6]
- b)  $200\text{ m}^3$  of air per minute at  $15^{\circ}\text{C}$  DBT and 75% R.H. is heated until its temperature is  $25^{\circ}\text{C}$ . [7]

Find :

- i) R.H. of heated air.
- ii) Wet bulb temperature of heated air.
- iii) Heat added to air per minute.

**x x x**



Total No. of Questions : 8]

SEAT No. :

P-2796

[Total No. of Pages : 4

[6002]-333

S.E. (Mechanical/Automobile/Mechanical SW)

STRENGTH OF MATERIALS

(2015 Pattern) (Semester - I) (202051)

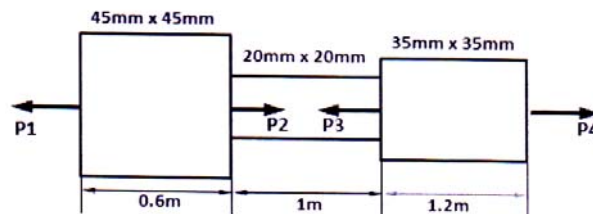
Time : 2 Hours]

[Max. Marks : 50

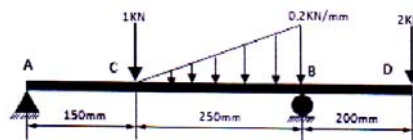
Instructions to the candidates :

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

- Q1) a) A member ABCD is subjected to point loads P1, P2, P3 & P4 as shown in figure below. [6]  
Calculate the force P3 necessary for equilibrium if P1 = 120KN, P2 = 220KN, & P4 = 160KN, also determine total deformation of the member. Take E=200Gpa.



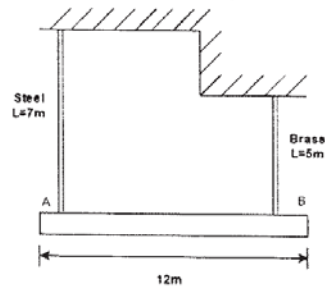
- b) Find the Shear Force Diagram and Bending Moment diagram for beam in figure below. [6]  
Also find position of Point of Contraflexure if any.



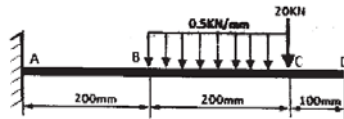
OR

P.T.O.

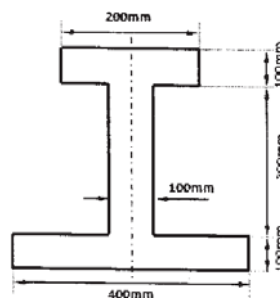
- Q2) a) A homogeneous 700kg bar AB is supported at either end by a cable as shown in figure below. Calculate the smallest area of each cable if the Stress is not exceed 80MPa brass and 130MPa in steel. [6]



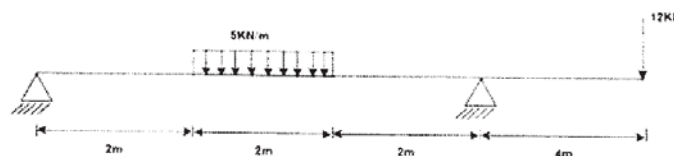
- b) Find the Shear Force Diagram and Bending Moment diagram for beam in figure below. [6]



- Q3) a) A simply supported beam of length 2m is supported at its end and a u.d.l. of intensity 'w' N/mm is applied over the complete length of beam. The cross-section of the beam as I-section, shown in figure below. If the allowable bending stress is not to exceed 50 Mpa, determine the maximum safe intensity of u.d.l. the beam can carry. [6]

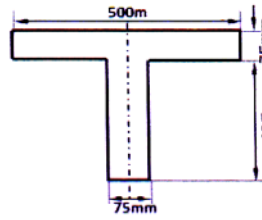


- b) A beam ABC of length 10m has one support at the left end other support at a distance of 6m from the left end. The beam carries a point load of 12kN at the right end & UDL of 5 kN/m at the distance of 2m from left as shown in figure below. Find the slop & Deflection at point C. [6]  
Take  $E = 2 \times 10^5 \text{ N/mm}^2$  &  $I = 5 \times 10^8 \text{ mm}^4$ .



