

[6581]-1901
F.E.
ENGINEERING MATHEMATICS - I
(2019 Pattern) (Semester - I) (107001)

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) Figure to the right indicates full marks.
- 5) Use of electronic pocket calculator is allowed.
- 6) Assume suitable data, if necessary.

Q1) Write the correct option for the following multiple choice questions. [10]

- a) If z is a homogeneous function of x and y and if $z = f(u)$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is

[1]

i) $\frac{f(u)}{f'(u)}$

ii) $n \frac{f(u)}{f'(u)}$

iii) $\frac{f'(u)}{f(u)}$

iv) $n \frac{f'(u)}{f(u)}$

- b) The product of eigen values of a matrix A is equal to **[1]**

i) Trace of A

ii) Determinant of A

iii) Rank of A

iv) None of the

- c) The eigen values of $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are **[2]**

i) 0,0,0

ii) 0,0,1

iii) 0,0,3

iv) 1,1,1

d) The rank of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ is [2]

i)	2	ii)	0
iii)	1	iv)	3

e) If $u = x^2 + y^2$, $v = 2xy$ then $\frac{\partial(u,v)}{\partial(x,y)}$ is [2]

i) $x^2 - y^2$ ii) $2(x^2 - y^2)$
iii) $4(x^2 + y^2)$ iv) $4(x^2 - y^2)$

f) If $x = r \cos \theta$ and $y = r \sin \theta$ then $\left(\frac{\partial y}{\partial r}\right)_x$ is [2]

i) $\frac{r^2}{y}$

ii) $\frac{r}{y^2}$

iii) $\frac{r^2}{y^2}$

iv) $\frac{r}{y}$

Q2) a) If $v = \frac{c}{\sqrt{t}} e^{(-x^2/4a^2t)}$ then show that $\frac{\partial v}{\partial t} = a^2 \frac{\partial^2 v}{\partial x^2}$. **[5]**

b) If $u = f\left(\frac{y}{x}\right) + \sqrt{x^2 + y^2}$ prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = (x^2 + y^2)^{1/2}$. [5]

c) If $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$ then find the value of $\frac{1}{x} f_x + \frac{1}{y} f_y + \frac{1}{z} f_z$. [5]

OR

Q3) a) If $x^2 = au + bv$, $y^2 = au - bv$ prove that $\left(\frac{\partial u}{\partial x}\right)_y \cdot \left(\frac{\partial x}{\partial u}\right)_v = \left(\frac{\partial v}{\partial y}\right)_x \cdot \left(\frac{\partial y}{\partial v}\right)_u$

[5]

b) If $u = \sec^{-1}\left(\frac{x^3 + y^3}{x + y}\right)$ prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2 \cot u$. [5]

c) If $z = f(x, y)$ and $x = e^u + e^{-v}, y = e^{-u} - e^v$ show that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$. [5]

- Q4) a)** If $x = u(1 - v)$, $y = uv$, prove that $JJ' = 1$. [5]
b) Prove that the functions $u = y + z$, $v = x + 2z^2$, $w = x - 4yz - 2y^2$ are functionally dependent and find the relation between them. [5]
c) Find the maximum and minimum values of $x^2 + y^2 + 8y + 15$. [5]

OR

- Q5) a)** If $u^3 + v^3 = x + y$, $u^2 + v^2 = x^3 + y^3$ Find $\frac{\partial(x, y)}{\partial(u, v)}$. [5]

- b)** A power dissipated in a resistor is given by $P = \frac{E^2}{R}$. Using calculus, find the approximate percentage error in P when E is increased by 3% and R is increased by 2%. [5]
c) Divide 24 into three parts such that the continued product of the first, square of the second and cube of the third may be maximum. [5]

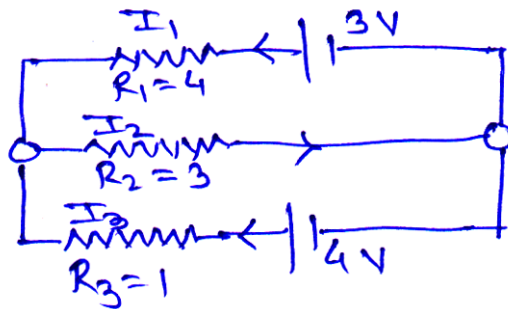
OR

- Q6) a)** Determine values of k for which the equations $2x - 3y + 5z = k$, $3x + y - z = 2$, $x + 4y - 6z = 1$ are consistent. [5]
b) Examine following set of vectors for linearly dependence. [5]
 $X_1 = (1, 2, 4)$, $X_2 = (2, -1, 3)$, $X_3 = (0, 1, 2)$, $X_4 = (-3, 7, 2)$.

- c)** Show that $A = \begin{bmatrix} 1/\sqrt{3} & 0 & 2/\sqrt{6} \\ 1/\sqrt{3} & 1/\sqrt{2} & -1/\sqrt{6} \\ -1/\sqrt{3} & 1/\sqrt{2} & 1/\sqrt{6} \end{bmatrix}$ is an orthogonal matrix. [5]

OR

- Q7) a)** Solve the system of equations $x + y + 3z = 0$; $x - y + z = 0$; $-x + 2y = 0$; $x - y + 2z = 0$ [5]
b) Examine whether the set of vectors $X_1 = (5, 3, 2)$, $X_2 = (2, 1, 1)$, $X_3 = (-3, 1, 6)$ are linearly independent. [5]
c) Find the current I_1, I_2, I_3 in the circuit shown in the figures : [5]



Q8) a) Find eigen values and eigen vectors for the given matrix $A = \begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$. [5]

b) Verify Cayley Hamilton theorem for following matrix $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. [5]

c) Find the modal matrix P which diagonalises the following matrix $A = \begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$. [5]

OR

Q9) a) Find eigen values and eigen vector corresponding to largest eigen value of a following matrix $A = \begin{bmatrix} 15 & 0 & -15 \\ -3 & 6 & 9 \\ 5 & 0 & -5 \end{bmatrix}$ [5]

b) Verify Cayley Hamilton theorem for following matrix and hence find A^{-1} $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. [5]

c) Express the following quadratic form as "Sum of the squares form" by congruent transformation. Write down the corresponding linear transformation. [5]

$$Q(x) = 6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 + 4x_1x_3 - 2x_2x_3$$



Total No. of Questions : 8]

SEAT No. :

PE-897

[Total No. of Pages : 3

[6581]-1903

F.E.

SYSTEMS IN MECHANICAL ENGINEERING

(2019 Pattern) (Semester - I / II) (102003)

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) Classify automobiles based on various considerations. [7]
- b) Define vehicle specification. Explain following engine specifications [7]
- i) Torque
 - ii) Power and
 - iii) Cubic Capacity
- c) Compare vehicle specifications for two-wheeler and three-wheeler vehicles. [4]

OR

- Q2)** a) Explain various components of S. I engine with neat sketch. [7]
- b) Explain electric vehicle with neat sketch. Mention its components. [7]
- c) State differences between electric and hybrid vehicle with examples.[4]
- Q3)** a) State importance of suspension system. Explain telescopic suspension system with neat sketch. [7]
- b) With neat sketch explain the construction and working of disc brake system. [7]
- c) Why safety arrangements needed in vehicle? Explain the importance of seat belts and air bags in the vehicle. [3]

P.T.O.

OR

- Q4)** a) Define Gear Ratio of gear box. A pinion of pitch circle diameter 150 mm meshes with a gear having 80 teeth. Gear ratio is 4 and speed of gear is 500 rpm. Determine [7]
- i) Pitch circle diameter of gear
 - ii) Speed of pinion
 - iii) Number of teeth on pinion.
- b) Explain the working principle of ABS system in vehicle with neat sketch. State its importance over conventional braking system. [7]
- c) Explain working of water-cooling system in vehicle with neat diagram. [3]
- Q5)** a) With neat sketch explain the shielded metal arc welding. State its applications. [7]
- b) State significance of Metal Cutting process in industry. Explain following metal cutting processes. [7]
- i) Turning
 - ii) Milling and
 - iii) Drilling operation with neat sketch.
- c) Explain concept of Internet of Things (IoT) and its applications in manufacturing. [4]

OR

- Q6)** a) Explain sand casting process with neat sketch. State its advantages and disadvantages. [7]
- b) State the importance of sheet metal working in manufacturing. Explain Punching and Blanking with neat sketch. [7]
- c) Draw a block diagram for a 3D printer with all its components. [4]
- Q7)** a) Using block diagram, explain the application of blower in kitchen chimney and vacuum cleaner. [7]
- b) Explain with neat sketch working of water pump used for lifting water for overhead tank. [7]
- c) An electric motor driven pump fills an over headed tank placed at a height of 20 m from the ground level. The mass of the water pumped per second is 5.56kg. Input power of the motor is 2200 W. Calculate the efficiency of the motor. (use $g = 9.81 \text{ m/s}^2$) [3]

OR

- Q8)** a) With the help of block diagram, explain working of electric geyser. State various specifications for an electric geyser. [7]
- b) Explain with neat sketch working of refrigerator. State its domestic and industrial applications. [7]
- c) A refrigerator has working temperatures in the evaporator and condenser coils as -30°C and 32°C . What is the maximum COP of the system? Draw its block diagram. [3]



Total No. of Questions : 9]

SEAT No. :

PE898

[Total No. of Pages : 3

[6581]-1904

F.E.

ENGINEERING CHEMISTRY

(2019 Pattern) (Credit System) (Semester - I/II) (107009)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No.1 is compulsory. 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.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables, slide rules, Mollier charts, Use of scientific calculator is allowed.
- 5) Assume suitable data, if necessary.

Q1) Multiple Choice Questions.

- i) All the carbon atoms in Graphene are _____ hybridized. [1]
 - a) SP
 - b) SP²
 - c) SP³
 - d) None of these
- ii) PHBV a copolymer is an example of _____ polymer. [1]
 - a) Biodegradable
 - b) Composite
 - c) Engg. Thermoplastic
 - d) Liquid Crystal
- iii) Reinforcing agent used in a polymer matrix _____. [1]
 - a) Carbon fibre
 - b) Glass fibre
 - c) Aramid fibre
 - d) All of these
- iv) Characteristics of a good fuel _____. [1]
 - a) High calorific value
 - b) Moderate ignition temp
 - c) Low Moisture content
 - d) All of the above
- v) Boy's calorimeter can be used to determine calorific value of _____. [1]
 - a) Solid fuel
 - b) Volatile liq fuel
 - c) Gaseous fuel
 - d) Both B & C
- vi) Fundamental modes of vibration in C₆H₆ are _____. [1]
 - a) 9
 - b) 6
 - c) 3
 - d) 30

P.T.O.

- Q5)** a) Explain the production of hydrogen by steam reforming of methane and coke with reaction conditions and removal of CO_2 . [6]
 b) What is Biodiesel? Give preparation reaction of biodiesel with reaction conditions give advantages and limitations of biodiesel. [5]
 c) 2.00g of coal sample was heated for one hour at 110°C , the weight of the residue was 1.80g. The residue was then covered with a vented lid and heated for exactly 7 minutes at 950°C . The residue weighed 1.00g. The crucible was then heated without lid till a constant weight of the residue of 0.15g was obtained. Calculate % of the various constituents of coal. [4]
- Q6)** a) Explain block diagram of single beam of UV-vis spectrophotometer. Explain its four components and give their function. [6]
 b) What are the conditions of IR radiations by the molecule? Calculate the fundamental modes of vibrations in the following molecules [5]
 i) H_2O
 ii) NO
 c) Define the following: [4]
 i) Beers law
 ii) Chromophore
 iii) Auxochrome
 iv) Bathochromic shift

OR

- Q7)** a) Give principle of IR spectroscopy. Explain modes of vibrations with stretching and bending vibrations. [6]
 b) Explain the possible electronic transitions with diagram which occur on absorption of UV. vis radiations by an org. molecule. [5]
 c) Explain any four applications of IR spectroscopy. [4]
- Q8)** a) Define corrosion. State the conditions under which wet corrosion occurs. Explain hydrogen evolution mechanism of wet corrosion. [6]
 b) What is the principle of cathodic protection? Explain any one method. [5]
 c) Explain any four factors affecting the rate of corrosion related to metal. [4]

OR

- Q9)** a) Define Electroplating. Explain the process with diagram and reactions. Give any two applications of electroplating. [6]
 b) What is PBR? Explain diff-types of films with related to nature of metal [5]
 i) Mg
 ii) Cu
 iii) Ag
 iv) Mo
 c) Distinguish between Galvanisation and Tinning. [4]

* * *

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 4

PE899

[6581]-1905

F.E. (All Branches)

BASIC ELECTRICAL ENGINEERING

(2019 Pattern) (Semester-I/II) (103004)

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) Define admittance. State its units. Express admittance in rectangular & polar form. **[4]**
- b) Obtain the expression for current when voltage $v = V_m \sin \omega t$ is applied across purely inductive circuit. Also draw the waveform for voltage & current against time as a common X-axis. **[6]**
- c) A series R-L-C circuit has resistance of 50 ohms, inductance of 0.1 H and capacitance of 50 micro farads connected across single phase 230 V, 50 Hz AC supply. **[8]**

Calculate:

- i) Inductive reactance
- ii) Capacitive reactance
- iii) Impedance
- iv) Current drawn by circuit
- v) Power factor of the circuit
- vi) Active & Reactive power consumed by the circuit.

OR

P.T.O.

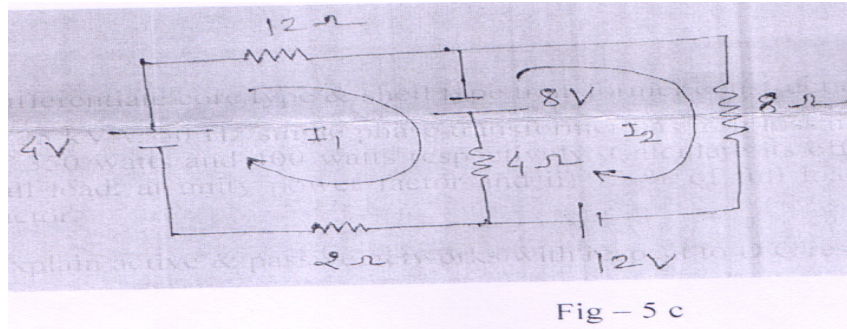
- Q2)** a) Draw power triangle for R-L series circuit. Define active power and state its unit. [4]
- b) Derive the expression for resonant frequency in case of series RLC a c circuit. Draw phasor diagram. [6]
- c) A series RC circuit consisting of a resistance of 50 ohm and capacitance of 100 micro farad. It is supplied by 1-ph 230 V, 50 Hz AC supply. Calculate: [8]
- Capacitive reactance
 - Impedance of the circuit
 - Current through the circuit
 - Voltage across resistance
 - Voltage across capacitance
 - Power factor of circuit
 - Power consumed by circuit. Also draw a neat phasor diagram

- Q3)** a) Define : [3]
- Phase sequence
 - Balanced load
 - Unbalanced load
- b) Derive emf equation of a single phase transformer. [6]
- c) Three identical impedances each of $6 + j 8$ are connected in star across 3 phase 400 V 50 Hz supply. Determine: [8]
- Phase current
 - Line current
 - Line & phase voltage
 - 3-phase active, reactive and apparent power.

OR

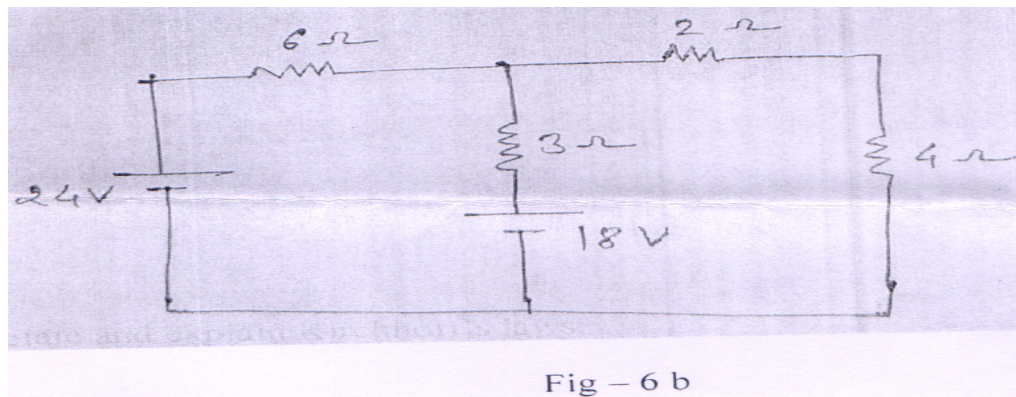
- Q4)** a) State the relation between
- Phase voltage and line voltage
 - Phase current and line current in case of balanced delta connected 3-phase load. Write down the expression for 3-phase active power. [3]
- b) Differentiate core type & shell type transformer construction. (any 6 points). [6]
- c) A 25 kVA, 50 Hz single phase transformer has iron loss and full load copper loss of 350 watts and 400 watts respectively. Calculate its efficiency at : [8]
- 50 % of full load, at unity power factor and
 - 75 % of full load at 0.8 lagging power factor.

- Q5) a)** Explain active & passive networks with respect to D C resistive network. [4]
- b) Derive the expression to convert given delta connected resistances into equivalent star connected resistances. [6]
- c) Using Kirchhoff's Law, determine the current I_1 & I_2 . Hence find current in 4 ohm resistance shown below in Fig. 5c. [8]

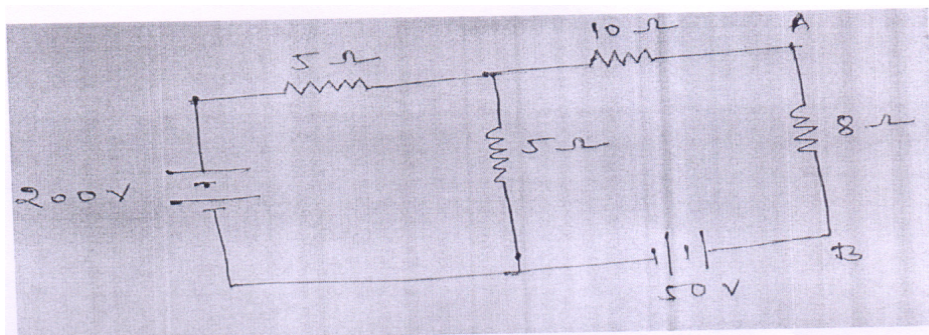


OR

- Q6) a)** State and explain Kirchhoff's laws. [4]
- b) Apply Superposition theorem to calculate current flowing in 4 ohms resistance for the network shown below in Fig. 6b [6]



- c) Determine the current in 8 ohms resistance connected across A and B by Thevenins theorem (Ref. Fig -6c). [8]



- Q7)** a) What are the indications of a fully charged lead acid battery? [3]
- b) With usual notations derive the expression $\alpha_2 = \alpha_1 / (1 + \alpha_1[t_2 - t_1])$. [6]
- c) An electric pump lifts 1.2 m^3 of water per minute to a height of 15 meters. The overall efficiency of pump & motor is 60%. Calculate the input power. If the pump is used 4 hours daily, calculate energy consumption for a month of 30 days at the rate of Rs. 5 per unit. [8]

OR

- Q8)** a) State any three applications of Li Ion battery. [3]
- b) A single core Copper cable has conductor diameter of 3 cm & insulation thickness of 2 cm. The resistivity of copper & insulation is 1.73×10^{-8} ohm meter & 9×10^{12} ohm meter respectively. Determine: [6]
- i) Resistance of conductor &
- ii) Insulation resistance of the cable for 150 m length.
- c) Explain with neat sketch the construction and working of a lead acid battery and state its any two applications. [8]



Total No. of Questions : 8]

SEAT No. :

PE900

[Total No. of Pages : 2

[6581]-1906

F.E.

BASIC ELECTRONICS ENGINEERING

(2019 Pattern) (Semester - I/II) (104010) (Credit System) (Theory)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) 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) Convert [6]

i) $(462.27)_{10} = ()_{16}$

ii) $(5F1.6C)_{16} = ()_{10}$

iii) $(110011-111001)$ using 2s complement method.

b) Define universal logic Gates. Draw basic gates using universal logic Gates? [6]

c) Draw & explain Block Diagram of Micro-controller. [6]

OR

Q2) a) With the help of Truth Table explain operation of AND,OR, EX-OR gates.[6]

b) State & Prove De-Morgan's theorems. [6]

c) Design & implement full adder. Write equation for sum & carry. [6]

Q3) a) Explain principle of operation & block diagram of Digital Multi-meter.[6]

b) Explain working of Auto transformer. List its Applications. [6]

c) Explain operation of DC Ammeter with suitable diagram. Explain circuit of multi-range Ammeter. [5]

OR

Q4) a) Draw block diagram of Function generator & explain functions of each block. [6]

b) Draw & explain block diagram of DSO. List its applications. [6]

c) Explain operation of DC Voltmeter with suitable diagram. Explain circuit of multi-range Voltmeter. [5]

P.T.O.

