



- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.
 5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
 6. Use of non programmable calculator is permitted.
 7. Answer **any five** questions as per internal given choice.

1. a) Point P and Q are indicated at (2,2,4) and (-3,1,5) calculate 8
- a) The position vector p
 - b) The distance vector from P to Q
 - c) The distance between P and Q
 - d) A vector parallel to PQ with magnitude of 10
- b) Three field quantities are given by 8
- $$P = 2ax - a,$$
- $$Q = 2ax - ay + 2az$$
- $$R = 2ax - 3ay + az$$
- Determine
- a) $(P + Q) \times (P - Q)$
 - b) $Q \cdot R \cdot XP$
 - c) $P \cdot Q \times R$
 - d) $P \times (Q \times R)$
 - f) A unit vector perpendicular to both Q and R

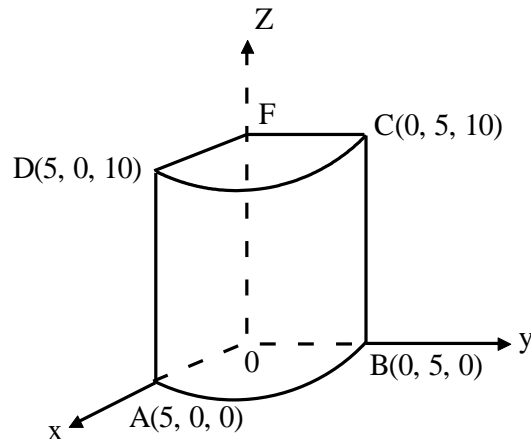
OR

2. a) Transform each of the following into cylindrical co-ordinates at the points indicated. 8
- i) $5a_x$ at (4, 120° , 2)
 - ii) $4a_x - 2a_y + 4a_z$ at (2, 3, 5)
 - iii) $3a_x + 4a_y$ at (2, 4, 9)

b) Consider the object shown in figure, calculate

8

- The distance BC
- The distance CD
- The surface area ABCD
- The surface area ABO
- The surface area A OFD
- The volume ABDCFO



3. a) Derive the expression for electric field intensity of an infinite uniform line charge having density $\rho_L \text{ C/m}$

8

b) Point charges 5 nC and -2 nC are located at $(2, 0, 4)$ and $(-3, 0, 5)$, respectively.

8

- Determine the force on a 1 nC point charge located at $(1, -3, 7)$
- Find the electric field E at $(1, -3, 7)$

OR

4. a) Three infinite uniform sheets of charge are located in free space as follows, 3 nC/m at $z = -4$, 6 nC/m at $z = 1$ and 8 nC/m at $z = 4$. Find E at the point.

8

$P_A(2, 5, -5)$

$P_B(4, 2, -3)$

$P_C(-1, -5, 2)$

$P_D(-2, 4, 5)$

b) Explain Gauss law and divergence theorem in detail. And also write the expression for divergence in three co-ordinate system.

8

5. a) Derive the expression for electric potential and electric field intensity for electric dipole.

8

b) An electric field is expressed in Cartesian coordinates by $E = 6x^2 a_x + 6y a_y + 4a_z \text{ V/m}$. Find

8

i) V_{MN} if points M and N are specified by $M(2, 6, -1)$ and $N(-3, -3, 2)$

ii) V_M if $V = 0$ at $P(4, -2, -35)$

iii) V_N if $V = 2 \text{ V}$ at $P(1, 2, -4)$

OR

6. a) Prove the uniqueness theorem for Laplace equations. 8
- b) Given the potential field in cylindrical co-ordinates $V = (100/Z^2 - 1) \rho \cos \phi$ volts and point p at $\rho = 3\text{m}$, $\phi = 60^\circ$ and $z = 2\text{m}$. Find values at point p for 8
- i) V ii) E
- iii) dv/dN iv) a_N
7. a) Derive continuity equations for time varying field. 8
- b) The current density in a certain region is expressed as $J = 10\rho^2 z a_\rho - 4\rho \cos^2 \phi a_\phi \text{ A/M}^2$ 8
- Find
- i) Current density at $\rho = 3$, $\phi = 30^\circ$ and $z = 2$
- ii) Determine total current flowing outward through the circular band $\rho = 3$, $0 \leq \phi \leq 2\pi$, $2 < z < 2.8$

OR

8. a) Determine the capacitance of a sphere having two dielectric layers which has the dielectric material. 8
- $\epsilon = \epsilon_1$ from $r = a$ to $r = r_1$ and
- $\epsilon = \epsilon_0$ from $r = r_1$ to $r = \infty$
- b) The polarization within a region having $E_Q = 2.26$ has the uniform value 8
- $P = -2a_x + 7a_y + 3a_z \text{ nC/m}^2$ find
- i) E ii) D iii) The magnitude of voltage gradient
9. a) Write Maxwell's equation in differential and integral form for time varying field. 8
- b) Select the value of K such that each of the following pairs of fields satisfies Maxwell's equations. 8
- $E = (Kx - 100t)a_y \text{ V/m}$
- i) $H = (x + 20t)a_z \text{ A/m}$
- $\mu = 0.25 \text{ H/m}$, $\epsilon = 0.01 \text{ F/m}$
- ii) $D = 5x a_x - 2y a_y + kza_z \text{ } \mu\text{C/m}^2$

OR

10. a) Write short notes on **any two**. 8
- i) Stokes theorem
- ii) Biot Savart law
- iii) Amperes Circuital law.

b) A plane wave of 9375 MHz travelling in free space has an amplitude of 20v/m. Find

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- i) Velocity of propagation.
- ii) Wavelength
- iii) Intrinsic impedance of medium.
- iv) Phase shift constant B.