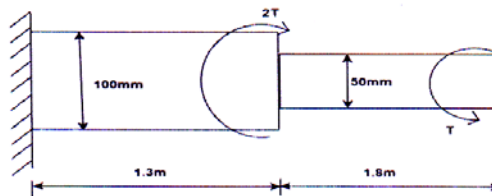
OR

- Q4) a)** A cast iron beam is of T-section as shown in figure below. Draw the shear stress distribution across the cross section for a maximum shear force of beam 500 KN. [6]



- b) A Cantilever beam of span 2.5m having cross section 25mm wide by 80mm depth. Determine strain energy stored in beam. Take  $E = 200 \text{ GPa}$ .
- if a concentrated load of 2.25KN act at free end
  - If total 1.5KN load is uniformly spread over a entire span

- Q5) a)** The stepped steel shaft as shown in figure below, subjected to a torque  $T$  at the free end & a torque  $2T$  in the opposite direction at the junction of the two sizes. What is the total angle of twist at the free end if the maximum shear stress in the shaft is limited to  $70 \text{ N/mm}^2$ . Take  $G=8.4 \times 10^4 \text{ N/mm}^2$ . [6]

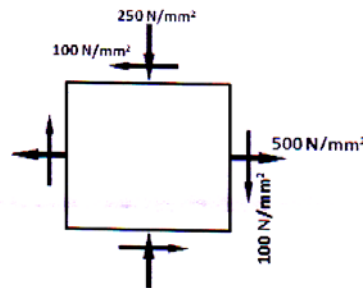


- b) A 2m long column has a circular cross section of 6cm diameter. One of the ends of the column is fixed & other end is free. Taking FOS as 3, Calculate the safe load using [7]
- Euler's formula ,young's Modulus for C.I =  $1.3 \times 10^5 \text{ Mpa}$ .
  - Rankine's formula take yield stress  $\sigma_c=550\text{Mpa}$  &  $\alpha =1/1500$  for pinned ends

OR

- Q6) a)** Two shafts of the same material & of same length are subjected to the same torque, if the first shaft is of a solid circular section & the second shaft is of hollow circular section, whose internal diameter is  $2/3$  of the outside diameter & the maximum shear stress developed in each shaft is same. Compare the weights of the shafts. [6]
- b) Determine Euler's crippling load for an I-section joint  $30\text{cm} \times 15\text{cm} \times 2\text{cm}$  & 5m long which is used as a strut with both ends fixed. Take  $E= 2 \times 10^5 \text{ N/mm}^2$ . [7]

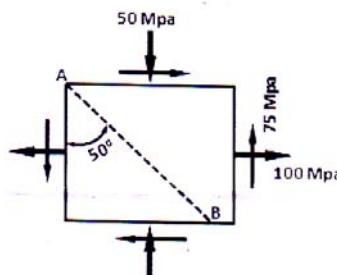
- Q7)** a) A Rectangular block of material is subjected to stresses on perpendicular planes as shown in figure below. Using analytical approach, find: [6]
- The principal stresses with its orientation.
  - The maximum Shear stress with its orientation



- b) According to the theory of maximum shear stress, determine the diameter of a bolt which is subjected to a bending moment of 9 KN-m together with a twisting moment of 4.5 KN-m. Elastic limit of bolt material in tension is  $325 \text{ N/mm}^2$ , Factor of Safety = 2.5 and Poisson's ratio = 0.3. [7]

OR

- Q8)** A Rectangular block of material is subjected to stresses on perpendicular planes as shown in figure below, find: [13]
- The principal stresses with its orientation only by Mohr's circle.
  - The maximum Shear stress with its orientation only by Mohr's circle.
  - The normal and shear stresses on a plane AB by Mohr's circle.
  - Also find the normal and tangential stresses on a plane AB by analytical approach and verified the answer with question no (iii).



Draw Mohr's circle with proper scale factor and using drawing instruments. Analytical formula can not be used to solve question no (i). (ii) & (iii).