- Q5)** a) Differentiate between active & passive sensors. [5]
b) Explain RTD with its Construction, Working advantages, Disadvantage, applications. [6]
c) Explain operation of Bio-Sensor with one application. [6]

OR

- Q6)** a) What are the different types of transducers. Give one example of each type. [5]
b) Explain working principle of strain gauge. Explain load cell. [6]
c) Draw construction of LVDT & explain its operation with advantages, disadvantages, applications. [6]

- Q7)** a) Explain different types used in cables, used in electronic communication. [6]
b) Draw & Explain block diagram of FM transmitter. [6]
c) Draw & Explain block diagram of GSM. [6]

OR

- Q8)** a) With the help of block diagram explain operation of communication system. [6]
b) Draw & explain IEEE electromagnetic frequency spectrum & state allotment of frequency bands for different applications. [6]
c) Draw & Explain block diagram of AM transmitter?(High power) [6]



[6581]-1907
F.E. (Programme)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I/II) (101011)

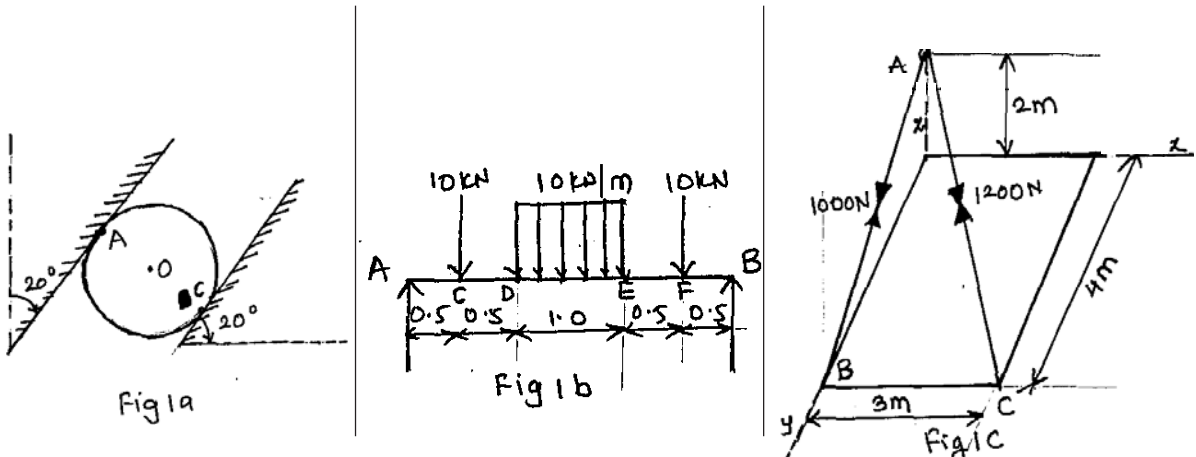
Time : 2½ Hours]

[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 Sketches must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary and mention it clearly.
- 5) Use of electronic pocket calculator is allowed.
- 6) Use of cell phone is prohibited in the examination hall.

- Q1)** a) A sphere weighing 500N is placed in a wrench as Shown in Fig. 1 a Find the reactions at the point of contacts A and C. [6]
- b) Determine Support Reactions for simply supported beam loaded and supported as shown in the Fig. 1 b. [6]
- c) Determine the magnitude of the resultant force ring at A , if the cable exerts the force $F_{AB} = 1000 \text{ N}$ $F_{AC} = 1200 \text{ N}$ as shown in Fig. 1c. [6]

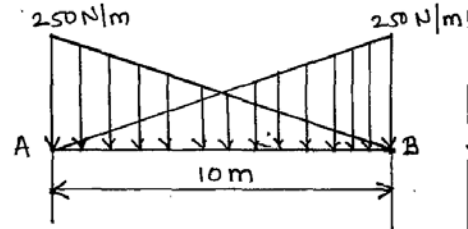
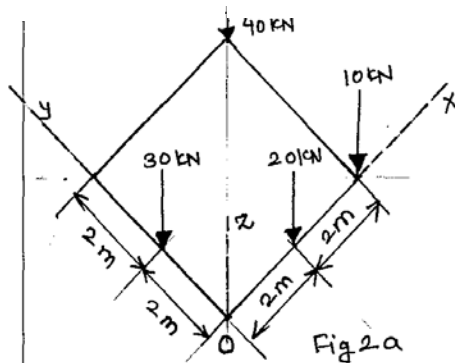


OR

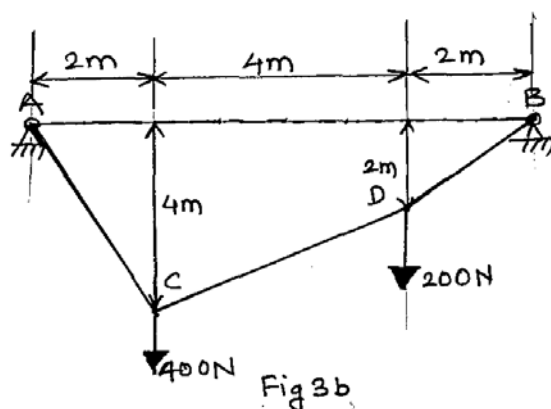
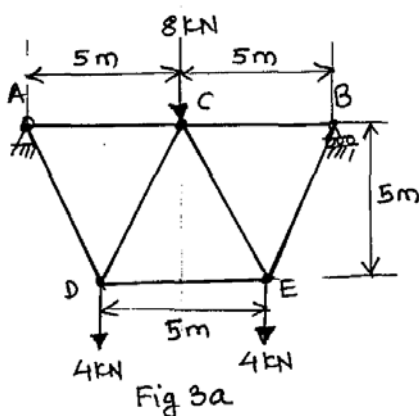
- Q2)** a) A square mat foundation supports four columns as shown in Fig. 2 a Determine magnitude and direction of Resultant with respect to origin 'O' [7]

P.T.O.

- b) Determine Support Reactions for Cantilever beam loaded and supported as shown in the Fig. 2 b. [7]
- c) Explain the term Free Body Diagram in detail. [4]



- Q3) a) Analyze the truss and determine the magnitude and nature of forces in the members of the truss loaded and Supported as shown in Fig. 3 a [7]
- b) Loads are suspended as shown in Fig. 3 b for the cable Determine the component of reaction at supports and maximum tension in the cable. [7]
- c) Explain in detail degree of static indeterminacy for the truss with neat sketches [4]



OR

- Q4) a) Determine forces in all members of a truss, also find support reaction as shown in Fig. 4 a. [7]
- b) Loads are suspended as shown in Fig. 4 b from cable, Determine the component of reaction at A and maximum tension in the cable. [7]

- c) Explain in detail methods of analysis of the truss with neat sketches.[4]

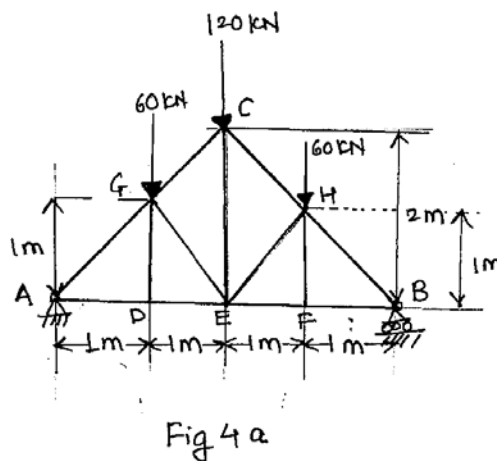


Fig 4a

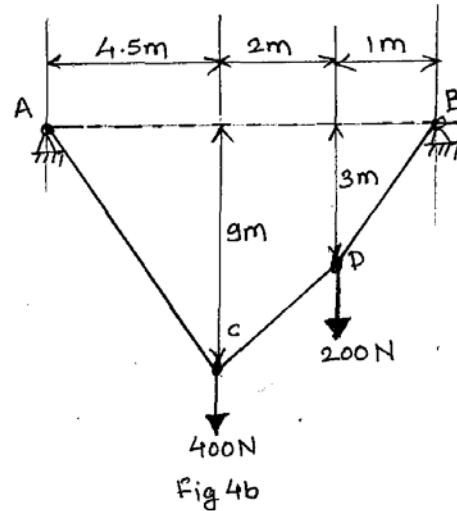


Fig 4b

- Q5) a) The motion of the particle is defined by, $X = t^3 - 9t^2 + 12t + 5$ where 'X' expressed in meters and t is in second Determine time at which velocity becomes zero, Also determine velocity and acceleration at $t = 5$ sec. [6]
- b) A Stone is thrown by a person from the ground clears 15 m high tree placed 50 m ahead of person if the angle of projection of stone is 60° determine velocity of projection of stone. Refer Fig 5 b [6]
- c) A train crosses a tunnel in 45 sec time, the speeds of the train at entry and at exit from the tunnel are 36 km/hr and 54 km / hr respectively, If acceleration remains constant then what will be length of the tunnel.[6]

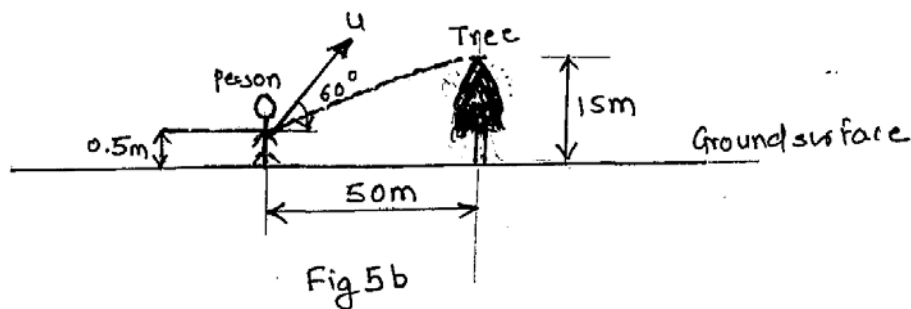
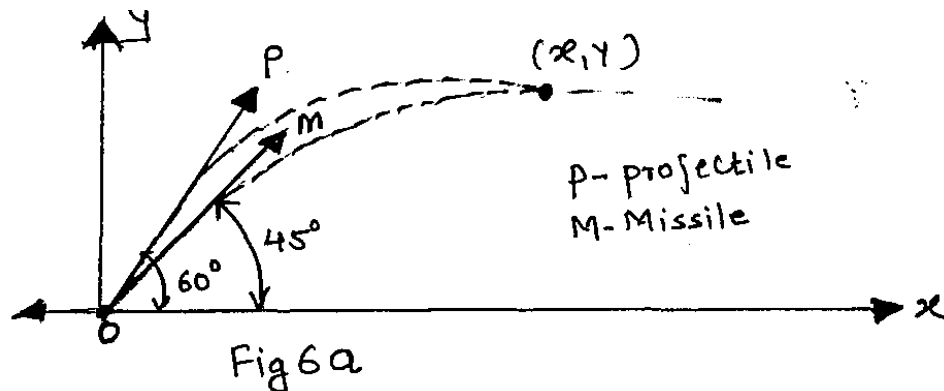


Fig 5b

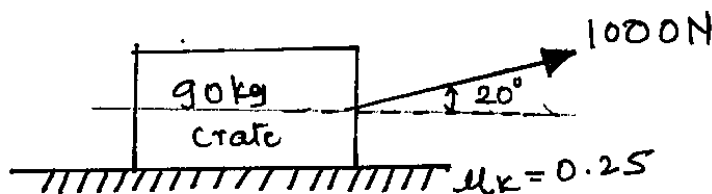
OR

- Q6) a) A projectile P is fired with a velocity of 200 m/sec at an angle of 60° with the horizontal. After some time a missile M is shot from the same point to destroy the projectile as shown in Fig. 6 a, The angle of projection and velocity of missile are 45° and 1000 m/sec respectively. Calculate the height, horizontal distance and time with respect to, firing of P at which destruction takes place. [6]

- b) A metal ball is thrown vertically Downwards with 100 m/s from top of the tower having 100m high. Determine velocity with which it hits the ground at the base of the building and also calculate time required to reach the ground level. [6]
- c) A car acceleration is defined by relation $a = -1.2 v$ where, 'a' is expressed in mm/s² and 'v' in mm/sec. If $v = 50$ mm/sec at $t = 0$ determine the distance the car will travel before coming to rest. [6]



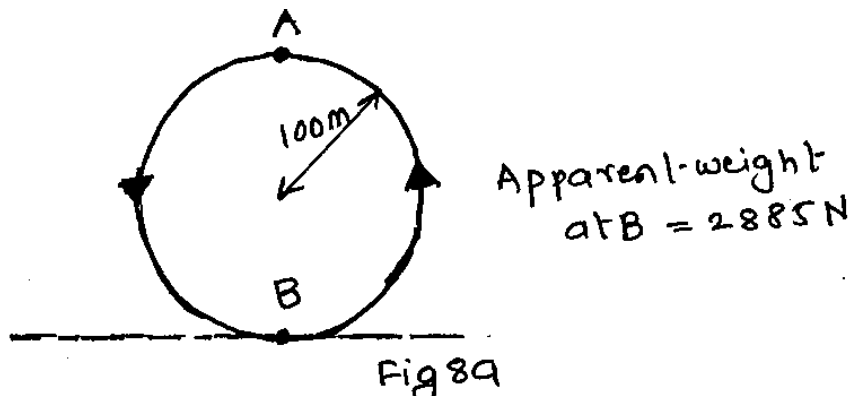
- Q7) a) The 90 kg crate as shown in the Fig 7 a rests on a horizontal plane for which coefficient of kinetic friction is 0.25. if the crate does not tip over when it is subjected to a 1000 N force determine velocity of the crate in 10 sec starting from rest. [6]



- b) A glass marble whose weight is 10 kg fall from height of 15 m and rebounds to a height of 10 m the marble and the floor remains in contact for 0.5 sec. Determine the impulse and the average force between the marble and floor. [6]
- c) Explain in detail conservative and non - Conservative Forces with examples. [4]

OR

- Q8) A 76 kg pilot flies in a plane moves in a vertical loop of 100 m radius as shown in Fig 8 a, knowing that the pilot has apparent weight of 2885 N find the speed of plane at B. [6]



- b) Two Steel Balls A and B having same mass 0.6 kg having velocities 4m/sec rightward and 2 m/sec leftward, before impact. After impact velocity of ball A is 2.5 m/sec to the left determine coefficient of restitution of the steel balls. [6]
- c) Explain in detail Impulse momentum principle and Work Energy principle. [4]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 3

PE-902

[6581]-1908

F.E. (Programme)

PROGRAMMING AND PROBLEM SOLVING

(2019 Pattern) (Semester - I/II) (110005)

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.

Q1) a) Explain the following with an example [5]

i) Keywords arguments

ii) Default arguments

b) Write a program to swap 2 numbers using a function [6]

c) What are [6]

i) Local Variables

ii) Global Variables. Explain with an example

OR

Q2) a) Explain the following with an example : [5]

i) Positional arguments

ii) Unlimited positional arguments

b) What is a Lambda function. Explain with an example using 2 arguments [6]

c) What is a function? Write a program to return the addition and multiplication of 2 numbers taken as input from the user using a function [6]

P.T.O.

- Q3)** a) Explain f-string method of string formatting with an example [5]
b) Explain the following with suitable example [6]
i) `is` and
ii) `is not` operators on string
c) What is the output of the following statement for the given string (i to vi)?
S = "Programming and Problem Solving" [6]
i) `print(S[16:])`
ii) `print(S[:28:2])`
iii) `print(S[:19:1])`
iv) `print ("and" in S)`
v) `print(S[:2])`
vi) `print(S[:-1])`

OR

- Q4)** a) Explain the following string methods with an example [5]
i) `title ( )`
ii) `rstrip ( )`
b) Explain the following with suitable example [6]
i) `ord ( )` function
ii) `chr ( )` function
c) Write a program to count the number of consonants in a string. Hint -
consonants are letters that are not (a, e, i, o, u) [6]
- Q5)** a) Explain the following programming paradigm [6]
i) Monolithic Programming
ii) Structured Programming
b) Explain the following with a suitable example [6]
i) Inheritance
ii) Function overriding
iii) Class Variables
c) Write a program to calculate the area of a square and rectangle using a class. [6]

OR

- Q6)** a) Explain the following with a suitable example [6]
i) Class Method
ii) Object
iii) Constructor
b) Explain the following programming paradigm [6]
i) Procedural Programming
ii) Object Oriented Programming
c) Write a program to create a class Book with two attributes Name and Author. Create 3 objects and display the information. [6]

- Q7)** a) Differentiate between text and binary files [6]
b) Explain the following dictionary methods [6]
i) update ()
ii) keys ()
iii) popitem ()
c) Write a python program that read data from one file and writes into another file line by line Hint: First line in the original file will be the first line in copied file [6]

OR

- Q8)** a) Explain the following file handling methods with an example [6]
i) readlines ()
ii) write ()
iii) tell ()
b) Explain the following access modes [6]
i) rb
ii) rb+
iii) ab+
c) Write a program that reads text from one file (line by line) and writes into another file but in the reverse order [6]



[6581]-1909
F.E. (Common)
ENGINEERING MATHEMATICS - II
(2019 Course) (Semester - II) (107008)

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

- 1) Q.1 is compulsory.
- 2) Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of electronic pocket calculator is allowed.
- 6) Assume suitable data, if necessary.

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

a) $\int_0^{\pi/2} \cos^4 x dx =$ [2]

- | | |
|------------------------|----------------------|
| i) 0 | ii) $\frac{3}{8}\pi$ |
| iii) $\frac{3}{16}\pi$ | iv) $\frac{\pi}{2}$ |

b) The curve $y^2 = x^2(2 - x)$ is symmetric about [2]

- | | |
|----------------------|------------|
| i) X-axis | ii) Y-axis |
| iii) both X & Y axis | iv) Origin |

c) Centre (C) and radius (r) of the sphere $x^2 + y^2 + z^2 - 2x - 2y - 2z - 6 = 0$ are [2]

- | | |
|---------------------------------------|------------------------------------|
| i) $C \equiv (1, 1, 1), r = \sqrt{3}$ | ii) $C \equiv (-1, -1, -1), r = 3$ |
| iii) $C \equiv (1, 1, 1), r = 3$ | iv) $C \equiv (-1, -1, -1), r = 9$ |

d) $\int_{y=0}^{y=1} \int_{x=0}^2 x dx dy = \dots$ [2]

- | | |
|--------|-------|
| i) 0 | ii) 1 |
| iii) 2 | iv) 4 |

P.T.O.

