

Duration 3hrs

Total Marks 80

NB:- 1) Question No. 1 is Compulsory.

- 2) Attempt any three Questions out of remaining five Questions.
- 3) Assume suitable data if necessary and justify the same.

Q.1 Answer any four out of five questions.

- | | | |
|----------|---|-----------|
| a | Explain Coulomb's law in Electrostatics and hence define Unit Charge. | 05 |
| b | Express the following vector in Cartesian co-ordinate system
$\mathbf{A} = 2 \cos \theta \hat{r} + 3 r \hat{\theta} - 4 \hat{z}$ | 05 |
| c | State and explain relationship between Electric Intensity and potential. | 05 |
| d | What is Lorentz force equation for moving charge? Enlist two applications. | 05 |
| e | Explain inconsistency in Ampere's circuital law | 05 |
-
- | | | | |
|-----------|----------|---|-----------|
| Q2 | a | Show that electric field due to infinite sheet of charge at a point is independent of distance at that point from the plane containing the charge. | 10 |
| | b | Three equal point charges of $2 \mu\text{C}$ are in free space at $(0,0,0)$, $(2,0,0)$, $(0,2,0)$ respectively. Find net force on fourth charge of $5 \mu\text{C}$ at $(2,2,0)$ | 10 |
-
- | | | | |
|-----------|----------|--|-----------|
| Q3 | a | Derive Poisson's and Laplace equation. Two plates of a parallel capacitors are separated by a distance 'd' and maintained at potential 0 and V_1 respectively. Find potential at any point between plates. | 10 |
| | b | Derive the set of Maxwell's equation for Static field and Time varying field | 10 |
-
- | | | | |
|-----------|----------|---|-----------|
| Q4 | a | Explain Ampere circuital law and differentiate between conduction current and displacement current | 10 |
| | b | Find the capacitance of a co-axial conductor of length L, where inner and outer radius are r_1 and r_2 respectively | 10 |
-
- | | | | |
|-----------|----------|---|-----------|
| Q5 | a | A current sheet $\mathbf{K} = 10 \hat{z}$ A/m lies in $X=4$ m plane and a second sheet $\mathbf{K} = -8 \hat{z}$ A/m is at $X=-5$ m plane. Find \mathbf{H} at points (i) $(1,1,1)$ (ii) $(0, -3, 10)$ | 10 |
| | b | Derive magnetic field intensity due to finite and infinite wire carrying a current I. | 10 |
-
- | | | | |
|-----------|----------|--|-----------|
| Q6 | a | Formulate the wave equation from Maxwell's equations for perfectly conducting medium | 10 |
| | b | Consider an interphase in Y- Z plane. The region $X < 0$ is medium 1 with $\mu_{r1} = 4.5$ and magnetic field, $\mathbf{H} = 4 \hat{x} + 5 \hat{y} - 6 \hat{z}$ A/m. The region $X > 0$ is medium 2 with $\mu_{r2} = 6$. Find \mathbf{H}_2 and \mathbf{B}_2 in medium 2 and also calculate the angle made by \mathbf{H}_2 with normal to interface. | 10 |