Total No. of Questions : 8]

SEAT No. :

**P2797**

[Total No. of Pages : 2

**[6002]-340**

**S.E. (Mechanical / Automobile) (Mech. /Sandwich)  
ELECTRICAL AND ELECTRONICS ENGINEERING  
(2015 Pattern) (Semester - II) (203152)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt Q.No.1 or Q.No.2, Q.No.3 or Q.No.4, Q.No.5 or Q.No.6, Q.No.7 or Q.No.8.*
- 2) *Neat Diagrams must be drawn wherever necessary.*
- 3) *Figure to the right indicate full marks.*
- 4) *Assume suitable data, if necessary.*

- Q1)** a) Derive the expression for armature torque developed in a DC motor.[6]  
b) The input power to a 6-pole, 3-phase, 50 Hz induction motor is 42 KW; the speed is 970 rpm. The stator losses are 1.2 KW and the friction and windage losses are 1.8 KW. Find (i) the rotor copper loss and (ii) efficiency of motor. [7]

OR

- Q2)** a) Draw the torque-slip characteristic curve for three phase induction motor. Explain the effect of increase in rotor resistance on torque-slip curve.[6]  
b) A 230 V DC shunt motor runs at 800 rpm and takes armature current of 50 A. Find the resistance to be added to the field circuit to increase speed to 1000 rpm at an armature current of 80 A. Assume flux is proportional to field current. Shunt field resistance is  $250\ \Omega$  and armature resistance is  $0.15\ \Omega$ . [7]
- Q3)** a) Explain the construction and working of linear induction motor with the help of suitable diagrams. Mention its any two applications. [6]  
b) What is an embedded system? Explain its essential ingredients and quote any four examples of an embedded system. [6]

OR

*P.T.O.*

- Q4)** a) Differentiate between a microprocessor and a microcontroller. [6]  
b) What is a stepper motor? Describe construction and working principle of any one type of stepper motors. [6]
- Q5)** a) Explain the interfacing of LED with Arduino board and write an algorithm to blink an LED frequently. [6]  
b) Explain the following functions used to handle GPIO in ATmega 328P based Arduino board with help of syntax: [6]  
i) PinMode ()  
ii) DigitalRead()  
iii) DigitalWrite()

OR

- Q6)** a) Explain the functions of LCD pins and draw the interfacing diagram of LCD with Arduino board. [6]  
b) What is meant by serial communication? Explain the use of Arduino IDE for serial communication with the help of suitable example. [6]
- Q7)** a) Explain working of LVDT and quote its any two applications. [6]  
b) Why is LM35 preferred in embedded systems? Explain its interfacing with Arduino Board with the help of diagram and algorithm. [7]

OR

- Q8)** a) What is function of ADC in data acquisition systems? List any five features of in-built ADC in ATmega 328P microcontroller. [6]  
b) Draw and explain the interfacing diagram of strain gauge with Arduino Board showing necessary subsystems. [7]



Total No. of Questions : 8]

SEAT No. :

**P2798**

[Total No. of Pages : 2

**[6002]-341**

**S.E. (Mechanical / Automobile)  
MANUFACTURING PROCESS - I  
(2015 Pattern) (Semester - I) (Theory) (202041)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

- Q1)** a) State the importance of allowances for pattern making. Explain characteristics of good moulding sand. [6]
- b) A 250 mm wide strip of 27 mm thickness is reduced to 24 mm in a single pass through a rolling process. The radius of each roller is 250 mm and its speed is 150 rpm. The strength coefficient for the work material is 275 N/mm<sup>2</sup> and  $n=0.15$ . The coefficient of friction between the workpiece and roll is 0.15. Find the roll force, torque and power required per roll. [6]

OR

- Q2)** a) What do you understand by recrystallisation and recrystallisation temperature? Differentiate between hot working and cold working process. [6]
- b) A cylindrical riser must be designed for a sand casting mould. The size of steel casting is 75 mm × 125 mm × 20 mm. The observation done earlier have indicated that the total solidification time for casting is 90 Sec. The cylindrical rise has  $(d/h) = 1$ . Find the size of riser so that its solidification time is 120 Sec. [6]
- Q3)** a) Explain injection moulding process with suitable sketch. Also state the applications of it. [6]
- b) Explain principle of resistance welding. State its advantages and limitations. [6]

OR

*P.T.O.*

- Q4) a)** Compare the thermosetting plastics and thermoplastic. State any two general properties and application. [6]
- b) Writes a short note on edge preparation in welding. List down different weld defects. [6]