- f) $\int \int \int 1 \, dx \, dy \, dz$ represents [1]
- i) Area ii) Centre of gravity
iii) Volume iv) Moment of Inertia

Q2) a) If $U_n = \int_0^{\pi/4} \tan^n \theta d\theta$, then Prove that, $n(U_{n+1} + U_{n-1}) = 1$ [5]

b) Evaluate, $\int_0^{\infty} \frac{x^4}{4^x} dx$ [5]

c) Evaluate, $\frac{d}{dx} \operatorname{erfc}(\sqrt{x})$ [5]

OR

Q3) a) If $I_n = \int_0^{\pi/3} \cos^n x dx$ then prove that,

$$I_n = \frac{\sqrt{3}}{n \cdot 2^n} + \frac{n-1}{n} I_{n-2} \quad [5]$$

b) Evaluate, $\int_3^5 (x-3)^{1/2} \cdot (5-x)^{1/2} dx$ [5]

c) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(a + 1)$ [5]

Q4) a) Trace the curve $xy^2 = a^2(a - x)$ [5]

b) Trace the curve $r^2 = a^2 \cos(2\theta)$ [5]

c) Show that in the Astroid
 $x^{2/3} + y^{2/3} = a^{2/3}$, $S^3 \propto x^2$. [5]

S being measured from the cusp which lies on Y axis

OR

- Q5)** a) Trace the curve $x^2y^2 = a^2(y^2 - x^2)$ [5]
b) Trace the curve $\gamma = a\cos(3\theta)$ [5]
c) Trace the curve $x = t^2, y = t - \frac{t^3}{3}$ [5]

- Q6)** a) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ and find the point of contact. [5]
b) Find the equation of right circular cone whose vertex is at $(1, -1, 2)$, axis is the line $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$ and semivertical angle 45° . [5]
c) Find the equation of right circular cylinder whose axis is $\frac{x}{2} = \frac{y}{1} = \frac{z}{-2}$ and radius is 4. [5]

OR

- Q7)** a) Find the sphere through the circle, $x^2 + y^2 + z^2 = 4, z = 0$, meeting the plane $x + 2y + 2z = 0$ in a circle of radius 3. [5]
b) Find the equation of the right circular cone whose vertex is at origin, axis is y axis and semivertical angle 30° . [5]
c) Find the equation of right circular cylinder of radius 2, whose axis passes through origin and makes equal angles with coordinate axes. [5]

- Q8)** a) Evaluate $\int_0^1 \int_{x^2}^x xy(x+y) dx dy$ [5]
b) Find the area bounded by the curves $y^2 = 4ax$ & $x^2 = 4ay$ [5]
c) A thin plate of uniform thickness and density is in the form of lamina bounded by the parabola $x^2 = y$ and the line $y = x + 2$. Find the moment of inertia of the lamina about Y - axis. [5]

OR

- Q9)** a) Evaluate $\int_0^1 dx \int_0^2 dy \int_1^2 x^2 yz dz$ [5]
b) Find the volume of the region enclosed by the paraboloid $z = x^2 + y^2$ and the plane $z = 4$ [5]
c) Find the centre of gravity of loop of the rose curve $r = a \sin 2\theta$ in the first quadrant. [5]



[6581]-1910
F.E.
ENGINEERING GRAPHICS
(2019 Pattern) (Semester - I/II) (102012)

Time : 2½ Hours]

[Max. Marks : 50

Instructions to the candidates:

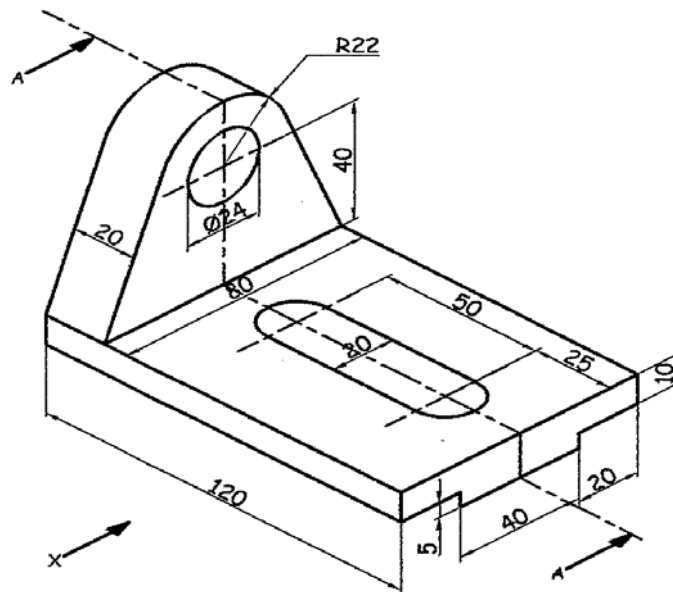
- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.
- 2) Assume suitable data, if necessary.
- 3) Retain all the construction lines.

Q1) Draw a curve by focus-directrix method when distance between focus and directrix is 63 and eccentricity as $5/4$. **[8]**

OR

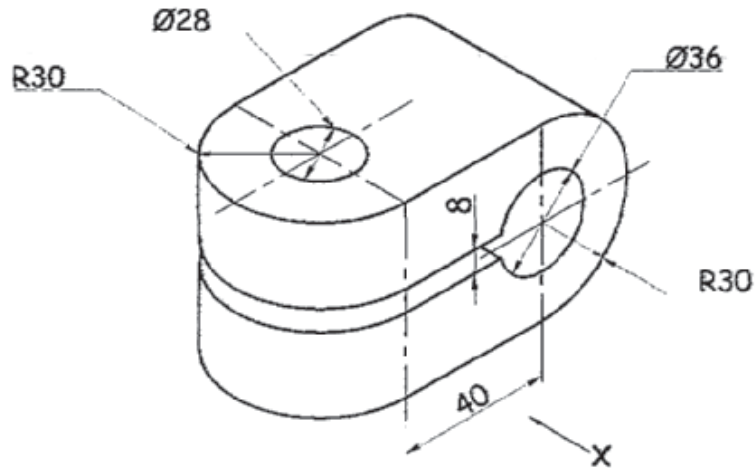
Q2) A point 'P' is moving around the surface of the cone of base 70 mm and height 100 mm. If the point starting from the apex, reaches the periphery of the cone base in one turn, draw the projections of the path of point 'P'. Assume axial decent of the point in uniform with its rotation. **[8]**

Q3) Figure shows a pictorial view of an object. By using first angle method of projection draw, Sectional Front View in the direction of X, Top View and Right-Hand Side View. Give dimensions in all views. **[16]**

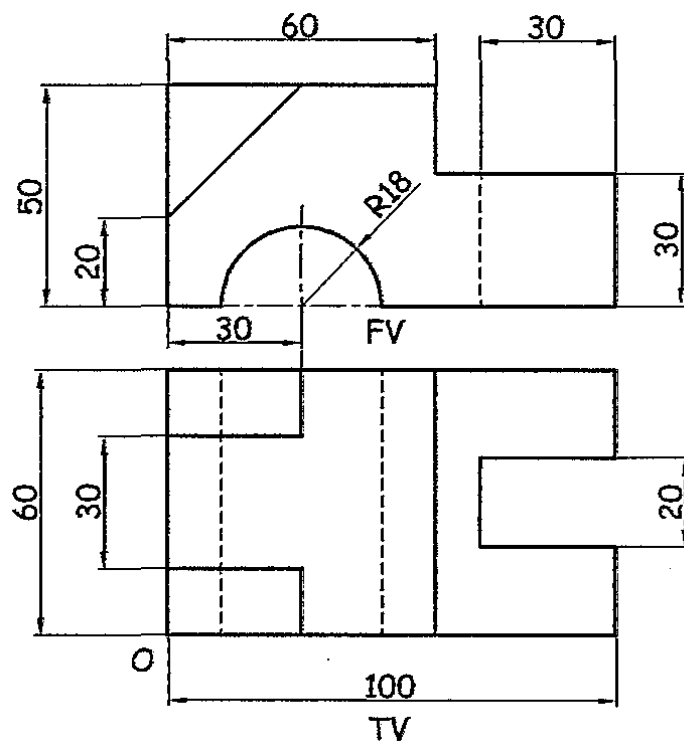


OR

- Q4)** Figure shows a pictorial view of an object. By using first angle method of projection draw, Front View in the direction of X, Top View and Left-Hand Side View. Give dimensions in all views. [16]

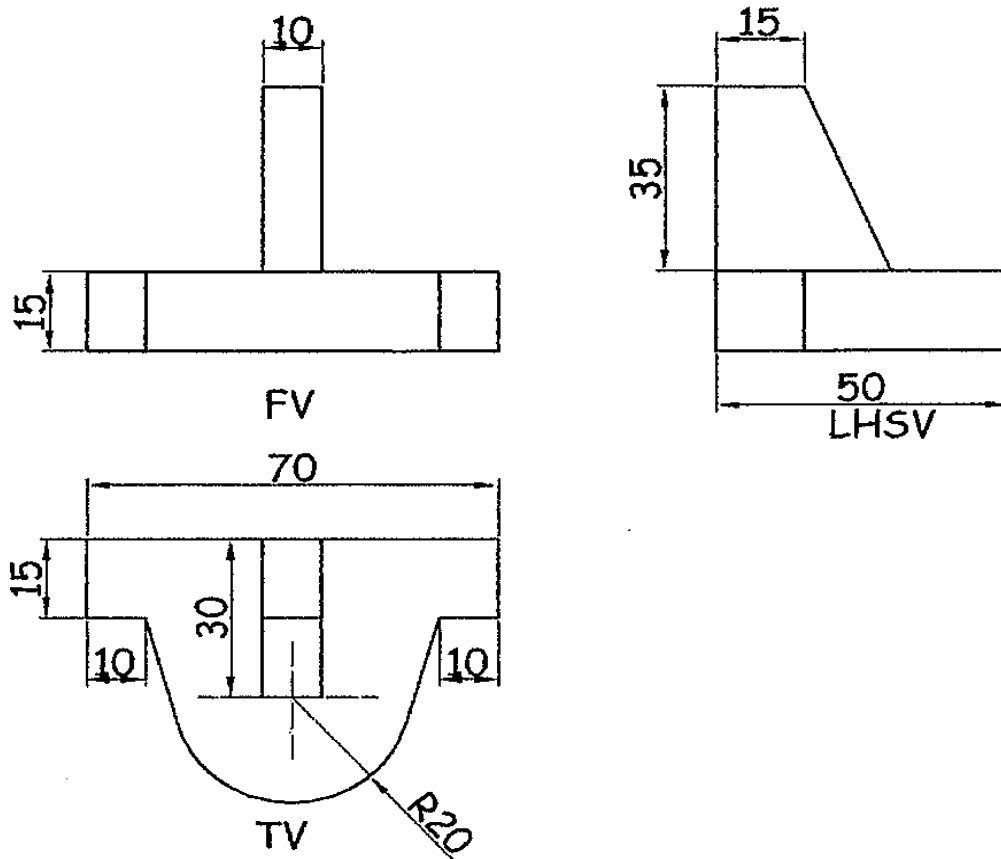


- Q5)** Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the necessary dimensions. [16]



OR

Q6) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view and give all the necessary dimensions.[16]



Q7) A square pyramid side of base 30 mm and axis 70 mm long is kept on HP in such a way that one of its base edges is parallel to the VP. A cutting plane bisects its axis at 45° . Draw the development of lateral surfaces of the square pyramid. [10]

OR

Q8) A cube of 50 mm edges, is resting on a face on H.P., such that all the sides are equally inclined to V.P. It is cut by a section plane perpendicular to V.P. and inclined at 30° to H.P and also passes through an axial point 12 mm from top side. Draw a development of lateral surfaces of a cube. [10]



Total No. of Questions : 11]

SEAT No. :

PE-12146

[Total No. of Pages : 4

[6581]-2401

F.E.

BSC-151-BES: ENGINEERING MATHEMATICS - II
(2024 Pattern) (Semester - I/II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. 1 is compulsory, Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9, Q10 or Q11.
- 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) Write the correct option :

i) $\int_0^{\pi/2} \sin^3 x \, dx$ is equal to _____. [2]

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

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

c) $\frac{2}{3}, \frac{\pi}{2}$

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

ii) The equation of tangents to the curve at origin, it exists, represented by the equation $y^2(2a - x) = x^3$ is _____. [2]

a) $x = 0, x = 2a$

b) $y = 0, y = 0$

c) $x = 0, x = 0$

d) $y = x$

iii) The value of integral $\int_0^{\pi/2} \int_0^{\pi/2} \sin(x + y) \, dx dy$ is _____. [2]

a) π

b) 0

c) $\pi/2$

d) 2

P.T.O.

- Q4)** a) Trace the curve $x^2y^2 = a^2(y^2 - x^2)$ [4]
 b) Trace the curve $r = a \cos 2\theta$. [4]
 c) Show that the plane $4x - 3y + 6z - 35 = 0$ is tangential to the sphere $x^2 + y^2 + z^2 - y - 2z - 14 = 0$ and find the point of contact. [4]

OR

- Q5)** a) Trace the curve $r = a(1 + \sin\theta)$ [4]
 b) Find the Equation of the right circular cone which passing through the point $(1, 1, 2)$ has its axis at the line $6x = -3y = 4z$ and vertex at origin. [4]
 c) Find the Equation of right circular cylinder of radius 2 whose axis passes through $(1, 2, 3)$ and has direction cosines proportional to $2, -3, 6$. [4]

- Q6)** a) Evaluate $\int_{-1}^1 \int_0^{1-x} x^{1/3} y^{-1/2} (1-x-y)^{1/2} dx dy$. [6]
 b) Evaluate $\iiint \frac{dx dy dz}{(1+x+y+z)^3}$ over the volume of tetrahedron bounded by $x = 0, y = 0, z = 0, x + y + z = 1$. [6]

OR

- Q7)** a) Find the area between the curve $y^2 = 4x$ and $2x - 3y + 4 = 0$. [6]
 b) Find the centre of gravity of the area bounded by $y^2 = x$ and $x + y = 2$. [6]

- Q8)** a) Solve $\frac{dy}{dx} = \frac{x - 2y + 5}{2x + y - 1}$. [4]
 b) Solve $(xy - 2y^2) dx + (3xy - x^2) dy = 0$. [4]
 c) Solve $x^2 \frac{dy}{dx} = 3x^2 - 2xy + 1$. [4]

OR

- Q9)** a) Solve $(x^2 + y^2 + x) dx + xy dy = 0$. [4]
 b) Solve $\cos x \frac{dy}{dx} + y = \sin x$. [4]
 c) Solve $xy + x^2y^3 = \frac{dx}{dy}$. [4]

- Q10)** a) A body originally at 85°C cools to 65°C in 25 minutes, the temperature of air being 40°C , what will be the temperature of the body after 40 minutes. [4]
- b) In an electric circuit containing inductance and resistance in series with constant emf E gives the differential equation $L\frac{di}{dt} + Ri = E$. If initial current is zero, find the current at any time ' t '. [4]
- c) Find orthogonal trajectories of the family of curves $x^2 + y^2 = c$. [4]

OR

- Q11)** a) A particle of mass ' m ' is projected upward with velocity ' v '. Assuming the air resistance ' k ' times its velocity. Write the equation of motion and show that it will reach maximum height in time $\frac{m}{k} \log \left(1 + \frac{kV}{gm} \right)$. [4]
- b) The charge Q on the plate of a condenser of capacity ' C ' charged through a resistance R by a steady voltage ' V '. If $Q = 0$, at $t = 0$, find the charge as a function of ' t '. [4]
- c) A steam pipe 20 cm in diameter is protected with covering 6 cm thick for which co-efficient of thermal conductivity is $k = 0.0003 \text{ cal/cms.}$ in steady state. Find the heat loss per hour through a meter length of the pipe if the inner surface of the pipe is at 200° and the outer surface of covering is at 30°C . [4]



Total No. of Questions : 10]

SEAT No. :

PE12171

[Total No. of Pages : 2

[6581]-2402

F.E.

**PCC-151-ITT : PROGRAMMING AND PROBLEM SOLVING
(2024 Pattern) (Credit System) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and clearly state.*

- Q1)** a) Explain the importance of algorithms and programs in computer problem solving. [3]
b) List different problem solving strategies. Explain any one with an example. [3]
c) Write any four features of the python programming Language. [4]
d) Illustrate top-down design using a suitable example. [4]

OR

- Q2)** a) Write a pseudo code for swapping two numbers. [3]
b) What is problem solving? List down the difficulties for the problem solving. [3]
c) What is object oriented programming? List down its features with suitable examples. [4]
d) Explain any four python programming language applications in details.[4]

- Q3)** a) What is dictionary? Mention any two dictionary operations. [3]
b) Explain Loop with flow chart. [3]
c) What is difference between 'break' and 'continue' statement in python?[4]
d) Write a program to test whether a number entered by user is positive, negative or zero. [4]

OR

- Q4)** a) Explain use of range () function in for loop with suitable example. [3]
b) Evaluate the importance of decision control statements in program execution. [3]
c) Differentiate between if-else and if-elif-else statement. [4]
d) Demonstrate the use of tuple data type with a suitable python program.[4]

P.T.O.

- Q5)** a) Write a Lambda function to check whether a number is positive or negative. [4]
b) Explain string immutability with an example. [5]
c) Explain slice operation in strings with an example. [5]

OR

- Q6)** a) Define the chr () function. How is it different from ord()? [4]
b) Develop a python program that counts the number of vowels and consonants in a given string using iteration. [5]
c) Define function, explain function definition and function call with suitable example. [5]

- Q7)** a) How can you check the current file position in a file. [4]
b) What is file path? Differentiate between absolute path and relative path. [5]
c) Discuss file handling. List down the handling operations with examples. [5]

OR

- Q8)** a) What does the flush () method do in file handling. [4]
b) Explain the difference between read () and readlines () methods. [5]
c) Discuss the purpose of file manipulation operations like renaming and deleting. [5]

- Q9)** a) Describe the concept of data abstraction and encapsulation in object oriented programming. [4]
b) How do the _init_() and _del_() methods help in creating and cleaning up objects in python? [5]
c) Differentiate between class & object with example. [5]

OR

- Q10)** a) What is polymorphism? Give two types of polymorphism in object oriented programming. [4]
b) Discuss garbage collection in python. How does it manage memory for objects? [5]
c) Differentiate between public and private members with example. [5]

x x x

Total No. of Questions : 11]

SEAT No. :

PE-12172

[Total No. of Pages : 4

[6581]-2403

F.E.

BSC-101-BES : ENGINEERING MATHEMATICS - I
(2024 Pattern) (Semester - I)

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, Q10 or Q11.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of electronic pocket calculators is allowed.
- 6) Assume suitable data, if necessary.

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

- i) Let $f(x) = 4 - x^2$ defined on the interval $(0, 2)$. The value of a_0 in the fourier series of $f(x)$ is equal to [2]

- | | |
|-------------------|-------|
| a) $\frac{16}{3}$ | b) 8 |
| c) $\frac{8}{3}$ | d) 16 |

- ii) If $u = \log (x^2 + y^2)$ then $\frac{\partial^2 u}{\partial y \partial x}$ equals to [2]

- | | |
|--------------------------------|---------------------------------|
| a) $\frac{2x}{x^2 + y^2}$ | b) $\frac{2y}{x^2 + y^2}$ |
| c) $\frac{4xy}{(x^2 + y^2)^2}$ | d) $\frac{-4xy}{(x^2 + y^2)^2}$ |

- iii) If $u = x(1 - y)$. $v = xy$ then $\frac{\partial(u, v)}{\partial(x, y)} =$ [2]

- | | |
|------------------|------------------|
| a) y | b) x |
| c) $\frac{1}{y}$ | d) $\frac{1}{x}$ |

P.T.O.

iv) Rank of matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 6 & 6 & 6 \end{bmatrix}$ is **[2]**

- a) 0 b) 1
c) 2 d) 3

v) If A is an orthogonal matrix then [1]

- a) $A^{-1} = 0$
c) $A^{-1} = A^t$
- b) $A^{-1} = I$
d) $A^{-1} = A^2$

vi) If $A = \begin{bmatrix} 3 & 0 & 0 \\ 5 & 7 & 0 \\ 2 & 6 & 1 \end{bmatrix}$ then eigen values of matrix A^{-1} are **[1]**

- a) 3, 7, 1 b) $\frac{1}{3}, \frac{1}{7}, 1$
c) 9, 49, 1 d) 0, 0, 0

Q2) a) If $a < 1$, $b < 1$ and $a < b$ then prove that $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$ [4]

b) Expand $x^3 + 7x^2 + x - 6$ in powers of $(x-3)$. [4]

c) Find the Fourier series for the function $f(x) = x - x^3$ in the interval $-\pi \leq x \leq \pi$. [4]

OR

Q3) a) Verify the Lagrange's mean value theorem for the function $f(x) = x^2 + 3x + 2$ in $[1, 2]$. **[4]**

b) Expand $(1+x)^{1/x}$ upto the term containing x^2 . [4]

c) Obtain the half range cosine series for the function $f(x) = x^2$, $0 < x < 1$. [4]

Q4) a) If $u = \log (x^2+y^2) -\log x - \log y$, then show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ [4]

b) If $x = e^u \tan v$, $y = e^u \sec v$, then prove that

$$\left(x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}\right) \cdot \left(x \frac{\partial v}{\partial x} + y \frac{\partial v}{\partial y}\right) = 0 \quad [4]$$

c) If $u = x^2 - y^2$ and $v = 2xy$ and $z = f(u, v)$. Then prove that

$$x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y} = 2\sqrt{u^2 + v^2} \frac{\partial z}{\partial u} \quad [4]$$

OR

Q5) a) If $x = r \cos \theta$ and $y = r \sin \theta$ then prove that

$$\frac{1}{r} \left(\frac{\partial x}{\partial \theta} \right)_r + \left(\frac{\partial r}{\partial x} \right)_y = r \left(\frac{\partial \theta}{\partial x} \right)_y + \left(\frac{\partial x}{\partial r} \right)_\theta \quad [4]$$

b) If $u = \frac{x^3 + y^3}{y\sqrt{x}} + \frac{1}{x^7} \sin^{-1} \left(\frac{x^2 + y^2}{x^2 + 2xy} \right)$ then find the value of

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} \quad [4]$$

c) If $u = f(x-y, y-z, z-x)$ then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ [4]

Q6) a) If $x = uv$, $y = \frac{u+v}{u-v}$, then find the value of $\frac{\partial(u,v)}{\partial(x,y)}$. [4]

b) If $u = \sin^{-1}(x) + \sin^{-1}(y)$ and $v = x\sqrt{1-y^2} + y\sqrt{1-x^2}$, then determine whether u, v are functionally dependent? If yes, find the relation. [4]

c) If $x = u + e^{-v} \sin u$
 $y = v + e^{-v} \cos u$
 then find $\frac{\partial u}{\partial y}$ [4]

OR

Q7) a) If $u^2 + xv^2 - xy = 0$ and $u^2 + xyv + v^2 = 0$ then find $\frac{\partial u}{\partial x}$. [4]

b) Find the stationary points of the function $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ to be maximum or minimum. [4]

c) While calculating the volume of right circular cylinder, the error of 2% and 3% are made in measuring the height and radius of the base of right circular cylinder respectively. Find the percentage error in calculated volume. [4]

Q8) a) Check whether the following system of equations is consistent or not?
 $x+y-3z = -1$; $4x-2y+6z = 8$; $15x-3y+9z = 21$. [4]

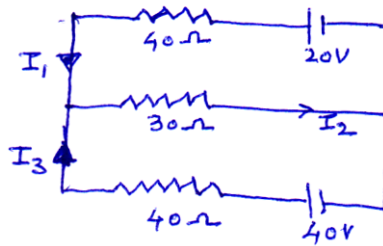
b) Examine for linear dependence. If dependent, find relation amongst

the following vectors $X_1 = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$, $X_2 = \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$, $X_3 = \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix}$ [4]

- c) Show that the matrix A is orthogonal $A = \begin{bmatrix} \cos \theta & 0 & \sin \theta \\ 0 & 1 & 0 \\ -\sin \theta & 0 & \cos \theta \end{bmatrix}$. [4]

OR

- Q9)** a) Solve the following system of equations by Matrix method.
 $x + y + z = 3$; $x + 2y + 3z = 4$, $x + 4y + 9z = 6$ [4]
 b) Examine the Linear dependence for the vectors (3, 1, 1), (2, 0, -1) and (4, 2, 1) [4]
 c) Find the current in the following network. [4]



- Q10)a)** Verify Cayley - Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$. Hence find A^{-1} if it exist. [6]

- b) Find the modal matrix P which diagonalizes matrix $A = \begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$. also write corresponding linear transformation. [6]

OR

- Q11)a)** Find eigenvalues and corresponding eigenvectors for $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$. [6]
 b) Reduce the following quadratic form to the "Sum of squares form" find the corresponding linear transformation $2x^2 + 9y^2 + 6z^2 + 8xy + 8yz + 6zx$. [6]



Total No. of Questions : 6]

SEAT No. :

PE-12172

[Total No. of Pages : 4

[6581]-2403

F.E.

