June 11, 2024 02:30 pm - 05:30 pm 1T00835 - T.E.(Electrical Engineering)(SEM-V)(Choice Base Credit Grading System) (R- 19) (C Scheme) / 32024 - Electromagnetic Field & Wave QP CODE: 10055996

Time: 3 Hours **Marks: 80**

Note:1 Question No.1 is compulsory.
2. Solve ANY THREE questions from the remaining five questions.
3. Figure to the right indicates full marks.
4. Assume suitable data wherever required, but justify the same.

Q. 1 Solve **ANY FOUR** questions from following. (Each question carries 5 marks)

a) Explain differential area in rectangular, cylindrical and spherical co-ordinate systems with an example. Give its significance **(05)**

b) Explain and derive the polarization of a dielectric material. **(05)**

c) What are advantages and limitation of Lorentz's force equation? **(05)**

d) 'The line integral of the magnetic field intensity around some closed loop is equal to the sum of the currents which pass through the loop.'Is the statement true or false. Justify the same. **(05)**

e) Point charge Q= -0.2 μC placed at origin in free space. Find electric field intensity and electric potential at (0,6,8)m. **(05)**

Q. 2 a) Formulate electromagnetic wave equation from Maxwell's equation for perfectly conducting and insulating media. **(10)**

Q. 2 b) State coulomb's law. Also derive electric field intensity due to an infinite and finite plane having density $\rho_s \left(C/m^2\right)$. **(10)**

Q. 3 a) If a current density is directed radially outward and decreases exponentially with time $\bar{J}=\frac{10}{r} e^{-t} \bar{a_r}$ A/m^2 Calculate current I at **(10)**
1) t=1 and r=5m ,
2) t=1 r=6 ,
And also calculate rate of change of volume charge density

Q. 3 b) Derive the expression for magnetic field intensity due to infinite and finite wire carrying current I. **(10)**

Q. 4 a) Derive electrostatic Gauss Divergence equation in both integral and point form. **(10)**

Q. 4 b) Give the potential difference $V=2x^2y-5z$ and a point p(-4,3,6)m. Find the electric field intensity and flux density at P.

Q. 5 a) Derive Kirchhoff current law KCL from continuity equation of current. **(10)**

Q. 5 b) Derive Faraday's law of electromagnetic induction in time and frequency. Domain. **(10)**

Q. 6 a) Use Biot-Savart's Law for any finite current carrying conductor to find magnetic field intensity. **(10)**

Q. 6 b) Find charge Q and volume charge density $\rho_v \left(C/m^3\right)$ for **(10)**
$\bar{D} = e^{-x} \sin y\, \bar{a_x} - e^{-x} \cos y\, \bar{a_y} + 2z\bar{a_z}$
For a cube with $-10 \le x \le 10$, $-10 \le y \le 10$, $-10 \le z \le 10$