- Q5) a)** State the necessity of reducing cutting forces in sheet metal works. Explain with neat sketch any two methods. [7]
- b) What is center of pressure? List down the procedure to calculate the centre of pressure. [6]

OR

- Q6) a)** Differentiate between compound die and progressive die. State the different sheet metal working operations. [7]
- b) Calculate blank size required for drawing a cylinder cup of internal diameter 50 mm, height of cup 85 mm, blank thickness 2 mm. Draw ratio restricted 45% in one draw, how many draws will be required if ultimate tensile strength is 427 N/mm<sup>2</sup>. Calculate drawing force required. (Change value) [6]

- Q7) a)** Write the different operations performed on lathe machine. Explain it with neat sketch. [7]
- b) Calculate the machining time required for 3 passes while reducing 60 mm diameter shaft to 50 mm diameter for a length of 1200 mm with depth of cut of 2 mm for rough cut and 1 mm for finish cut. Given cutting speed = 25 m/min, feed 0.5 mm/rev, approach length = 5 mm and overrun length = 5mm (take approach length value - 10 mm). [6]

OR

- Q8) a)** What are different taper turning methods? Explain tailstock offset method with proper sketch. [7]
- b) Explain any three lathe operations with sketch. [6]





Total No. of Questions : 8]

SEAT No. :

**P2799**

[Total No. of Pages : 2

**[6002]-342**

**S.E. (Mechanical/Automobile Engg.)**

**MATERIAL SCIENCE**

**(2015 Pattern) (Semester - I) (202044)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*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 Diagram must be drawn wherever necessary.
- 3) Use of Calculator is allowed.
- 4) Figure to the right indicates full marks.
- 5) Assume suitable data, if necessary.

- Q1) a)** Calculate the atomic packaging factor for FCC and HCP crystal structure. **[6]**
- b) Describe any three imperfections in crystals. **[6]**

OR

- Q2) a)** Draw the following planes and Directions in a cubic system (111), (110) Planes and (101) direction. **[6]**
- b) Explain Geometrical Hardening and Geometrical Softening phenomenon. **[4]**
- c) What makes ceramics different than polymers with respect to properties. **[2]**

- Q3) a)** What is creep in metals? Draw a typical Creep curve and explain the various stages in creep. **[7]**
- b) What do you understand by the term corrosion? Explain the mechanism of corrosion in brief. **[6]**

OR

*P.T.O.*

- Q4)** a) Draw self-explanatory sketches of the following. [4]  
i) Galvanic Corrosion  
ii) Pitting Corrosion  
b) What is Cathodic Protection? [3]  
c) Differentiate between Engineering Stress Strain curve and True stress strain curve. [6]
- Q5)** a) Why surface preparation is required before applying any coating? State the various techniques of surface preparation and explain them in brief. [6]  
b) What is Electroplating? [3]  
c) List out the factors affecting electro deposition. [3]

OR

- Q6)** a) Compare PVD and CVD coating. [4]  
b) Explain Chemical Vapour deposition (CVD Process. State its advantages over PVD Process. Give unique applications of this process. [6]  
c) What is Organic Coating? [2]
- Q7)** a) What is Powder Metallurgy? Discuss the advantages and disadvantages of P/M techniques. [4]  
b) Describe the Various steps involved in P/M with importance of each steps in controlling the properties of final sintered component. [6]  
c) Why sintering is important step in Powder Metallurgy? [3]

OR

- Q8)** a) Draw the flow sheet for manufacturing of Cemented Carbide. [4]  
b) What is conditioning of metal powder? Why is it done? [5]  
c) Write short note on Self Lubricated Bearing. [4]

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Total No. of Questions : 8]

SEAT No. :

**P2800**

**[6002]-343**

[Total No. of Pages : 3

**S.E. (Mech./Auto.)**

**FLUID MECHANICS**

**(2015 Pattern) (Semester - II) (202045)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

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

**Q1) a) Define the following terms. Also state it's SI units. [6]**

- i) Specific weight
- ii) Capillarity
- iii) Dynamic Viscosity

b) For a two dimensional potential flow, the velocity potential function is given by  $\phi = 5(x^2 - y^2)$ , calculate the velocity component in x and y directions. Also find the values & velocity components at point (4, 5). [6]