BSC-101-BES : ENGINEERING MATHEMATICS - I
(2024 Pattern) (Semester - I)

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates:

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

Q1) Write the correct option for the following :

i) $\lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{\cos x}$ is equal to [2]

- | | |
|---------|----------|
| a) -1 | b) π |
| c) 0 | d) 3 |

ii) If $u = \tan^{-1} \left(\frac{x}{y} \right)$ then $u_x =$ [2]

- | | |
|--------------------------|---------------------------|
| a) $\frac{y}{x^2 + y^2}$ | b) $\frac{-x}{x^2 + y^2}$ |
| c) $\frac{1}{x^2 + y^2}$ | d) $\frac{xy}{1 + x^2}$ |

iii) If $x = r \cos \theta$, $y = r \sin \theta$ then $\frac{\partial(x, y)}{\partial(r, \theta)} =$ [2]

- | | |
|------------------|--------|
| a) θ | b) r |
| c) $\frac{1}{r}$ | d) 1 |

P.T.O.

iv) The rank of a matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$ is [2]

- a) 1 b) 2
c) 3 d) 4

v) The characteristic equation of matrix $A = \begin{bmatrix} 14 & -10 \\ 5 & -1 \end{bmatrix}$ is [2]

- a) $\lambda^2 - 15 \lambda + 25 = 0$ b) $\lambda^2 + 13 \lambda - 36 = 0$
c) $\lambda^2 - 5 \lambda + 10 = 0$ d) $\lambda^2 - 13 \lambda + 36 = 0$

Q2) Attempt any two :

- Using Lagrange's mean value theorem, prove that $\frac{b-a}{b} < \log\left(\frac{b}{a}\right) < \frac{b-a}{a}$ for $0 < a < b$. Hence show that $\frac{1}{4} < \ln\left(\frac{4}{3}\right) < \frac{1}{3}$. [5]
- Use Taylor's theorem to expand $x^3 + 7x^2 + x - 6$ in powers of $(x-3)$ [5]
- Prove that $e^{\cos x} = 1 + x + \frac{x^2}{2} - \frac{x^3}{3} - \frac{11x^4}{24} + \dots$ [5]
- Find the Fourier series to represent the function $f(x) = x^2$ in the interval $-\pi < x < \pi$ and $f(x+2\pi) = f(x)$. [5]

Q3) Solve any two :

- a) If $u = 2\log(x-y) + \log(x+y)$ then prove that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y}\right)^2 u = \frac{-4}{(x+y)^2}$. [5]
- b) If $x = u \tan(v)$, $y = u \sec(v)$, then prove that $\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial v}{\partial x}\right)_y = \left(\frac{\partial u}{\partial y}\right)_x \left(\frac{\partial v}{\partial y}\right)_x$ [5]
- c) If $u = \cos^{-1}\left(\frac{xy}{\sqrt{x^2+y^2}}\right)$ then prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -\cot(u) (\operatorname{cosec}^2(u) - 1) \quad [5]$$

- d) If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ then find the value of [5]

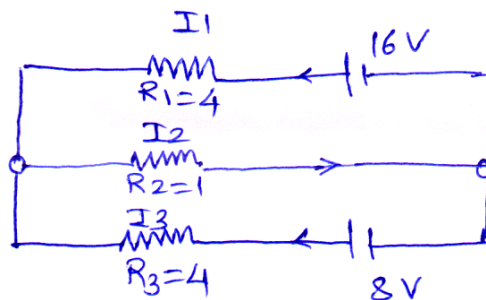
$$\frac{1}{2} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z}$$

Q4) Solve any two :

- a) If $u + v^2 = x$, $v + w^2 = y$, $w + u^2 = z$ then find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$. [5]
- b) Examine $u = \frac{x-y}{x+y}$, $v = \frac{x+y}{x}$ are functionally dependent. If so, find the relation between them. [5]
- c) Find the percentage error in the area of an ellipse when an error of 2% and 1% is made in measuring its major & minor axis respectively. [5]
- d) Discuss the maxima and minima of the function $f(x, y) = x^3 + y^3 - 3axy$. Also find the extreme values. Note that a is positive constant. [5]

Q5) Solve any two :

- a) Solve the system of equations $x + y + 2z = 0$, $x + 2y + 3z = 0$, $x + 3y + 4z = 0$. [5]
- b) Examine the following system of vectors for linear dependence. If dependent, find relation between them. $X_1 = (1, 1, 3)$, $X_2 = (1, 2, 4)$, $X_3 = (1, 0, 2)$ [5]
- c) Find the values of a , b , & c when $A = \frac{1}{9} \begin{bmatrix} -8 & 4 & a \\ 1 & 4 & b \\ 4 & 7 & c \end{bmatrix}$ is orthogonal. [5]
- d) Find the current I_1 , I_2 & I_3 in the circuit as shown in the figure. [5]



Q6) Attempt any two :

- a) Find Eigen values for the matrix A and Eigen vector corresponding to

largest eigenvalue $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ [5]

- b) Verify Cayley - Hamilton theorem for matrix A and hence find A^{-1}

$A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ [5]

- c) Find the modal matrix P which diagonalises $A = \begin{bmatrix} 5 & 3 \\ 3 & 5 \end{bmatrix}$ [5]

- d) Reduce the following quadratic form to the "sum of the squares form".
Find the corresponding Linear transformation

$Q(x) = 3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2xz$ [5]



Total No. of Questions : 6]

SEAT No. :

PE12173

[Total No. of Pages : 8

[6581]-2404

F.E.

BSC-102-BES : ENGINEERING PHYSICS
(2024 Pattern) (Credit System) (Semester - I/II)

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *Q.1 is compulsory. Attempt any one of the remaining questions.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of non-programmable electronic pocket calculators is allowed.*
- 5) *Assume suitable data, if necessary.*

Physical Constants:

- Plank's constant, $h = 6.63 \times 10^{-34}$ J.S
- Mass of electron, $m_e = 9.1 \times 10^{-31}$ Kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C

Q1) Write the correct option with answers for the following questions (1 mark each). **[10]**

- a) The propagation of light in an optical fiber is based on the principle of:
 - i) Total Internal Refraction
 - ii) Total Intervened Reflection
 - iii) Total Internal Reflection
 - iv) Through Internal Refraction
- b) The process of raising the atoms from a lower energy state to a higher one to create population inversion is called:
 - i) Pumping
 - ii) Stimulated emission
 - iii) Spontaneous emission
 - iv) Absorption
- c) The De-Broglie's wavelength of an electron is _____ to square root of accelerating potential:
 - i) Equal
 - ii) Inversely proportional
 - iii) Directly proportional
 - iv) Independent

P.T.O.

- d) The full form of STM is:
- i) Scientific technical microscope
 - ii) Scanning tunneling microscope
 - iii) Super tensile microscope
 - iv) None of the above
- e) In positive crystal the velocity of the O-ray, except optic axis is:
- i) Half of the velocity of the E-ray
 - ii) Less than the velocity of the E-ray
 - iii) Greater than the velocity of the E-ray
 - iv) None of the above
- f) If a thin film appears dark in reflected light, it will appear _____ in transmitted light as:
- i) Dark
 - ii) Bright
 - iii) Partially dark
 - iv) Invisible
- g) In intrinsic semiconductors Fermi level lies _____.
- i) Close to Valance Band
 - ii) Close to Conduction Band
 - iii) Exactly at center between valance band and conduction band
 - iv) None of the above
- h) In Hall effect, the Hall voltage develops is _____ to both Transverse Magnetic field and Current.
- i) Incline
 - ii) Parallel
 - iii) Equal
 - iv) Perpendicular
- i) The minimum magnetic field required to destroy superconductivity is called:
- i) Critical magnetic field
 - ii) Applied magnetic field
 - iii) External magnetic field
 - iv) None
- j) Physical Vapor Deposition (PVD) method is known as:
- i) Top-down method
 - ii) Chemical etching method
 - iii) Lithography method
 - iv) Bottom-up method

- Q2) a)** Solve any one.
- With a neat labeled diagram Explain construction and working of CO₂ laser. [5]
 - Define: [5]
 - Stimulated emission
 - Population inversion
 - Resonant cavity
 - Metastable state
 - Pumping
- b)** Solve any one.
- Differentiate between step index and graded index optic fibers. (Any five points). [5]
 - Define: [5]
 - Numerical Aperture,
 - Angle of acceptance, Calculate the acceptance angle and numerical aperture for an optical fiber whose core R.I. is 1.55 and cladding R.I. is 1.48.
- Q3) a)** Solve any one.
- Derive Schrodinger's time Independent wave equation. [5]
 - State properties of Matter waves. (any 3) [5]
Calculate the de-Broglie wavelength of an electron when accelerated with the P.D. of 10 KV.
- b)** Solve any one.
- Obtain relation for De-Broglie's Wavelength in terms of Kinetic Energy. Find lowest energy of an electron which is confined in a Rigid box of length 1 Å. [5]
 - With a neat diagram explain working of Scanning Tunneling Microscope. [5]
- Q4) a)** Solve any one.
- Derive the equation of path difference between reflected rays when monochromatic light of wavelength ' λ ' falls with angle of incidence ' i ' on the uniform thickness film of refractive index μ . [5]
 - Explain applications of interference: Anti-reflection coating. [5]
Fringes of equal thickness are obtained in a thin glass wedge of Refractive Index 1.52. The fringe spacing is 1 mm and wavelength of light is 5893 Å. Calculate the angle of wedge in seconds of an Arc.
- b)** Solve any one.
- Explain the Huygens's Wave Theory of Double Refraction. [5]
 - Explain the classification of the solids into conductors, semiconductors and insulators on the basis of band theory of solids with neat Diagrams. [5]

Q5) a) Solve any one.

i) Draw neat labelled Energy Band diagram in following modes for PN junction diode. [5]

1) Reverse biased mode

2) Forward biased mode

ii) Explain production of ultrasonic waves by piezoelectric method.[5]

b) Solve any one.

i) What are Ultrasonics? Give any two the properties of Ultrasonic waves. An ultrasonic pulse is sent through a block of copper. The echo pulse is recorded after $5\mu\text{s}$. If the velocity of ultrasonic in copper is 5500 m/s, calculate the thickness of the copper block.[5]

ii) Explain the following properties of Nano Particles. [5]

1) Mechanical Property

2) Electrical Property

Q6) a) Solve any one.

i) Explain the applications of Nano technology in. [5]

1) Targeted Drug delivery and

2) Automobile field

ii) Distinguish between types of superconductors. (Minimum 5 points) [5]

b) Solve any one.

i) Explain electrical and optical properties of nanoparticles. [5]

ii) Explain what is Meissner effect? [5]

The critical temp. For lead is 7.2 K. However at 5 K it loses its superconductivity when subjected to a magnetic field of $3.3 \times 10^4 \text{ A/m}$. Find the maximum value of critical magnetic field which will allow to retain its superconductivity at 0 K.



Total No. of Questions : 11]

PE12173

[6581]-2404

F.E.

**BSC-102-BES : ENGINEERING PHYSICS
(2024 Pattern) (Credit System) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Q.1 is compulsory.*
- 2) *Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9 and Q.10 or Q.11.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Assume suitable data, if necessary.*

Physical Constants:

- Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
- Charge on electron, $e = 1.6 \times 10^{-19}$ C
- Planck's constant, $h = 6.63 \times 10^{-34}$ J-sec

Q1) Choose the correct answer and rewrite it.

[10]

- a) Carbon dioxide laser emits wavelength in _____.
 - i) Visible region
 - ii) Ultraviolet region
 - iii) Infrared region
 - iv) None of the Above
- b) In optical fiber, acceptance cone is _____ the acceptance angle.
 - i) Equal
 - ii) Double
 - iii) Half
 - iv) One Third
- c) The mater waves are _____.
 - i) Electromagnetic waves
 - ii) Mechanical Waves
 - iii) Ultrasonic waves
 - iv) Neither Electromagnetic nor Mechanical Waves
- d) Wave function Ψ of a particle is
 - i) A real quantity
 - ii) A complex quantity
 - iii) An imaginary quantity
 - iv) None of these

- e) The points of constructive interference of light are,
- i) Always bright ii) May be bright or dark
 - iii) Always dark iv) Neither bright nor dark
- f) The Plane-polarized light, vibrations of particles in medium are in the direction to direction propagation of light.
- i) Inclined ii) Perpendicular
 - iii) Antiparallel iv) None
- g) The energy band gap size for semiconductors is in the range _____ eV.
- i) 1-2 ii) 0
 - iii) 3-4 iv) >4
- h) The Frequency range for ultrasonic is
- i) less than 20Hz ii) 20 Hz to 20 KHz
 - iii) Greater Than 20 KHz iv) None of the above
- i) The minimum magnetic field required to destroy superconductivity is called _____
- i) Critical magnetic field iii) Applied magnetic field
 - iii) External magnetic field iv) None
- j) Nanotechnology studies for the size of particles
- i) 100-1000 nm ii) More than 100 nm
 - iii) 1-100 nm iv) None

- Q2)** a) With the help of an energy level diagram, explain the construction and working of CO₂ laser. [6]
- b) Differentiate between step index and graded index fibers. (Any three points). [3]
- c) Calculate the numerical aperture and acceptance angle of an optical fiber having $n_1 = 1.48$ and $n_2 = 1.45$. [3]

OR

- Q3)** a) What is attenuation in optical fibers? Discuss in brief the various internal and external factors responsible for attenuation. [6]
- b) State characteristics of a laser. Explain any one of them in brief. [3]
- c) What is stimulated emission? Explain its significance in the production of lasers. [3]

- Q4)** a) Starting from de Broglie equation, derive Schrodinger's Time Independent wave equation. [6]
- b) State de Broglie hypothesis. Derive the equation of de Broglie wavelength by analogy with radiation. [3]
- c) Lowest energy of an electron trapped in potential well is 38 eV. Calculate the width of well. [3]

OR

- Q5)** a) For a particle trapped in a one-dimensional rigid box, derive the equation for its energy. [6]
- b) Differentiate between classical and quantum computing (any three). [3]
- c) Compute the wavelength of the De Broglie waves associated with a proton moving at 5% of the velocity of light. Proton has 1856 times the mass of one electron. (Given: $m_e = 9.1 \times 10^{-31}$ kg, $c = 3 \times 10^8$ m/s). [3]

- Q6)** a) For a thin parallel film derive an expression for the effective path difference in the reflected system. Obtain the condition of maximum and minimum. [6]
- b) Differentiate between positive and negative crystal. [3]
- c) Obtain the intensity of light transmitted by the analyzer if the angle between the polarizer and analyzer is 45°. [3]

OR

- Q7)** a) What is double refraction? Explain Huygens' theory of double refraction. [6]
 b) Explain the application of interference as an antireflection coating. [3]
 c) The wedge-shaped film with a refractive index of 1.5, is illuminated by the light of wavelength $5890\text{\AA}$, If the angle of the wedge is 30 seconds, Calculate the fringe width. [3]

- Q8)** a) State and explain Hall effect. Derive the equation of Hall voltage and Hall coefficient. [6]
 b) What are ultrasonic waves? State characteristics of ultrasonic wave, (any four) [3]
 c) An ultrasonic pulse is sent through a steel block, an echo is recorded after 1.512 microseconds, calculate the thickness of steel block if the velocity of ultrasonic waves is 5900 m/s. [3]

OR

- Q9)** a) What is an echo sounding technique? Using this technique explain the method for flaw detection using ultrasonic waves. [6]
 b) Define Fermi level for metal. Write the formula for Fermi-Dirac distribution function and explain terms involved in it. [3]
 c) In a semiconductor with a Hall coefficient of $145\text{ cm}^3/\text{C}$ having a width of 2 cm and a thickness 0.2 cm with a magnetic field induction of 2T along the smaller dimension with a current of 150 mA. Calculate hall voltage. [3]

- Q10)** a) Explain the process of manufacturing nanoparticles using Physical Vapor Deposition. State advantages and limitations of this method. [6]
 b) What is Critical magnetic field? Write its equation and explain the terms involved in it. A superconductor has a critical temperature of 3.7 K. At 0 K the critical magnetic field is 0.0306 Tesla. What is the critical magnetic field at temperature 2 K. [6]

OR

- Q11)** a) Explain the Meissner effect. What is the cause of the Meissner effect? Show that superconductors exhibit perfect diamagnetism. [6]
 b) Explain electrical and optical properties of nanoparticles. [6]



Total No. of Questions : 11]

SEAT No. :

PE-12174

[Total No. of Pages : 4

[6581]-2405

F.E

**BSC-103-BES : Engineering Chemistry
(2024 Pattern) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) Q. No. 1 is compulsory.
- 2) Solve Q2, or Q3 Q4 or Q5 Q6, or Q7 Q8 or Q9 Q10 or Q11.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Assume suitable data, if necessary.
- 6) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

Q1) Multiple Choice Questions.

- i) Zeolite is regenerated by washing Zeolite bed with solution of _____ [1]
 - a) NaCl
 - b) $MgCl_2$
 - c) HCl
 - d) $CaCl_2$
- ii) A semipermeable membrane allows the flow of _____ [1]
 - a) Solvent molecules
 - b) Solute molecules
 - c) Both solute & solvent molecules
 - d) Neither solute & solvent molecules
- iii) Calomel electrode is made by using _____ [1]
 - a) Hg with mercurous chloride
 - b) Zn with mercurous chloride
 - c) Mg with mercurous chloride
 - d) Ca with mercurous chloride
- iv) The ratio of specific conductance to that of observed conductance is called as _____ [1]
 - a) Specific resistance
 - b) Molar conductance
 - c) Equivalent conductance
 - d) Cell constant
- v) Quantum dot is _____ nanomaterial. [1]
 - a) Zero dimensional
 - b) One dimensional
 - c) Two dimensional
 - d) Three dimensional

P.T.O.