OR

**Q2) a) Explain the following. [6]**

- i) Pascals law
- ii) Newton's law & viscosity.
- iii) Buoyancy

b) A rectangular plane surface 3m wide and 4m deep lies in water in such a way that its plane makes an angle of  $30^\circ$  with the free surface of water. Determine the total pressure force and position of center of pressure, when the upper edge of the plane is 2m below the free surface. [6]

**P.T.O.**

**Q3) a)** State the Bernoulli is theorem. Write the equation with meaning of each term. Also state the assumptions made. [6]

b) An oil of viscosity  $0.1 \text{ Ns/m}^2$  and specific gravity 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/sec. Find the pressure drop in a length of 300m and also the shear stress at the pipe wall. [6]

OR

**Q4) a)** Derive an expression of shear stress and velocity distribution for lamiral flow through circular pipe. [6]

b) A  $20\text{cm} \times 10 \text{ cm}$  venturimeter inserted in a vertical pipe carrying an oil of specific gravity 0.8. The flow of oil is in upward direction. The reading of differential manometer connected to the inlet and throat is 30cm of mercury? Draw the sketch of venturimeter and determine the rate flow of oil. Take coeff. of discharge equal to 0.98. [6]

**Q5) a)** Explian the following dimation less Numbers [6]

i) Froude's Number

ii) Weber's Number

iii) Reynold's Numbers.

b) An oil of sp.gr. 0.9 and dynamic viscosity 0.06 poise is flowing through a pipe of dia. 200mm at the rate of 60 lit/sec. Find the lead loss due to friction and power required to maintain the flow for a length of 500 m. Consider the co-efficient of friction  $f = 0.079/(\text{Re})^{0.25}$ . [7]

OR

**Q6) a)** Derive an expression for Darcy-Weisbach equation. [6]

b) Show that frictional torque T of a disc of diameter D rotating at a speed N in a fluid & viscosity  $\mu$  and density  $\rho$  in a turbulet flow is given[7]

$$\text{by } T = D^5 N^2 \rho \phi \left[ \frac{\mu}{D^2 N \rho} \right].$$

**Q7) a)** For the following profiles, determine whether the flow has separated or an the verge of separation or will remain attached with the surface. [6]

i)  $\frac{u}{U} = \frac{3}{2}\eta - \frac{1}{2}\eta^3$

ii)  $\frac{u}{U} = -2\eta + \eta^2$

iii)  $\frac{u}{U} = 2\eta^2 - \eta^3$  where  $\eta = \frac{y}{\delta}$

b) Write a short note on separation of boundary layer and it's control. [7]

OR

**Q8) a)** Derive an expression for displacement momentum and energy thickness. [9]

b) What is drag and lift? Explain the different types of drag on an immersed body. [4]



Total No. of Questions : 8]

SEAT No. :

P-2801

[Total No. of Pages : 3

[6002]-344

S.E. (Mechanical/Automobile)

ENGINEERING METALLURGY

(2015 Pattern) (Semester - II) (202049)

*Time : 2 Hours]*

*[Max. Marks : 50*

*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) Figures to right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Neat diagrams must be drawn, wherever necessary.

**Q1)** a) Define the following : [4]

- i) System
- ii) Phase
- iii) Variable
- iv) Alloys

b) Explain Hume Rutherly's rule of solid solubility. [4]

c) Explain the solidification of pure metal. [4]

OR

**Q2)** a) Explain in detail the preparation of specimen for optical microscopy?[4]

b) Differentiate between Microscopy and Macroscopy. [4]

c) Write short note on **any two** process of the following : [4]

- i) Sulphur Printing
- ii) Flow Line Observation
- iii) Spark Test

*P.T.O.*

- Q3)** a) What are the advantages of cast iron over steels? [3]  
b) Compare Gray Cast Iron & White Cast Iron with respect to composition, microstructure, application. [6]  
c) Give brief information of Austenite to Pearlite Transformation. [4]

OR

- Q4)** a) Draw Iron carbon equilibrium diagram. [3]  
b) Compare Induction hardening and Flame hardening. [6]  
c) Draw TTT curve and state the transformed product for [4]  
i) Martempering  
ii) Austempering

- Q5)** a) Give classification of steels on the basis of composition. [4]  
b) Explain Sensitization and Weld Decay. [4]  
c) What are stainless steels? Give typical composition and two uses of the various types of stainless steels? [4]