- vi) Biopol is a trade name of _____ [1]
 a) Polylactic acid
 b) Polyacetylene
 c) Polycarbonate
 d) Poly (hydroxy butyrate - hydroxyvalerate)
- vii) Power alcohol is _____ blended with petrol. [1]
 a) Water
 b) Kerosene
 c) Ethanol
 d) Benzene
- viii) Lithium ion battery uses _____ as an anode. [1]
 a) Copper
 b) Aluminium
 c) Porous carbon
 d) Zinc
- ix) Corrosion between dissimilar metals is called as _____. [1]
 a) Galvanic corrosion
 b) Dry corrosion
 c) Oxidation corrosion
 d) Concentration cell corrosion
- x) An example of anodic coating is _____ on iron metal. [1]
 a) Zinc
 b) Chromium
 c) Nickel
 d) Copper

- Q2)** a) Define Temporary & Permanent hardness of water. Explain the process for determination of total hardness with suitable chemical reactions involved. [6]
 b) Give the principle of electrodialysis & draw neat labelled diagram. [3]
 c) A water sample was non alkaline to phenolphthalein. However 50 ml of alkaline water sample on titration with 0.02 N H_2SO_4 required 10.5 ml to get methyl orange end point. Find types & amount of alkalinities in water. [3]

OR

- Q3)** a) What are scales & sludges? Explain any 3 causes & enlist any 2 disadvantages of scales in boilers. [6]
 b) Give exchange reactions with zeolite if water contains salts like CaCl_2 , MgSO_4 , $\text{Ca}(\text{HCO}_3)_2$. [3]
 c) 25 ml hard water consumed 8.5 ml 0.01 M of EDTA where as 25 ml of boiled water consumed 5 ml of same EDTA. Calculate Total, permanent & temporary hardness of above water sample. [3]

- Q4)** a) Explain various stages of conductometric titration for strong acid and strong base with titration curve & reaction involved in it. Also write any 2 applications of conductometry. [6]
- b) Draw a labelled diagram of glass electrode. Write its cell representation & give any 2 advantages. [3]
- c) Define - [3]
- i) Auxochrome
 - ii) Chromophore
 - iii) Bathochromic shift

OR

- Q5)** a) With the help of energy diagram, explain different types of transitions with suitable example, involved in organic molecule after absorbing UV radiations. [6]
- b) Which electrodes are used in pH metric titration? Explain the process for calibration of pH meter. [3]
- c) What are ion selective electrodes? Give construction & diagram of ion selective electrode for fluoride ion determination. [3]
- Q6)** a) What are carbon nanotubes? Discuss different types of carbon nanotubes w.r.t. their structure. [6]
- b) Compare polymers on the basis of action of heat. [3]
- c) Give the reaction involved in preparation of polycarbonate. Write any 2 applications of it. [3]

OR

- Q7)** a) What is conducting polymer? What are structural requirements of conducting polymers? Explain P-doping & n-doping with reactions. [6]
- b) What are nanomaterials? Classify on the basis of dimensions w.r.t. example (any 2). [3]
- c) Explain the structure of graphene with diagram. Write any 2 applications of it. [3]

- Q8)** a) Draw a neat labelled diagram & give construction, working of Bomb calorimeter to determine GCV of a fuel. State the formula for GCV & NCV of a solid fuel. [6]
- b) Explain the process with formula to calculate % C & % H by ultimate analysis of coal. [3]
- c) 1 gm of coal was heated for 1 hr at 110° c, weight of residue was 0.9 gm. The crucible then heated to a constant weight of 0.02 gm. In another expt. 1 gm of sample was heated at 925°c, 7 min, the weight of residue was 0.40 gm. Calculate % of fixed carbon present in coal. [3]

OR

- Q9)** a) What is biodiesel? Give preparation reaction of biodiesel. Write any 4 advantages & any 2 limitations. [6]
- b) Explain hydrogen production by steam reforming of coke with reaction conditions. Give process of CO₂ removal. [3]
- c) The following data was obtained in Boy's gas calorimeter experiment
Volume of gas burnt at STP = 0.1m³
Mass of cooling water = 30 kg
Temperature of water inlet & water outlet = 22°c & 30°c resp.
Mass of condensed steam = 0.08 kg.
Calculate GCV & NCV of the fuel [3]
- Q10)** a) Explain hydrogen evolution & oxygen absorption mechanism of wet corrosion. [6]
- b) i) Explain the process of cathodic protection using sacrificial anode with diagram. [3]
- ii) What are anti corrosive paints? Give any 4 advantages using nanoparticles in paints. [3]

OR

- Q11)** a) Describe Galvanising & Tinning with suitable diagram. [6]
- b) i) Explain any 3 factors affecting rate of corrosion w.r.t. nature of environment. [3]
- ii) Give the reaction & type of oxide film formed in the oxidation of Na & Cr metal. [3]



Total No. of Questions : 6]

SEAT No. :

PE-12174

[Total No. of Pages : 4

[6581]-2405

F.E

**BSC-103-BES : Engineering Chemistry
(2024 Pattern) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates :

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Assume suitable data, if necessary.*

Q1) Multiple Choice Questions.

[10]

- i) Which of the following is an example of suspended impurities in water?
 - a) Dissolved Salt
 - b) Bacteria
 - c) CO₂
 - d) Clay and mud
- ii) The process of removing dissolved ionic impurities from water by passing a direct current using electrodes and ion selective membrane pairs is called as ____
 - a) Osmosis
 - b) Electrodialysis
 - c) Reverse osmosis
 - d) Distillation
- iii) The resistance offered by a cube of unit length to the passage of electricity through it is called ____
 - a) Specific resistance
 - b) Specific conductance
 - c) Resistance
 - d) Conductance
- iv) When absorption maxima of a compound shifts to longer wavelength, it is known as ____
 - a) Bathochromic shift
 - b) Hyperchromic shift
 - c) Hypsochromic shift
 - d) Blue shift
- v) Polymers that do not become soft on heating and hard on cooling are ____
 - a) Thermosetting polymer
 - b) Thermoplastic polymer
 - c) Thermo elastic polymer
 - d) Thermotropic polymer

P.T.O.

- vi) Applications of Quantum dots are _____
- a) Light emitting diode b) Photo detectors
c) Biological analysis d) All of these
- vii) Biodiesel is obtained from vegetable oil by process called as _____
- a) Oxidation b) Reduction
c) Transestrification d) Hydrogenation
- viii) Calorific value of gaseous fuel is determined by _____
- a) Boys gas calorimeter b) Bomb calorimeter
c) Calorimeter d) Junkers calorimeter
- ix) Example of anodic coating is _____
- a) Cu on Fe b) Zn on Fe
c) Ag on Fe d) Sn on Fe
- x) Electrolyte used for electroplating of copper on iron is _____
- a) NaOH b) KOH
c) CuSO_4 d) ZnSO_4

Q2) Solve any 2 :

- a) Explain the zeolite process for water softening with a neat diagram. Give exchange and regeneration reactions and any two disadvantages. [5]
- b) Define scale. Explain any three causes of scale formation. List down any two disadvantages of scale formation. [5]
- c) i) A 50 ml water sample requires 12.6 ml of 0.02 M EDTA for the end point. The same volume of boiled water requires 7.3 ml of 0.02 M EDTA. Calculate the total hardness, permanent hardness and temporary hardness of the water sample. [3]
- ii) Define - Hard water and soft water. [2]
- d) A 25 ml water sample requires 5.4 ml of 0.025 N HCl up to phenolphthalein end point and 8.7 ml of 0.025 N HCl upto the methyl orange end point. Calculate the types and amount of alkalinity present in the water sample. [5]

Q3) Solve any 2 :

- a) Explain the construction of a calomel electrode with a neat labeled diagram and give its electrode representation and two disadvantages. [5]
- b) Describe any Four factor affecting conductance. Give any Two applications of conductometry. [5]
- c) Explain the various stages of pH metric titration of a strong acid with a strong base. Draw the titration curve and write the reaction involved.[5]
- d) Draw diagram of double beam UV - visible spectrophotometer and state the function of any three components of UV - visible spectrophotometer. [5]

Q4) Solve any 2 :

- a) What are conducting polymers? Explain the structural requirements of conducting polymer. Describe any one process of doping in polymer.[5]
- b) Give the preparation of polycarbonate. Write any three properties and three applications of polycarbonate. [5]
- c) Define Nanomaterial. Explain the classification of nanomaterials based on dimension. [5]
- d) Explain the structure of Grapheme with the help of neat diagram. Mention any two properties and any two applications of Grapheme. [5]

Q5) Solve any 2 :

- a) Explain the working of Bomb calorimeter with diagram for determination of GCV of solid fuel. Give the formula for GCV. [5]
- b) Write the chemical reactions involved in the production of Ethanol. State any Four advantages and any two disadvantages of power alcohol. [5]
- c) 1.50 gm of coal sample was heated in silica crucible at 110°C for 1 hour. The weight of the residue was 1.43 gm. The residue was then heated in a crucible covered with a vented lid for exactly 7 minutes at 950°C. The residue weighted 1.03 gm. The crucible was then heated without lid to a constant weight of 0.18 gm. Calculate % moisture, volatile matter, ash and fixed carbon. [5]
- d) 0.25 gm of coal sample on burning in a combustion chamber in a current of oxygen increased the weight of KOH u. tube by 0.69 gm and CaCl_2 u tube by 0.18 gm. Find % C and % H in coal.
The same coal sample in determination of sulphur gave precipitate of BaSO_4 weighing 0.12 gm calculate % S in coal. [5]

Q6) Solve any 2 :

- a) What is pilling Bedworth ratio? Give its significance. Give the chemical reaction and nature of oxide films formed due to oxygen on metals Na and Al. [5]
- b) What is the principle of cathodic protection? Explain Cathodic protection by the sacrificial anode with diagram for corrosion protection. Give its two applications. [5]
- c) What is wet corrosion? Explain the hydrogen evolution mechanism of wet corrosion with a neat labeled diagram. [5]
- d) Explain any five factors affecting the rate of corrosion. [5]



Total No. of Questions : 10]

SEAT No. :

PE-12175

[Total No. of Pages : 4

[6581]-2406

F.E.

**ESC-101-ETC : Basic Electronics Engineering
(2024 Pattern) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 60

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 and Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator is allowed.

- Q1)** a) Recognize the Impact of Electronics on industry and society? [6]
b) Draw circuit diagram and explain operation of Bridge Rectifier with the help of neat waveforms? [6]

OR

- Q2)** a) Draw circuit diagram and explain operation of Half-Wave Rectifier with the help of neat waveforms? [6]
b) Draw V-I characteristics of P-N Junction Diode and define these parameters. [6]
i) Barrier Potential
ii) Reverse Breakdown Voltage
iii) Reverse saturation current

- Q3)** a) Draw the construction diagram and explain the operation of Enhancement type N-channel MOSFET in detail? [6]
b) Define Current Gain, α , β and γ . Determine the dc current gain β (Beta) and the collector current I_C for a transistor where $I_B = 20\mu A$ and $I_E = 2 mA$. [6]

OR

- Q4)** a) Draw the construction diagram and explain the operation of Enhancement type P-channel MOSFET in detail? [6]
b) Draw the V-I Characteristics of BJT in common emitter configuration and explain in detail? [6]

P.T.O.

- Q5)** a) Classify the different types of Logic Gates? Draw and explain any two Logic gates with its truth table & logic equation. [6]
b) Convert: $(1101.101)_2$ into $(--)__{10}$ and $(35.56)_{10}$ into $(--)_2$ [6]
State the binary addition rule and Perform the addition of $(110101)_2$ & $(0101)_2$

OR

- Q6)** a) Draw & Explain Half adder and Full adder Circuit using basic logic gates with truth table. [6]
b) Draw the block diagram of Microprocessor and explain the functions of each block in detail. [6]
- Q7)** a) Draw the block diagram of Digital Multimeter. Explain the function of each block. [6]
b) Summarize an Ideal characteristic of Op-Amp and mention the practical values of each one. [6]

OR

- Q8)** a) Draw the block diagram of Function Generator. Explain the function of each block. [6]
b) Explain Non inverting amplifier using op-amp in detail. And If $R_1 = 1k\Omega$ and $R_f = 10k\Omega$ with $V_{cc} = \pm 12V$ applied, $V_{in} = 200mV$. Calculate Voltage gain and Output Voltage. [6]
- Q9)** a) What are the different Selection criteria used while selecting the sensors for particular application? [6]
b) Provide a table of Electromagnetic Frequency Spectrum with their applications. [6]

OR

- Q10)** a) Describe the Block diagram of IoT based Data Acquisition and Automation System. [6]
b) Describe the Basic block diagram of Communication System. [6]



Total No. of Questions : 10]

PE-12175

[6581]-2406

F.E.

**ESC-101-ETC : Basic Electronics Engineering
(2024 Pattern) (Semester - I/II)**

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 and Q.9 or Q.10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Use of electronic pocket calculator is allowed.

Q1) a) Draw V- I characteristics of P-N Junction Diode and define these parameters. **[5]**

- i) Cut-in Voltage
- ii) Reverse saturation current
- iii) Reverse Breakdown Voltage

b) Draw circuit diagram and explain operation of half Wave Rectifier with the help of neat waveforms? **[5]**

c) Compare P-N Junction Diode and LED in detail. **[4]**

OR

Q2) a) Draw circuit diagram and explain operation of Full-Wave Bridge Rectifier with the help of neat waveforms? **[5]**

b) Recognize the Impact of Electronics on industry and society? **[5]**

c) Compare Active and Passive Components in detail. **[4]**

Q3) a) What is N-Well method of VLSI CMOS manufacturing, Explain in detail. **[5]**

b) Draw the construction diagram and explain the operation of Enhancement type N-channel MOSFET in detail? **[5]**

c) Compare BJT and MOSFET in detail. **[4]**

OR

Q4) a) Draw the construction diagram and explain the operation of Enhancement type P-channel MOSFET in detail? **[5]**

b) Draw the V-I Characteristics of BJT in common emitter configuration and explain in detail? **[5]**

c) Define transistor. Determine the dc current gain β (Beta) and the emitter current I_E for a transistor where I_B 40 μ A and I_C 3.4 mA. **[4]**

- Q5)** a) Classify the different types of Logic Gates? Draw and explain any two Logic gates with its truth table & logic equation. [5]
 b) Draw the block diagram of Microprocessor and explain the functions of each block in detail. [5]
 c) Convert : [4]
 i) $(11101010)_2$ into $(-----)_{10}$
 ii) $(25.625)_{10}$ into $(----)_2$
 iii) $(78.33)_{10}$ into $(----)_2$
 iv) $(1101.11)_2$ into $(----)_{10}$

OR

- Q6)** a) State and Prove De-Morgan's Theorem. [5]
 b) Draw & Explain Full adder Circuit using basic logic gates with truth table. [5]
 c) Compare Microprocessor and Microcontroller in detail. [4]
- Q7)** a) Draw the Functional block diagram of operational amplifier and explain in detail. [5]
 b) Draw the block diagram of Digital Multi-meter. Explain the function of each block. [5]
 c) Summarize an Ideal characteristic of Op-Amp. [4]

OR

- Q8)** a) Draw the block diagram of Function Generator. Explain the function of each block. [5]
 b) Draw the block diagram of Regulated DC power supply and explain in detail. [5]
 c) For Non-inverting amplifier using op-amp, If $R_1 = 1k\Omega$ and $R_f = 10k\Omega$ with $V_{ec} = \pm 12$ V applied, Calculate Close loop Gain and Output Voltage, if $V_{in} = 100$ mV. [4]

- Q9)** a) What is the different Selection criteria used while selecting the sensors for particular application? [5]
 b) Provide a table of Electromagnetic Frequency spectrum with their applications. [5]
 c) Give detail comparison of Active Sensors and Passive Sensors. [4]

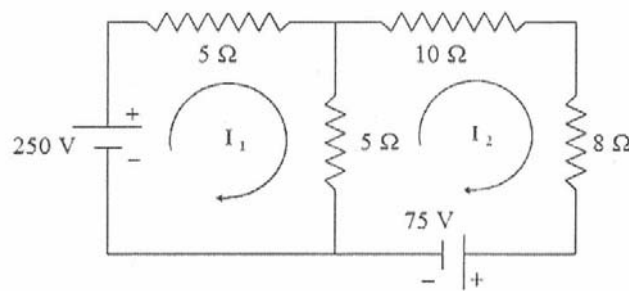
OR

- Q10)** a) Describe the Basic block diagram of Communication System. [5]
 b) Describe the Block diagram of GSM. [5]
 c) Describe the Block diagram of IoT based Data Acquisition and Automation System. [4]

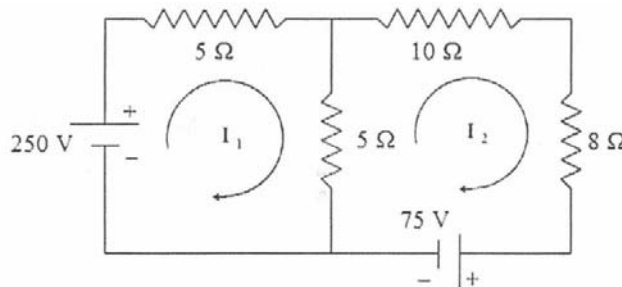


[6581]-2407**F.E.****ESC-102-ELE : Basic Electrical Engineering
(2024 Pattern) (Semester - I/II)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates :**

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 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) Find current through 8 Ohm resistance using KVL**[6]**

- b) Explain typical power system with neat block diagram. Mention voltage levels of every section. **[8]**

OR**Q2) a) Find current through 8 Ohm resistance using Super position theorem [6]**

- b) Derive the formulae for conversion of delta to equivalent star connected network. Draw neat circuit diagram. **[8]**

P.T.O.

- Q3)** a) A steel ring of 175 cm mean diameter has a cross - sectional area of 250 mm². Flux developed in the ring is 500 μwb when 3500 turns coil carries certain current. Assuming μ_r of steel to be 1250. [6]

Find i) mmf required ii) reluctance iii) current

- b) Define magnetic circuit. State any 04 similarities and any 02 dissimilarities with electrical circuit. [8]

OR

- Q4)** a) Define reluctance. Write formula and its unit. State the formula for reluctance magnetic circuit i) having only iron path ii) having iron path & one air gap. [6]

- b) With usual notation derive the formula for self-induced emf. Enlist the factors affecting self- inductance. [8]

- Q5)** a) If $A = 25 + j 35$, $B = 30 < 40$ and $C = j 15$ [6]

Find i) $A + B - C$ ii) $AB - C$ iii) $A + BC$

- b) Define average value of an alternating quantity. Obtain an expression for average value in terms of maximum value. [8]

OR

- Q6)** a) An AC voltage of $v = 250 \sin (314.16t)$ applied to a pure capacitance of 125 μF. [6]

i) Write equation for current

ii) Draw phasor diagram

iii) Average power consumed.

- b) When voltage $v = V_m \sin (\omega t)$ is applied to purely inductive circuit.[8]

i) Derive current equation

ii) State instantaneous power equations

iii) Draw the phasor diagram.

Q7) a) A coil having resistance of $7\ \Omega$ and an inductance of $31.8\ \text{mH}$ is connected to single phase 230V $50\ \text{Hz}$ AC supply. **[6]**

Calculate

- i) Impedance
 - ii) Current through circuit
 - iii) Power factor
 - iv) Power consumed
 - v) Voltage drop across resistance and inductor
- b) What is series resonance? Derive the expression for resonance frequency. Draw phasor diagram for resonance condition. **[8]**

OR

Q8) a) Each phase of star connected load has an impedance $25 + j40\ \Omega$ connected across 3 phase $415\ \text{V}$ $50\ \text{Hz}$ supply. **[6]**

Find i) Phase and line current ii) All powers

- b) Derive formula for relation between phase voltage and line voltage in delta connected resistive load. State formulae for all powers in terms of only line parameters. **[8]**

Q9) a) An $80\ \text{KVA}$ $1000 / 250\ \text{V}$ $50\ \text{Hz}$ 1- phase transformer has iron loss of $800\ \text{watt}$ and full load copper loss of $1200\ \text{watt}$. **[6]**

Estimate i) Efficiency at full load 0.8 power factor

ii) Efficiency at half load unity power factor

- b) Compare between core and shell type of single-phase transformers **[8]**

OR

Q10) a) Explain the working principle of 3 phase squirrel cage induction motor. State any two applications. **[6]**

- b) Explain the construction and working principle of DC shunt motor with suitable diagram. State any two applications of it. **[8]**



[6581]-2407

F.E.