OR

- Q6)** a) Name the different standards used for the Designation of Steels. Give examples of each standard. [4]  
b) What is High Speed Steel? State and explain the important properties of the two types of high speed steels. [4]  
c) What do you mean by AISI 1090 & FE-230 [4]

- Q7)** a) Explain classification of Cu base alloys based on the percentage of Cu and Zn? Explain role of Zn in brasses. [6]  
b) What is Age Hardening. [4]  
c) Write a short note on Bearing Materials. [3]

OR

- Q8)** a) Give the composition of duralumin. What are its properties? [6]
- b) Give typical composition, property and application for the following (any four): [4]
- i) LM14
  - ii) Invar
  - iii) Statuary bronze
  - iv) Cartridge brass
- c) What are the requirements of bearing materials? explain with suitable example. [3]





Total No. of Questions : 8]

SEAT No. :

P-2802

[Total No. of Pages : 4

[6002]-345

S.E. (Mechanical/Automobile)

THEORY OF MACHINES - I

(2015 Pattern) (Semester - II) (202048)

Time : 2 Hours]

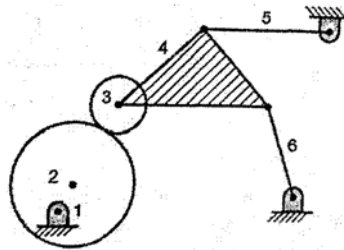
[Max. Marks : 50

Instructions to the candidates:

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

Q1) a) Explain different types of constrained motion with neat sketch. [6]

b) Calculate the number of degrees of freedom of mechanism as shown in fig. [4]



OR

Q2) a) With the help of neat sketch, derive the frequency equation of compound Pendulum. [5]

b) The connecting rod of an engine has length equal to 200 mm between centers and has mass equal to 2.5 kg. Its C.G. is at 80 mm from big end center and radius of gyration about axis through C.G. is 100 mm. Determine: [5]

- i) Two mass dynamically equivalent system, when one mass is placed at the small end.
- ii) The correction couple if two masses are placed at the two ends and angular acceleration of connecting rod is  $100 \text{ rad/s}^2$  clockwise.

P.T.O.

- Q3) a)** Explain the construction and working principle of Epicyclic Train Dynamometer with neat sketch. [4]
- b) A conical clutch has a cone angle of  $30^\circ$ , if the maximum intensity of pressure between the contact surface is limited to 70 kPa and the width of conical surface is not exceed  $\frac{1}{3}$  rd of the mean radius. Find the dimensions of the contact surfaces to transmit 22 kW at 2000 rpm assuming uniform wear and the coefficient of friction is 0.15. [6]

OR

- Q4) a)** Derive an equation for finding of angular velocity and angular acceleration of connecting rod by using analytical method. [5]
- b) Angle between two shafts connected by a Hook's joint is  $25^\circ$ . If the driving shaft is rotating at 1000 rpm. Determine: [5]
- Minimum speed of driven shaft in r.p.m.
  - Maximum speed of driven shaft in r.p.m.
  - Driving shaft rotation angles at which driven and driving shaft speeds are same.

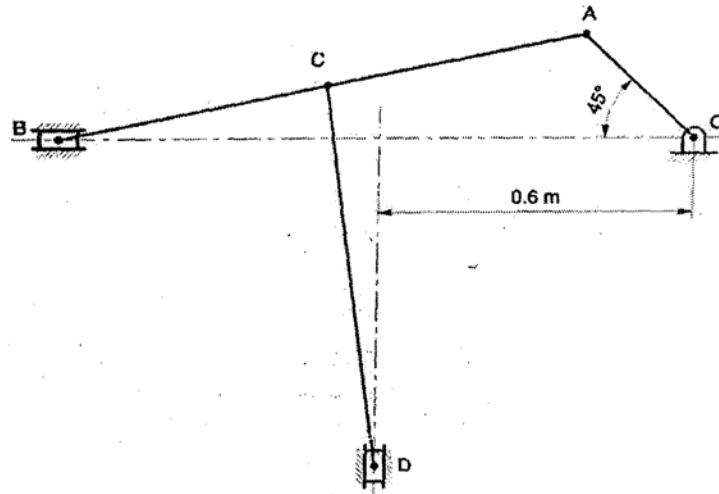
Also draw schematic Polar Diagram for above hook joint indicating all important values.