ESC-102-ELE : Basic Electrical Engineering
(2024 Pattern) (Semester - I/II)

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates :

- 1) Attempt any one from Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.
- 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 generation, transmission and distribution of electricity with the help of neat labeled single line diagram. [6]
- b) Find out current in the $1\ \Omega$ resistance in Fig. 1 by using Kirchhoff's loop current analysis. [6]

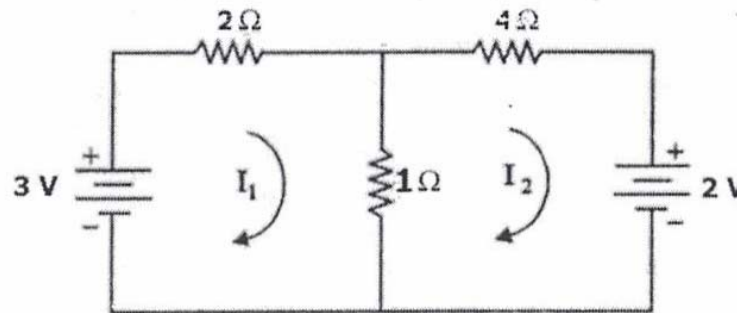


Fig. 1

OR

- Q2)** a) Derive the equations to convert delta connected resistive network into equivalent star connected network. [6]
- b) Find out current in the $1\ \Omega$ resistance in Fig. 1 by using superposition theorem. [6]

P.T.O.

- Q3)** a) Compare electric circuit with magnetic circuit by mentioning their similarities & dissimilarities. [6]
- b) Two coils have 200 and 100 turns respectively wound on magnetic circuit with cross sectional area of 5 cm^2 . They have current of 2A and 0.5A flowing in it respectively and producing 1 mili-weber flux in each coil. The coefficient of coupling between them is 0.8. Calculate the self-inductance of each coil and mutual inductance between them. [6]

OR

- Q4)** a) Define self-inductance in two ways. Also state the factors on which self- inductance depends. [6]
- b) Derive the expression for coefficient of coupling between two coils.[6]
- Q5)** a) Define average value and derive an expression for average value of sinusoidal current in terms of its peak value. [6]
- b) An alternating current of pure sine wave has peak value 14. 14A and frequency of 50Hz. Find the instantaneous value of current at 4 milli-seconds and 8 milli-seconds. Also show these values on current waveform. [6]

OR

- Q6)** a) Derive the mathematical expression for the current flowing through a pure capacitor when connected to an AC supply. Support your answer with : [6]
- i) A neatly labelled circuit diagram
- ii) A phasor diagram
- iii) Waveforms of voltage and current
- b) Single phase, 230V, 50Hz AC supply is connected to 30 milli-henry pure inductor. Draw circuit diagram and phasor diagram. Calculate. [6]
- i) Inductive reactance
- ii) Current
- iii) Power factor
- iv) Power consumed

- Q7)** a) Draw impedance triangles for RL and RC series circuit. Also, express impedance in rectangular and polar form in both cases. [6]
b) Single phase, 230V, 50Hz AC supply is connected to series circuit with resistance of 30 ohm and capacitive reactance of 40 ohm. Calculate [6]
i) Impedance
ii) Current
iii) Power factor angle
iv) Power factor
v) Power consumed. Also draw phasor diagram

OR

- Q8)** a) With the help of suitable circuit diagram and phasor diagram, derive relationship between line current and phase current in delta connected balanced R-L load supplied by symmetrical three phase AC supply. [6]
b) Three phase, 400V, 50Hz AC supply is connected to star connected three phase load having series circuit consisting of resistance of 8 ohm and inductive reactance of 6 ohm in each phase. Calculate [6]
i) Impedance per phase,
ii) Phase voltage
iii) Phase current
iv) Power factor
v) Active power
vi) Reactive Power
- Q9)** a) State different types of losses taking place in transformer along with mathematical equations. In which part do these losses take place. How these losses can be minimized. [6]
b) A 5 kVA, 3000V/200V, 50 Hz single phase transformer has cross sectional area of 150 cm² for the core. If the number of turns of low voltage winding are 80, then calculate [6]
i) Number of turns of high voltage winding
ii) Maximum value of flux density in core
iii) Secondary full load current

OR

- Q10)** a) Describe working principle of three phase induction motor by using rotating magnetic field theory. State two applications of squirrel cage induction motor and slip ring induction motor. [6]
b) Explain working of split phase type of single-phase induction motor with the help of circuit diagram. State the function of centrifugal switch and auxiliary winding in it. Also write any two applications of this motor. [6]



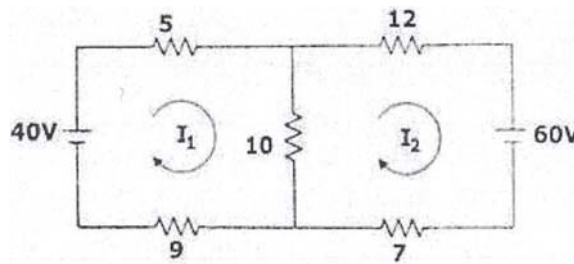
[6581]-2407-CR

F.E.

**ESC-102-ELE : BASIC ELECTRICAL ENGINEERING
(2024 Pattern) (Semester - I & II)****Time : 2½ Hours]****[Max. Marks : 70****Instructions to the candidates:**

- 1) Attempt any one from Q1 OR Q2, Q3 OR Q4, Q5 OR Q6, Q7 OR Q8, Q9 OR Q10.
- 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.

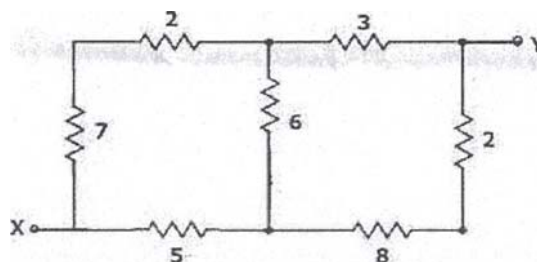
- Q1) a)** Find the current flowing through 10 ohm resistance using Kirchhoff's loop current method. **[6]**



- b) Explain with suitable diagram **[8]**
- i) Linear network
 - ii) Nonlinear network
 - iii) Lumped network
 - iv) Distributed network.

OR

- Q2) a)** Find the equivalent resistance between terminals X and Y. All resistances are in ohm. **[6]**



- b) State and explain Superposition theorem with the help of suitable example. **[8]**

P.T.O.

Q3) a) A coil of 1480 turns is wound uniformly on an iron ring of mean circumference 500 cm and cross-sectional area of 8 cm². A current of 3A is passed through the coil. The iron ring has the relative permeability of 1200. Calculate [6]

- i) Magnetomotive force
 - ii) Magnetic field strength
 - iii) Magnetic flux density
 - iv) Reluctance of the iron ring
- b) Define self-inductance and derive the expression for Energy stored in magnetic field. [8]

OR

Q4) a) Obtain an expression for coefficient of coupling between two magnetically coupled coils. [6]

- b) Derive the expression for mutually induced EMF in terms of mutual inductance. Also state any three factors affecting value of mutual inductance. [8]

Q5) a) If $\bar{V}_1 = 12 + j15$ and $\bar{V}_2 = 8 - j6$ then find the results of following mathematical operations in polar form [6]

i) $\bar{V}_1 + \bar{V}_2$

ii) $\bar{V}_1 - \bar{V}_2$

iii) $\bar{V}_1 \times \bar{V}_2$

iv) $\frac{\bar{V}_1}{\bar{V}_2}$

- b) Define the RMS value and derive an expression for RMS value in terms of maximum value for sinusoidally varying alternating current.[8]

OR

Q6) a) A pure inductor having inductance of 200mH is connected across a 230 V, 50 Hz single phase AC supply. Determine [6]

- i) Inductive reactance
 - ii) RMS and maximum value of current
 - iii) Equation for instantaneous value of current
- b) Derive the expression for instantaneous and average power in case of purely resistive circuit. Also draw the waveforms for voltage, current and instantaneous power. [8]

- Q7) a)** Resistance of 20 ohm and Capacitance of 50 μ F are connected in series across 230 V, 50 Hz single phase AC supply. Calculate [6]
- Capacitive reactance
 - Impedance
 - Current
 - Active power
- b)** Draw phasor diagram for following cases for R-L-C series circuit [8]
- $X_L > X_C$
 - $X_L < X_C$
 - $X_L = X_C$

OR

- Q8) a)** A three-phase delta-connected load, with impedance of $Z_{ph} = (25+j40)\Omega$ is fed from a three-phase 440 V, 50 Hz supply, Calculate : [6]
- Phase current
 - Line current
 - Power factor
 - Total active power
- b)** Define the following terms related with three phase AC circuit [8]
- Phase Sequence
 - Symmetrical system
 - Balanced load
 - Unbalanced load
- Q9) a)** A 10 kVA 220/440V, 50Hz, single phase transformer has primary and secondary resistance of 0.42 Ω and 0.84 Ω respectively. The eddy current loss in core is 310W and hysteresis loss in the core is equal to 380W. Calculate [6]
- Total iron losses
 - Total copper losses on full load
 - Efficiency at 80% of the full load at 0.8 p.f leading
- b)** List the different types of electrical Motors. Explain working principle of 3 phase induction motor. [8]

OR

- Q10)** a) Derive the EMF equation of single-phase transformer. [6]
- b) Draw the sectional view of the DC motor. Explain in detail the functions of any four parts of the DC motor. [8]



Total No. of Questions : 10]

SEAT No. :

PE-12242

[Total No. of Pages : 4

[6581]-2407-CR

F.E.

**ESC-102-ELE : BASIC ELECTRICAL ENGINEERING
(2024 Pattern) (Semester - I & II)**

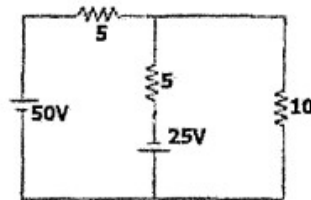
Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates:

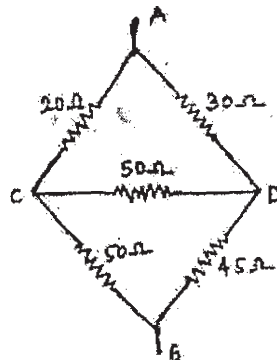
- 1) Attempt any one from Q1 OR Q2, Q3 OR Q4, Q5 OR Q6, Q7 OR Q8, Q9 OR Q10.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable additional data, if necessary.
- 5) Use of non-programmable calculator is allowed.

- Q1)** a) Define active network and passive network. Also state and explain Kirchhoff's Laws. [6]
- b) Find the current flowing through $10\ \Omega$ resistance by using Superposition theorem. (All resistances are in ohm) [6]



OR

- Q2)** a) Define resistance and resistivity. State the factors affecting value of resistance and resistivity. [6]
- b) Find the equivalent resistance between terminals A and B by using star delta and series parallel conversion process. [6]



P.T.O.

- Q3) a)** State and explain Faradays first and second law of electromagnetic induction. [6]
- b) A current of 10 A flowing through a coil wound with 750 turns produces a magnetic flux of 1.2 milli-weber. Calculate the self-inductance of coil. If the current in the coil is reversed in 0.02 seconds, determine the average emf induced in coil. Also calculate energy stored in the coil for a current of 10 A. [6]

OR

- Q4) a)** Derive the expression for mutually induced emf in terms of mutual-inductance when two coils are kept side by side. [6]
- b) Derive the following terms. Also state their units. [6]
- i) Magnetic flux density
 - ii) Magnetic field strength
 - iii) MMF
 - iv) Reluctance
- Q5) a)** Explain the concept of lagging and leading considering two alternating quantities as voltage and current, with the help of their equations, waveforms and phasor diagrams. [6]
- b) An alternating current of frequency 50 Hz has rms value of 5 A. Write the expression for its instantaneous value. Also Calculate [6]
- i) time required to reach 4 A, after the instant $t = 0$
 - ii) instantaneous value of current 2.5 milliseconds after the instant current is zero and increasing negatively.

OR

- Q6) a)** Derive the expression for instantaneous and average power in case of Purely resistive circuit. Draw voltage, current and power waveforms. [6]
- b) Calculate maximum and rms values of currents, when a voltage $v = 282.84 \sin 314t$ volt, is applied separately across inductance of 159.25 milli-henry and capacitance of 79.617 micro-farad. [6]

- Q7) a)** Draw phasor diagram for following cases for R-L-C series circuit [6]
- i) $X_L > X_C$
 - ii) $X_L < X_C$
 - iii) $X_L = X_C$
- b) A resistance of 25Ω and Capacitance of $80\mu\text{F}$ are connected in series across 230 V, 50 Hz supply. Then calculate [6]
- i) Capacitive reactance
 - ii) Impedance
 - iii) Current
 - iv) Power factor and its nature
 - v) Active power
 - vi) Reactive Power

OR

- Q8) a)** Define phase sequence and balanced load. State the relations between line and phase parameters for star and delta connected balanced loads.[6]
- b) Three phase 400 V, 50 Hz supply is connected across a balanced delta connected load having impedance of $(20 \angle 60^\circ)\Omega$ per phase. Calculate [6]
- i) Phase Voltage
 - ii) Phase Current
 - iii) Line Current
 - iv) Active Power
 - v) Reactive Power
 - vi) Apparent Power
- Q9) a)** Explain the working principle of single-phase transformer with a suitable diagram. Also explain, when the transformer will act as step up and step-down transformer. [6]
- b) A 40 kVA, 2000V/250 V single phase transformer has primary winding resistance of 1.15Ω and secondary resistance of 0.0155Ω . The iron losses are 500 watts. Calculate [6]
- i) Full load copper losses
 - ii) Efficiency at full load, with 0.85 lagging power factor
 - iii) Efficiency at half load, with 0.6 leading power factor

OR

- Q10)**a) Draw the cross-sectional view of DC motor. State function of pole shoe, field winding, commutator and carbon brush. [6]
- b) State three applications of Squirrel cage type and three applications of Slip ring type three phase induction motor. [6]



Total No. of Questions : 10]

SEAT No. :

PE12177

[Total No. of Pages : 7

[6581]-2408

F.E.

**ESC-103-MEC : ENGINEERING GRAPHICS
(2024 Pattern) (Credit System) (Semester - I/II)**

Time : 3 Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) *Figures to the right indicate full marks.*
- 3) *State clearly the assumptions made, if any.*
- 4) *Use of non-programmable calculator is allowed.*
- 5) *Assume suitable data if necessary.*

Q1) A point of line AB is in HP and 20mm in front of VP its front view and top view makes an angle of 40° and 45° with the HP and VP respectively. The projector distance end points of line is 50mm. Draw the projection of line find its true length and True inclinations. **[10]**

OR

Q2) The point A of 80mm long line AB is 15mm above HP, while its other end B is 60mm above HP and 20mm in front of VP. Draw the projection of line AB, if its FV measures 65mm. Find inclinations made by line with the HP and VP. **[10]**

Q3) A hexagonal plane of 30mm side has one of its sides on the H.P. and inclined at 45° to the V.P. The surface of the plane is inclined at 45° to H.P. Draw its projections. **[10]**

OR

Q4) A rectangular plane ABCD with side AB 30mm and BC 50mm is resting on the H.P. on its smaller side AB. Draw the projections of the plane when its surface makes an angle of 45° with the H.P. and the side AB which is on the H.P. is inclined at 45° to the V.P. Draw the projections of the plane. **[10]**

- Q5)** a) Draw an ellipse by rectangle method if the major axis and minor axis are 100mm and 80mm respectively. **[6]**
- b) Draw the development of the lateral surface of the square pyramid of base side 30mm and axis height 60mm, when one side of the base is at 45° to V.P. **[6]**

OR

P.T.O.

- Q6)** a) Draw a hyperbola by directrix focus method if focus is 60mm from directrix and eccentricity is $3/2$. [6]
 b) Draw the development of the lateral surface of a Pentagonal prism of base side 30mm and axis height 70mm. [6]

Q7) Fig. 1 shows pictorial view of an object. Using first angle method of projections draw : [14]

- a) Sectional Front View [5]
 b) Top View [4]
 c) Left Hand Side View [4]
 d) Give Dimensions [1]

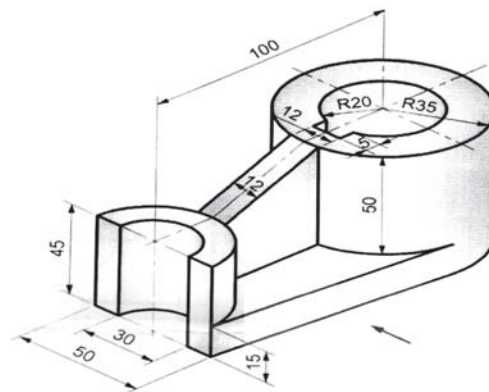


Fig. 1

OR

Q8) Fig. 2 shows pictorial view of an object. Using first angle method of projections draw : [14]

- a) Front View [5]
 b) Top View [4]
 c) Left Hand Side View [4]
 d) Give Dimensions [1]

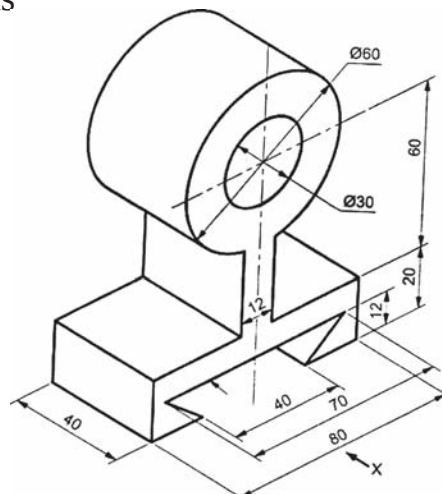
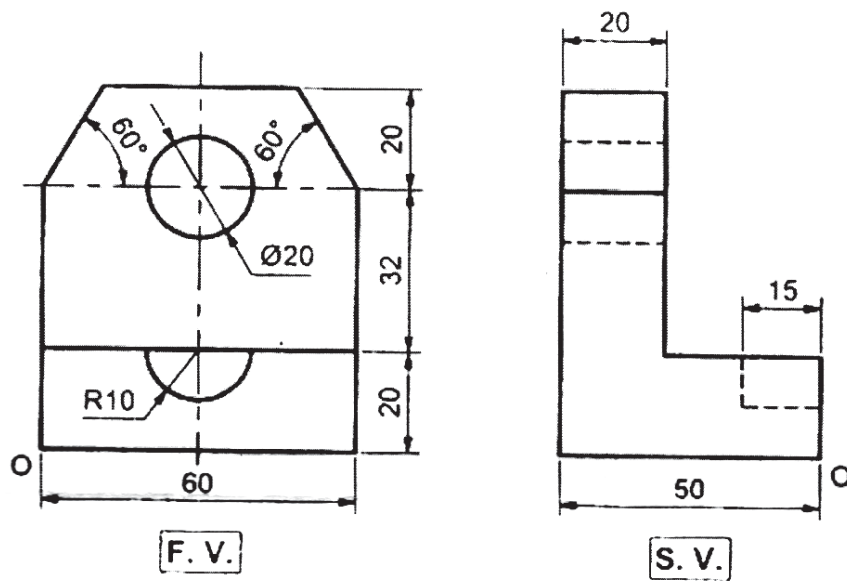


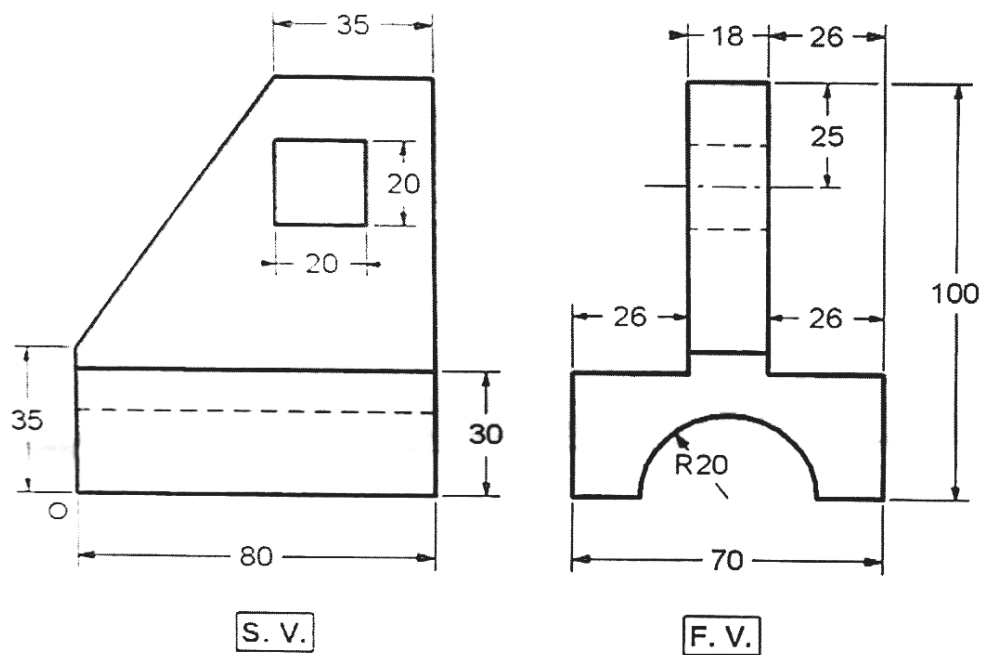
Fig. 2

Q9) Figure show orthographic views of an object by first angle method of projection.
Draw its isometric view. [14]



OR

Q10) Figure show orthographic views of an object by first angle method of projection.
Draw its isometric view. [14]



Total No. of Questions : 10]

PE12177

[6581]-2408

F.E.