- Q5) a)** State and explain Kennedy's Theorem of three centers in line. [3]
- b) The length of various links of mechanism as shown in fig. are  $OA = 0.3\text{m}$ ,  $AB = 1\text{m}$ ,  $CD = 0.8\text{m}$  and  $AC = CB$  [12]

Determine for the given configuration

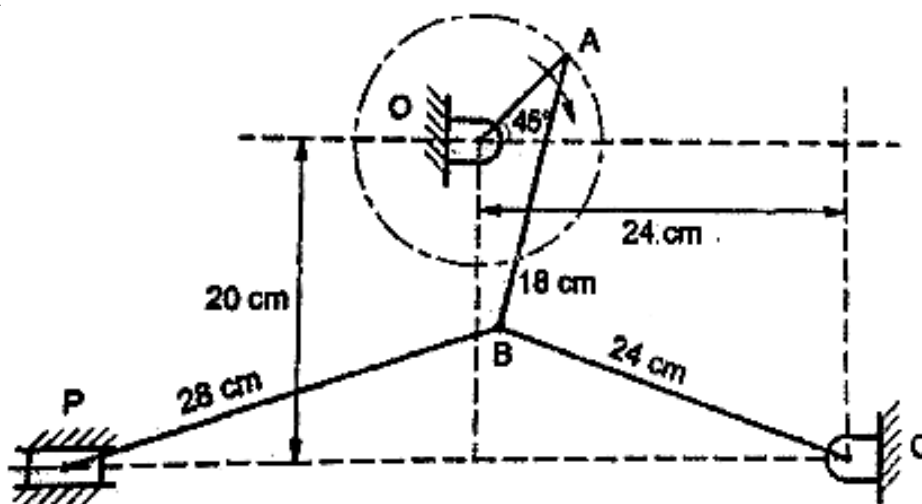
- Velocity of slider B

- ii) Velocity of Slider D
- iii) Angular Velocity of CD
- iv) Angular Velocity of AB

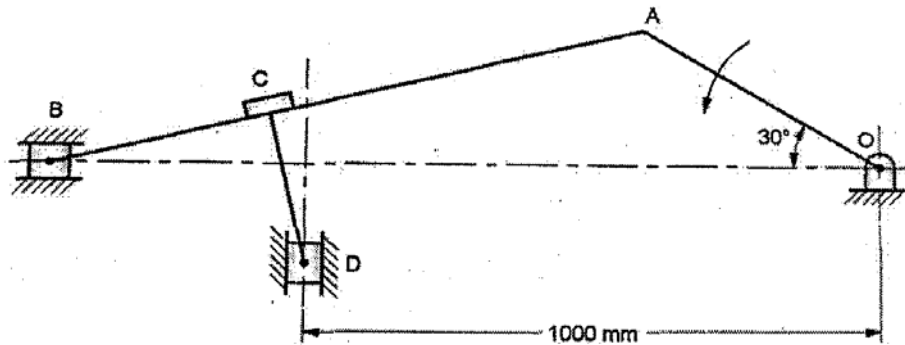


OR

- Q6) a)** Explain the terms with suitable sketch “Body centre and Space centre”. [5]
- b)** Fig. shows toggle mechanism in which the crank OA rotates at a uniform speed of 105 rpm in clockwise direction. Determine the velocity and acceleration of slider P. The lengths of various links are OA = 8 cm, AB = 18 cm, BC = 24 cm and BP = 28 cm [10]



- Q7) a)** Discuss all four cases to determine direction of Coriolis components of acceleration when block is sliding on rotating link. [5]
- b)** Crank OA of a compound slider crank mechanism as shown in fig. rotates at 20 rpm anticlockwise and give motion to sliding blocks B and D. The dimensions of various links are OA = 300mm, BC= 450mm, CD = 450mm. Determine linear acceleration of block D. [10]



OR

- Q8) a)** Explain Coriolis Component of Acceleration. [5]
- b)** The crank of an engine is 200 mm long and the ratio of connecting rod length to the crank radius is 4. Determine the acceleration of the piston, the acceleration of a point X on the connecting rod (located at  $\frac{3}{4}$ <sup>th</sup> distance from the small end) and angular acceleration of the connecting rod when crank is turned through  $45^\circ$  from the IDC position for the following cases [10]
- When the crank rotates at uniform speed of 240 rpm clockwise
  - When instantaneous speed of rotation of the crank is 240 rpm clockwise and is increasing at the rate of  $100 \text{ rad/s}^2$ . Use Klein's Construction.

**x x x**

Total No. of Questions : 8]

SEAT No. :

**P2803**

[Total No. of Pages : 2

**[6002]-346**

**S.E. (Mechanical/ Automobile)**

**APPLIED THERMODYNAMICS**

**(2015 Pattern) (Semester - II) (202050)**

*Time : 2 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer 4 questions out of 8, Q1 or 2, Q3 or 4, Q5 or 6, Q7 or 8.
- 2) Answer the four questions should be written in same Answer book, attach supplement if required.
- 3) Use of scientific calculator is Allowed.
- 4) Draw Diagram wherever Necessary.
- 5) Assume suitable data, if necessary.

**Q1) a)** Draw and explain with neat sketch of simple carburetor. **[6]**

**b)** Explain brief classification of I.C Engine. **[6]**

OR

**Q2) a)** What are the various losses which make the operation of actual cycle differ from that of air standard cycle Explain each loss in brief. **[6]**

**b)** What are the main Effects of Detonation? **[6]**

**Q3) a)** Explain the various factors that influence the delay period in C.I Engine. **[6]**

**b)** Explain the stages of combustion in a C.I Engine with neat sketch. **[6]**

OR

**Q4) a)** During a trial of a 4 cylinder, 4 stroke SI Engine running at 50 rev/s, the brake load was 267 N when all cylinders were working. When each cylinder was cut off in turn and speed returned to same 50 rev/s, brake readings were 178N, 187N, 182N, and 182N. Determine BP, IP and mechanical Efficiency of the Engine for  $BP = F \cdot N/455$  (KW), where F is brake load in Newton's & N rev/s following results were obtained. Fuel consumption = 0.568 lit in 30 seconds. Specific gravity = 0.72, CV = 43000 kJ/kg, A/F ratio = 14:1, Exhaust temp = 760°C,  $C_{pg} = 1.015$  kJ/kg, water inlet temp = 18°C and outlet temp = 56°C, water flow rate = 0.28 kg/s, ambient temp = 21°C Draw heat balance sheet in kJ/s. **[6]**

**P.T.O.**

- b) Define [6]
- i) Mechanical Efficiency
  - ii) Specific output
  - iii) Volumetric Efficiency
  - iv) Thermal Efficiency
  - v) Relative Efficiency
  - vi) Brake specific fuel consumption in I.C. Engine

- Q5)** a) Explain the working of Electronic Ignition system with neat sketch. [7]  
b) Discuss the major air pollutants from I.C. Engines and their effects on human body and on environments. [6]

OR

- Q6)** a) List the types of Lubricants with at list two examples. Explain in detail properties of liquid Lubricants. [7]  
b) What is Engine Governing? Explain centrifugal governer with neat sketch. [6]

- Q7)** a) A single stage single acting air compressor has the bore of 200 mm and stroke 300mm. It run at 420 rpm and has clearance ratio of 0.065. The index of compression can be assumed as 1.3. The inlet pressure is 1 bar and intake temperature is 27°C, delivery pressure is 500 kPa, [7]  
Determine
- i) Free air delivered at NTP in m<sup>3</sup>/hr.
  - ii) Volumetric efficiency
  - iii) Delivery air temp
  - iv) Isothermal efficiency

- b) Write down advantages of multistaging in Reciprocating air compressor, and draw sketch of two stage Reciprocating air compressor. [6]

OR

- Q8)** a) Explain screw compressor with neat sketch. [7]  
b) A two stage double acting air compressor runs at 120 rpm it draw air at 1 bar and 293 K and compress it with a total pressure ratio of 10, the intercooler used between the stages work at pressure of 3 bar and the air is cooled in it up to temp. of 302 K. Determine the shaft power of the compressor having mechanical and volumetric efficiency is 90% and 82% respectively. The diameter of L.P. cylinder is 25 cm and stroke 37.5 cm, the index of compression for each stage is 1.3. [7]