**ESC-103-MEC : ENGINEERING GRAPHICS
(2024 Pattern) (Credit System) (Semester - I/II)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Figures to the right indicate full marks.*
- 3) *State clearly the assumptions made, if any.*
- 4) *Use of non-programmable calculator is allowed.*
- 5) *Assume suitable data if necessary.*

Q1) The line AB which is 120 mm long makes 35° angle with HP. Its end A is 25 mm above HP and 15 mm in front of VP. Draw the projections of line if its elevation makes 40° angle with XY. **[12]**

OR

Q2) The end Q of line PQ is 25 mm above HP and end P is 30 mm in front of VP. The distance between end projectors of line is 70 mm. Draw the projections of the line if the elevation and plan of the line make 40° and 50° with XY line respectively. **[12]**

Q3) A Hexagonal plate base side 50 mm is resting in HP on one of its corner with its side parallel to VP. Its surface is inclined to HP so that the corner opposite to the resting corner is 51 mm above HP. Draw the projections, if its top view line passing through resting corner and its opposite corner is inclined to VP at an angle of 35° . **[12]**

OR

Q4) Draw the projections of a regular hexagon of 35 mm sides, having one of its sides in the HP and inclined at 60 degree to the VP and its surface making an angle of 40 degree with the HP. **[12]**

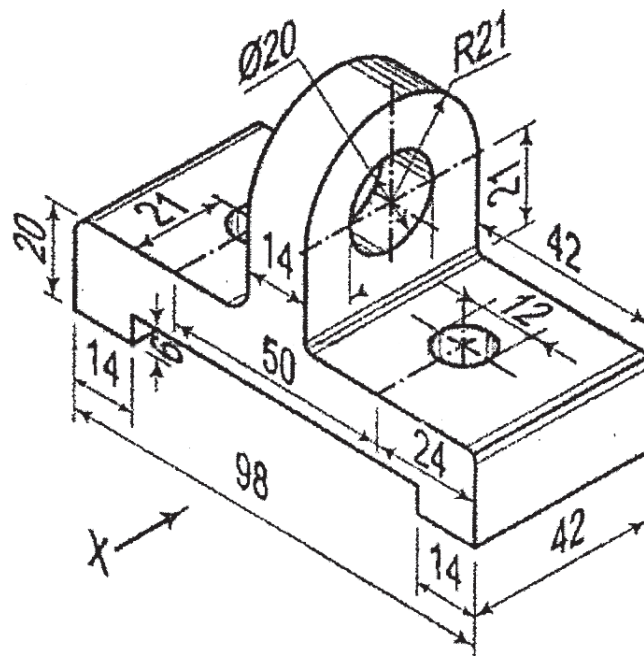
- Q5) a)** Construct an ellipse by directrix and focus method if distance of focus from the directrix is 60 mm. Take eccentricity $e=1/2$. [7]
- b)** Draw the development of the lateral surface of a pentagonal pyramid having base edge 45 mm and axis height 90 mm resting on HP in such a way that one of its base edges is parallel to VP. [7]

OR

- Q6) a)** Construct and name the curve having eccentricity $e=4/2$ and distance of the focus from the directrix is 60 mm. [7]
- b)** Draw the development of lateral surfaces of a cone having base diameter 50 mm and axis height 100 mm resting on HP on its base. [7]

Q7) Fig. shows pictorial view of an object. Using first angle method of projection draw: [16]

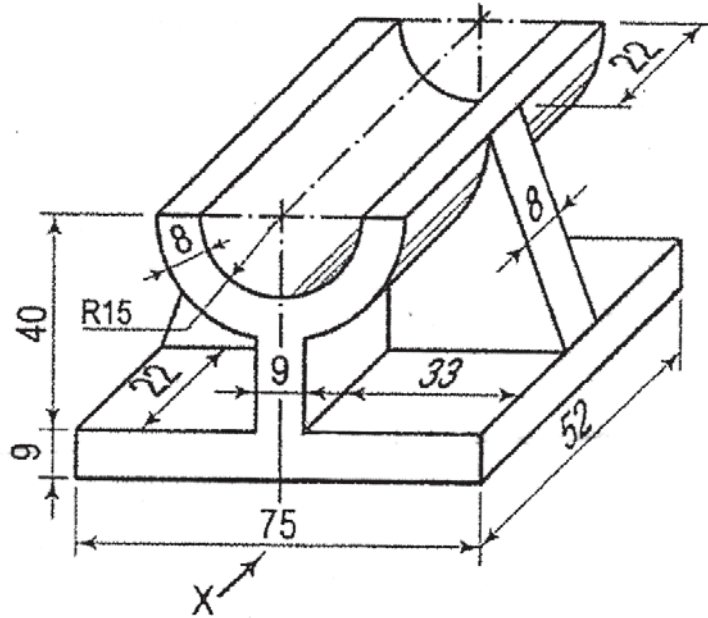
- a)** Front View of object [6]
- b)** Top View [4]
- c)** Right Hand Side View [5]
- d)** Give Dimensions [1]



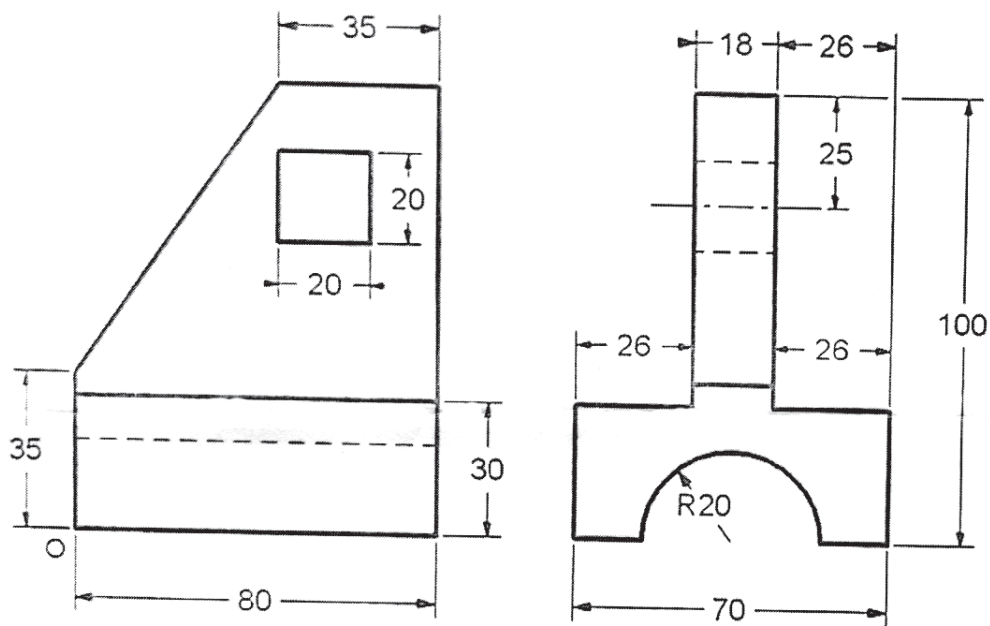
OR

Q8) Fig. shows pictorial view of an object. Using first angle method of projection draw: **[16]**

- | | | |
|----|---|------------|
| a) | Sectional Front View along symmetry of object | [6] |
| b) | Top View | [4] |
| c) | Right Hand Side View | [5] |
| d) | Give Dimensions | [1] |

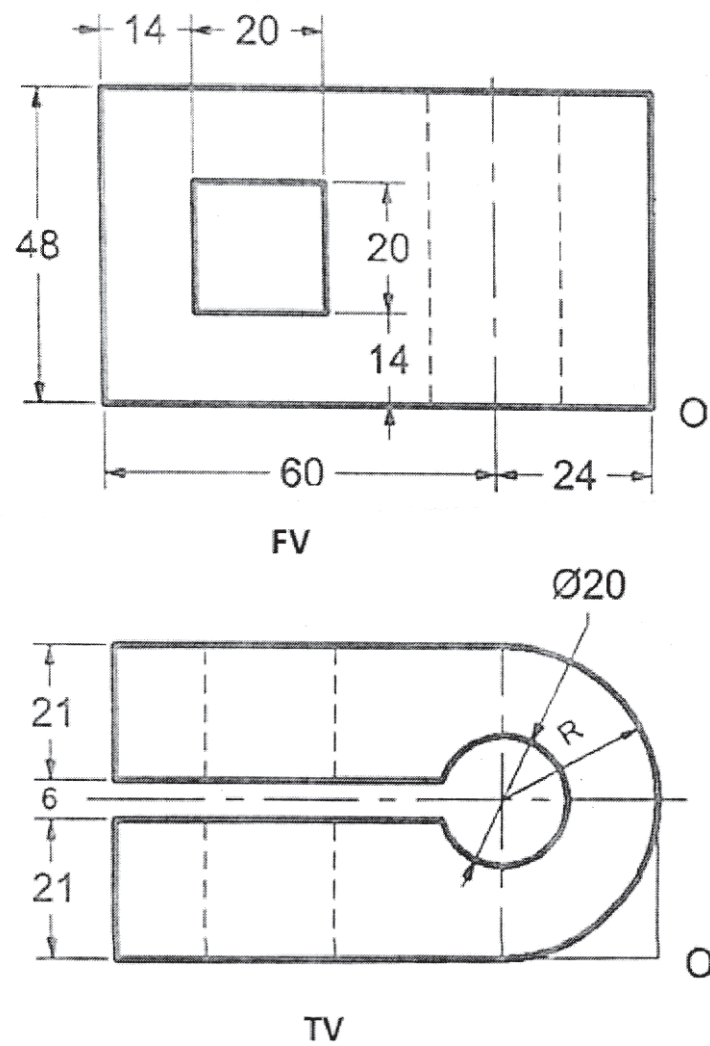


Q9) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view. **[16]**



OR

Q10) Figure show orthographic views of an object by first angle method of projection. Draw its isometric view. **[16]**



❗❗❗❗

Total No. of Questions : 6]

SEAT No. :

PE-12178

[Total No. of Pages : 6

[6581]-2409

F.E.

**ESC-104-CVL : ENGINEERING MECHANICS
(2024 Pattern) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates :

- 1) *All questions are compulsory.*
- 2) *Neat sketches must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and mention it clearly.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

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

[10]

- i) Complete determination of resultant force in non concurrent forces is [2]
 - a) Determination of Magnitude
 - b) Determination of Direction
 - c) Determination of point on its line of action
 - d) All of these
- ii) Simply supported beam of span 'L' m. is loaded with Uniformly distributed load of 'W' KN/m, what is the reaction at left support? [2]
 - a) $W/2$
 - b) $WL/2$
 - c) $W^2/2$
 - d) $W^2L/2$
- iii) If m = number of members of the truss, j = number of joints of truss & if $m = (2j - 3)$ then truss is known as [2]
 - a) Statically Determinate Truss
 - b) Statically In-Determinate Truss
 - c) Unstable Truss
 - d) None of these

P.T.O.

- Q2) Solve any Two of the following :**

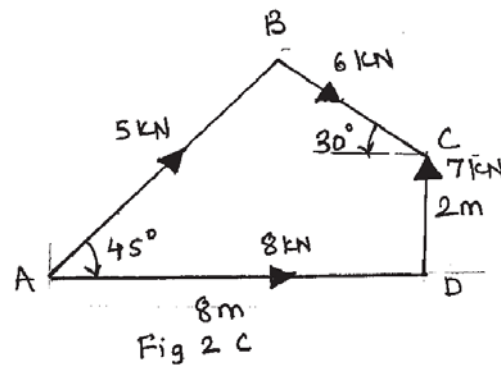
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Fig 2 a

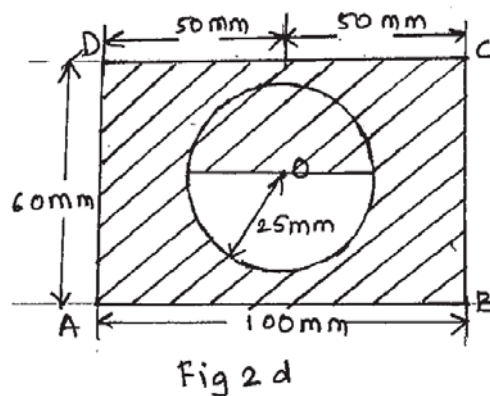
-
- Diagram of a simply supported beam PQRS. The beam has a total length of 6 m, divided into three equal segments of 2 m each (PQ, QR, RS). A downward point load of 10 kN is applied at support P. An upward reaction of 15 kN is shown at support Q. A downward point load of 10 kN is applied at support R. An upward reaction of 15 kN is shown at support S.

Fig 2 b

- c) Determine magnitude, direction and point of application of the resultant with respect to Point A for the force system shown in the Fig. 2 c. [6]

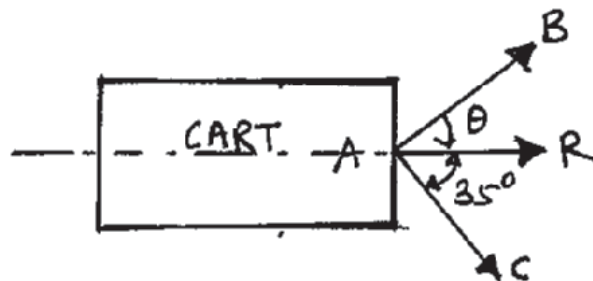


- d) Determine the X and Y coordinate of centroid of the shaded area as shown in Fig. 2 d with respect to point A. [6]

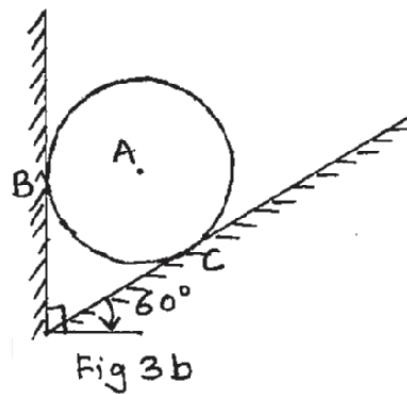


Q3) Solve any Two of the following :

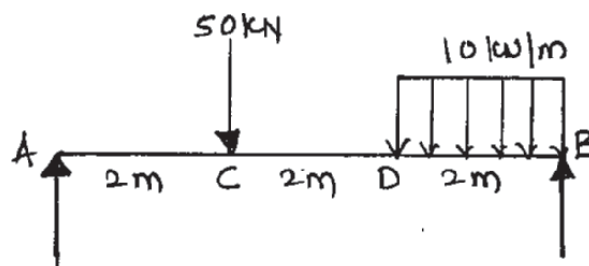
- a) The resultant of two Ropes pulling a cart as shown in the Fig. 3 a acts along horizontal axis of the cart and has magnitude of 6 kN what would be tension in the ropes when $\theta = 30^\circ$, what will be θ if tension in rope AB is minimum also find minimum tension. [6]



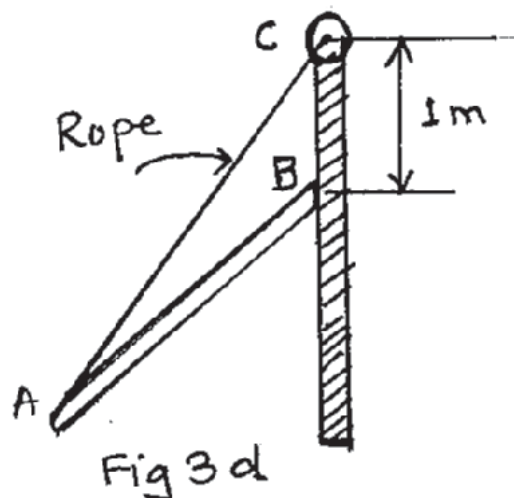
- b) A sphere weighing 2000N is placed in a wrench as Shown in Fig. 3 b Find the reactions at the point of contacts. [6]



- c) Determine Support Reactions for simply supported beam loaded and supported as shown in the Fig. 3 c. [6]



- d) A rod having length 2 m and weight 2 kg of uniform cross section is held in equilibrium as shown in Fig. 3 d, one end of the rod is touching the frictionless wall and other end is attached to the rope. Determine length of rope required and also calculate Tension in the Rope. [6]



Q4) Solve any Two of the following :

- Define angle of repose, angle of friction, coefficient of friction and cone of friction with sketches. [6]
- Determine the Horizontal force P required to just start moving 1000 N Block Shown in Fig. 4 b Take coefficient of friction as 0.35. [6]

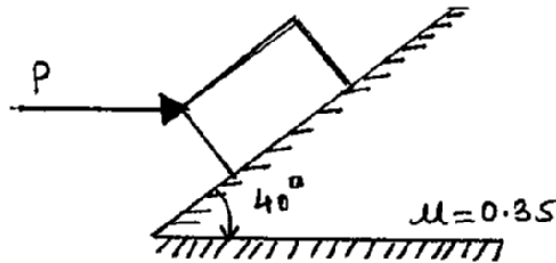


Fig 4b

- Determine distance ' x ' from A to which the 80 kg man can climb without causing the 4 m ladder to slip at its lower end A as shown in Fig. 4 c. The top of the 10kg ladder has a small roller and at the ground the coefficient of static friction is 0.2. The mass center of the man is directly above his feet. [6]

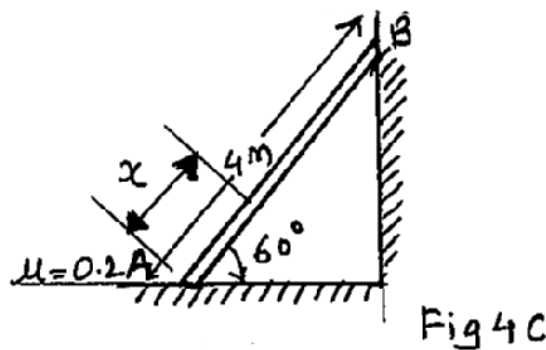


Fig 4c

- Analyze the Truss shown in Fig. 4 d by method of joints. [6]

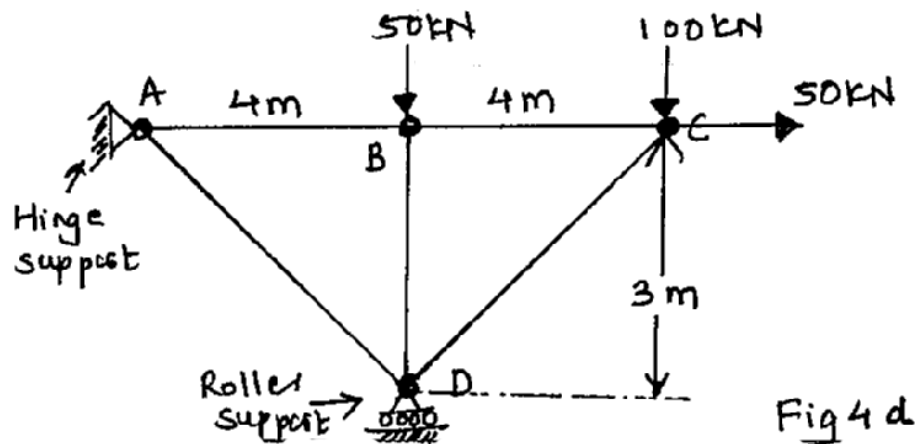


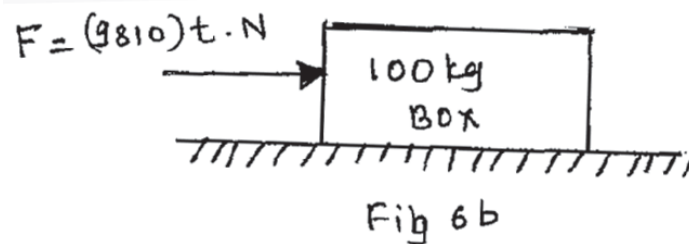
Fig 4 d

Q5) Solve Any Two of the following :

- a) A vehicle is travelling 100 m in 10 seconds and break is applied when vehicle deaccelerates constantly at rate of 1 m/s^2 . Determine initial velocity of the vehicle, also find final velocity and distance travelled by vehicle in first 1 second. [6]
- b) A metal ball is thrown vertically upwards with 100 m/s from top of the building having 100m high. Determine velocity with which it hits the ground at the base of the building and also calculate time required to reach the ground level. [6]
- c) A cricket ball shot by a Batsman from height of 2m from ground at an angle of 45° with the horizontal with velocity of 30 m/s is caught by fielder at a height of 0.5 m above the ground. Determine distance between the batsman and fielder. [6]
- d) A vehicle is being driven along circular track with diameter 300 m, if the normal component of acceleration is 5 m/s^2 what will be speed of the vehicle. [6]

Q6) Solve Any Two of the following :

- a) In ice hockey, player hits a puck so that it comes to rest after 10 sec. after sliding over distance of 50 m horizontal plane on ice. What will be initial velocity of the puck and also calculate the coefficient of friction between puck and ice. [6]
- b) The 100 kg box is subjected to Force as shown in Fig 6 b determine its velocity when $t = 4$ seconds, if $v = 0$ when $t = 0$. [6]



- c) Explain in detail principle of conservation of Energy. Define Conservative and Non-Conservative Force. [6]
- d) Two Cars A and B having same mass 'm'. Car A is moving towards right with as speed of 80 kmph, when it collides with car B which was at rest. Determine how far Car B will slide before coming to rest after impact. Assume coefficient of kinetic friction as 0.4 and $e = 0.5$, Neglect sizes of the car. [6]



Total No. of Questions : 6]

SEAT No. :

PE-12178

[Total No. of Pages : 7

[6581]-2409

F.E.

**ESC-104-CVL : ENGINEERING MECHANICS
(2024 Pattern) (Semester - I/II)**

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates :

- 1) *All questions are compulsory.*
- 2) *Neat sketches must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Assume suitable data, if necessary and mention it clearly.*
- 5) *Use of electronic pocket calculator is allowed.*
- 6) *Use of cell phone is prohibited in the examination hall.*

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

[10]

- i) The parallel axis theorem states that Moment of inertia about any axis is equal to : **[2]**
 - a) Centroidal Moment Plus Area
 - b) Centroidal Moment Plus mass
 - c) Centroidal Moment Plus Product of Area and square of distance
 - d) Centroidal Moment Minus Product of Area and square of distance
- ii) A hinged (Pinned) support provides **[2]**
 - a) One Reaction force
 - b) Two reaction force and one moment
 - c) Two reaction force and No moment
 - d) One reaction force and one moment
- iii) If the angle of repose is 30° , the coefficient of friction is : **[2]**

a) 0.25	b) 0.50
c) 0.57	d) 0.87

P.T.O.

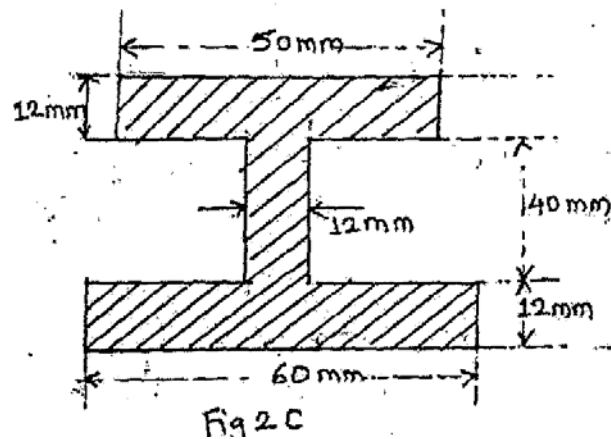
- Q2) Solve Any Two of the following :**

-

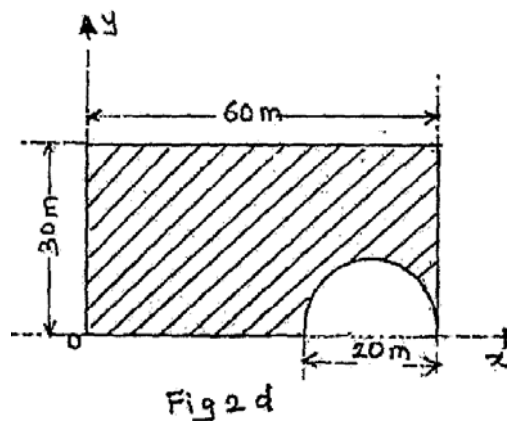
Fig 2a

-
- The diagram shows a rectangular frame with a total width of 5.0 m (two 2.5 m segments) and a total height of 7.5 m (three 2.5 m segments). The corners are labeled S (top-left), P (bottom-left), Q (bottom-right), and R (top-right). The following forces are applied:
- A horizontal force of 100 N acting to the right at corner R.
 - A horizontal force of 150 N acting to the left at the midpoint of the right vertical edge (between R and Q).
 - A vertical force of 50 N acting downwards at corner P.
 - A force of 100 N acting at corner S, directed downwards and to the left at an angle of 30° to the horizontal.
 - A force of 50 N acting at corner Q, directed upwards and to the right at an angle of 30° to the horizontal.
- Fig 2b

- c) Determine the Moment of Inertia of I section as shown in the Fig. 2c about centroidal X-X and Y-Y axis. [5]

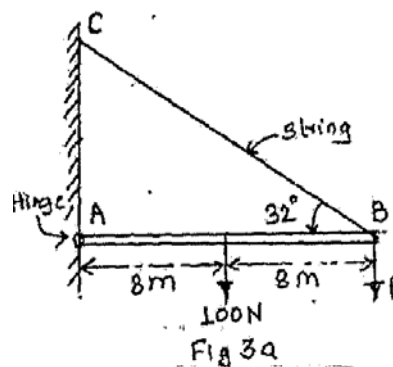


- d) Determine the X and Y coordinate of centroid of the shaded area as shown in Fig. 2d. [5]

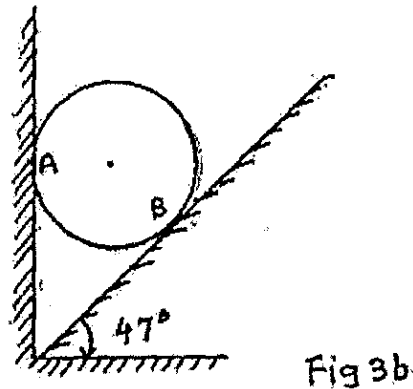


Q3) Solve Any Two of the following :

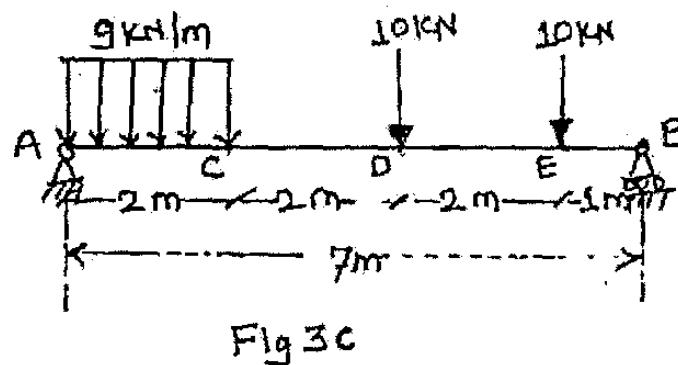
- a) Calculate Tension in the string CB and reaction at Hinge A for rod if Force P is 1000 KN as shown in Fig. 3a. [5]



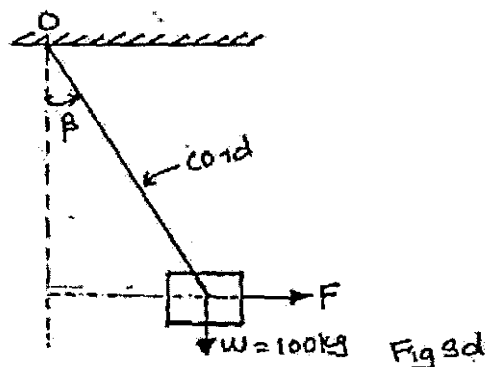
- b) A sphere weighing 50 N is placed as Shown in Fig. 3b Find the reactions at the point of contacts. [5]



- c) Determine Support Reactions for beam loaded and supported as shown in the Fig. 3c. [5]

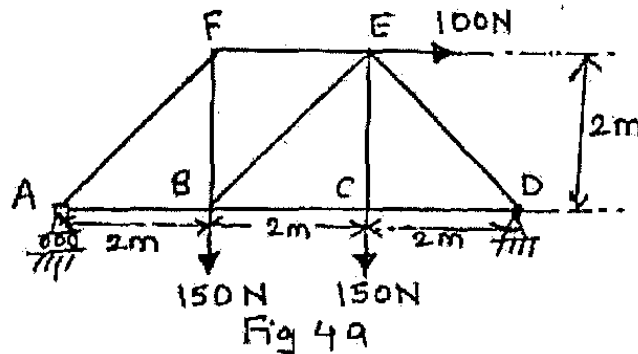


- d) A weight of 100 kg tied to the end of a cord of length 5 m, determine the magnitude of force F to pull the weight at an angle β is 30° as shown in Fig. 3d and also calculate tension in the cord. [5]

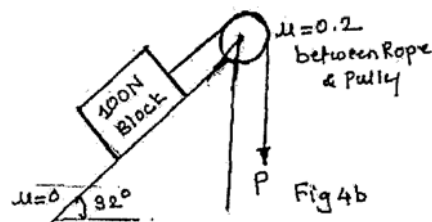


Q4) Solve Any Two of the following :

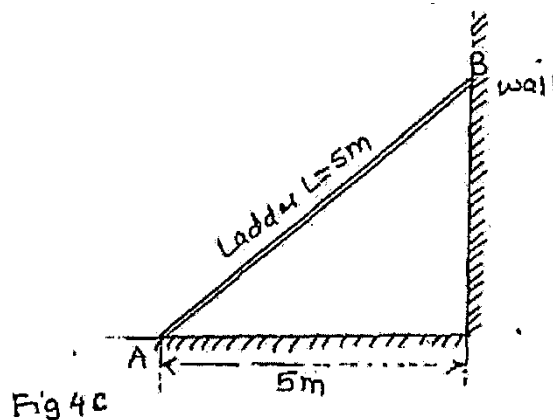
- a) Calculate force in the members FE, BE, BC of truss shown in Fig. 4a.[5]



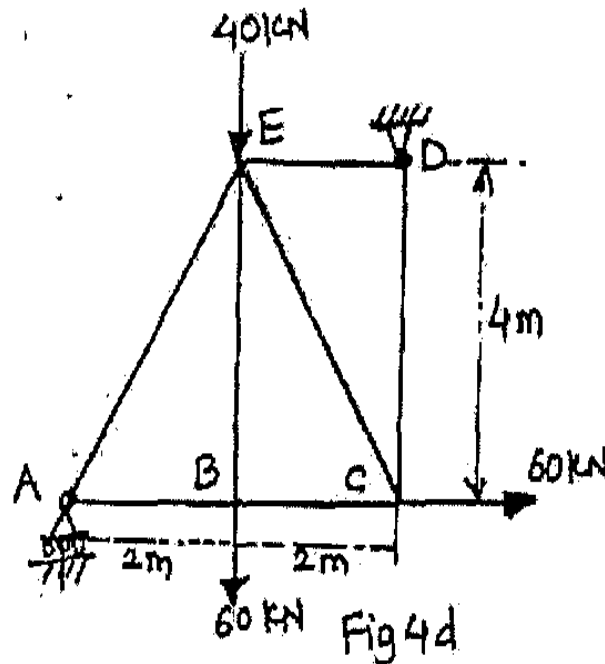
- b) Determine range of 'P' to maintain the equilibrium of the system as shown in Fig. 4b. The coefficient of friction between rope and pulley is 0.2 and between 100 N block and inclined surface is zero. [5]



- c) A uniform ladder of length 5 m and weighing 25 N is placed against a smooth vertical wall with its lower end 5m away from the wall as shown in Fig. 4c if the ladder is just to slip determine the coefficient of friction between the ladder and floor. Also calculate frictional force acting on the ladder at the point of contact between ladder and floor. [5]



- d) Analyze the Truss shown in Fig. 4d by method of joints. [5]

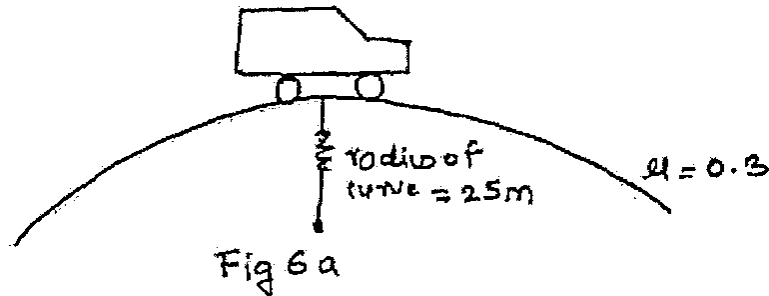


Q5) Solve Any Two of the following :

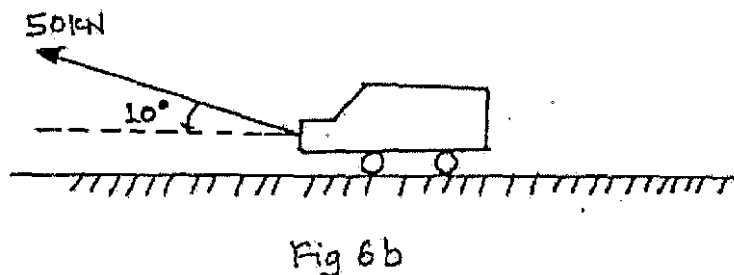
- A particle travels in a straight line such that for a short time $t = 10$ sec to 12 sec, its motion is described by $v = (10/a)$ m/sec, where 'a' is in m/sec^2 . If $v = 15$ m/sec when $t = 10$ sec, determine the particle acceleration when $t = 11$ sec. [5]
- A stone is dropped from the top of a tower 100 m high, at the same time another stone is thrown vertically upward from the top of the tower with a velocity of 50 m/sec. When and where do the two stones cross each other? [5]
- An object is projected at an angle of 40° with the horizontal, if the horizontal range of the object is 2.5 km, calculate the velocity of projection and the maximum height attained by the object. [5]
- A man drives an automobile which starts from rest and increases the speed uniformly to 100 kmph in 10 sec on a curved road of radius 500 m. Determine the magnitude of the total acceleration 5 sec after start. [5]

Q6) Solve Any Two of the following :

- a) An automobile is moving on a curve with radius 25 m, along a road at speed of 35 kmph, knowing that coefficient of friction between tyres and road surface is 0.3 determine acceleration in tangential direction produced when breaks are suddenly applied. [5]



- b) A car is pulled with constant acceleration of 0.5 m/sec using cable that makes angle of 10° with horizontal as shown in Fig. 6b if the force in the cable is 50 kN determine mass of the car by using Newton's 2nd law of motion. [5]



- c) A 1 kg stone is dropped from height 'h' m and strikes the ground with velocity of 25m/sec, using work energy principle find kinetic energy of the stone as it strikes the ground and height 'h' from which it was dropped. [5]
- d) Prove that the coefficient of restitution $e = 1$ for perfectly elastic collision and Solve following numerical in which 'A ball is dropped from unknown height on a horizontal floor from which it rebounds to height of 10 m, if $e = 0.75$ calculate the height from which the ball is dropped'? [5]



Total No. of Questions :5]

SEAT No. :

PE12179

[Total No. of Pages : 4

[6581]-2410

F. E.

**ESC-105-COM : FUNDAMENTALS OF PROGRAMMING
LANGUAGES**

(2024 Pattern) (Semester-I/II) (Credit System)

Time : 2½ Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *All five questions are compulsory, and for each question students must attempt any three out of the six sub-questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume Suitable data wherever necessary.*

Q1) Solve any three

- a) List any three features that make C an important programming language. [4]
- b) What is the difference between a keyword and an identifier in C? [4]
- c) Explain how variables are declared in C. What are the rules and syntax for declaring variables? [4]
- d) Explain the difference between a constant and a variable in C. [4]
- e) Explain the purpose of using the const keyword when declaring a variable in C. [4]
- f) Explain the role of the volatile keyword in C programming and when it is typically used. [4]

Q2) Solve any three

- a) List the arithmetic operators in C with their symbols. [4]
- b) Explain the difference between && (AND) and || (OR) logical operators in C. [4]
- c) Explain any 4 bitwise operators in C. [4]
- d) List the types of assignment operators available in C. [4]
- e) How would you use relational operators to compare two numbers in C? Provide an example. [4]
- f) Explain the difference between pre-increment (++i) and post-increment (i++) operators in C. [4]

P.T.O.

Q3) Solve any three

- a) Explain while loop with a suitable example. [4]
- b) Explain simple if statement if-else statement and nested if-else statement with suitable example. [4]
- c) Write a program for finding factorial of a number. [4]
- d) Explain for loop with continue and break statement. [4]
- e) Describe how a “Switch” statement works and compare it to an “if-else” structure. [4]
- f) Write a program that reads a number from the user and prints whether the number is positive, negative, or zero using an “if-else” statement. [4]

Q4) Solve any three

- a) Explain how an array is stored in memory and how elements can be accessed using an index. [4]
- b) Explain various function for reading and writing a string. [4]
- c) Write a program that asks the user to input 10 numbers, stores them in a one-dimensional array, and then prints the sum of the numbers. [4]
- d) Explain how a string in C is terminated and how this affects string operations. [4]
- e) Explain any five String handling Functions with example. [4]
- f) Write a program that reverses a string entered by the user without using built-in functions. [4]

Q5) Solve any three

- a) Explain the concept of return values in C. How is the return type of a function determined? Provide an example of a function that returns an integer value. [4]
- b) Write a C program that accepts two numbers from the user, swaps them using a function. [4]
- c) Explain various Categories of Function. [4]
- d) How do you initialize structures in C? Explain with an example of initializing a structure that holds a book’s title, author, and price. [4]
- e) Create a structure in C called Employee that holds the employee’s name , ID and salary. Write a program to initialize a structure variable with values and display the employee’s information. [4]
- f) Differentiate Between Recursion and Iteration in function with suitable example. [4]



Total No. of Questions :10]

PE12179

[6581]-2410

F. E.

**ESC-105-COM : FUNDAMENTALS OF PROGRAMMING
LANGUAGES
(2024 Pattern) (Semester-I/II) (Credit System)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8 , Q9 or Q10.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume Suitable data if necessary.

- Q1)** a) What is a character set in C? Explain with examples. [3]
b) What are keywords and identifiers in C? [3]
c) What are C tokens? Explain the different types. [4]
d) Describe the history and importance of the C programming. [4]

OR

- Q2)** a) Write an algorithm to perform arithmetic operations (+, -, *). [3]
b) What are symbolic constants in C? How are they defined? [3]
c) Define flowchart. Draw the flowchart to compute the area of circle. [4]
d) Define variables with syntax. Enlist the datatypes in C. [4]

- Q3)** a) Explain increment and decrement operators in C with suitable examples. [3]
b) Explain operator precedence and associativity in C. [3]
c) Describe arithmetic expressions in C with suitable examples. [4]
d) What are bitwise operators in C? [4]

OR

- Q4)** a) What is a conditional operator in C? Explain with suitable example. [3]
b) Describe various logical operators in C. [3]
c) Write a program in C to demonstrate use of relational operators. [4]
d) How are expressions evaluated in C? [4]

- Q5)** a) What is the if else statement in C? Explain with examples. [4]
b) Write a program in C to generate the multiplication table of a number. [5]
c) Describe the syntaxes of while and do while loop. [5]

OR

- Q6)** a) What is the use of the break statement in loops or switch statements? [4]
b) Write a program in C to decide the greatest amongst three numbers. [5]
c) Write a program in C to decide if the entered number is prime or not. [5]

- Q7)** a) How do you declare a one-dimensional and two-dimensional array? [4]
b) Describe the different ways of array initialization. [5]
c) How do you write and read input strings from terminal in C ? [5]

OR

- Q8)** a) What is a two-dimensional array? Explain with example. [4]
b) Describe the basic predefined string handling functions. [5]
c) Write a C program to provide the comparison result of user input strings. [5]

- Q9)** a) Why do we need user-defined functions in C? [4]
b) Describe the elements of user defined functions. [5]
c) Write a program to generate fibonacci series up-to first 10 numbers. [5]

OR

- Q10)** a) Explain structure declaration and initialization. [4]
b) What is recursion? Explain with suitable example. [5]
c) Explain categories of functions in C with examples. [5]

