

3 Hours

Total marks : 80

Instructions:

1. QuestionNo.1 is compulsory.
2. Answer any **three** from the remaining **five** questions
3. **Figures** to the **right** indicate full **marks**.

1 Solve **any four**:-

(20)

- a) Convert $\vec{A} = 3\vec{a}_x + 4\vec{a}_y + 5\vec{a}_z$ at the point(3,4,5) in spherical coordinates.
- b) State and explain Biot-savart law .
- c) Explain Coulomb's Law.
- d) Find the force on current carrying wire in a magnetic field.
- e) What do you mean by irrotational and solenoidal fields?

2

- a) An aluminium conductor is 30 m long and has circular cross section with a diameter of 20.32mm. If there is a d.c. voltage of 1.2V between two ends, find (i) (J) (ii) Current (iii) Power dissipated, conductivity of $Al=3.82 \times 10^{-7}$ mho/m. (10)
- b) Find the force on a $100\mu C$ charge at (0,0,3)m if four like charges of $20\mu C$ are located on the x and y axis at $\pm 4m$. (10)

3

- a) Derive an electric field intensity due to infinite sheet charge. (10)
- b) Given that $\vec{D}=30 e^{-\frac{r}{b}}\vec{a}_r - 2(z/b)\vec{a}_z$ (c/m²) in cylindrical coordinates, find the outward flux crossing the rights circular cylinder described by $r=2b, z=0$ and $z=5b(m)$. (10)

4

- a) The region $x<0$ contains dielectric medium for which $\epsilon_{r1}=4$,while the region $x > 0$ is characterized by $\epsilon_{r2}=2$ if $\vec{E}_1 = 50\vec{a}_x - 30\vec{a}_y + 60\vec{a}_z$ (KV/m) find i) E_{n1} ii) θ_1 iii) E_{t1} iv) E_2 v) θ_2 (10)
- b) $V=0$ volts for $r=0.1m$ and $V=100$ Volts for $r=2m$ in spherical co-ordinates Assuming free space between the concentric spherical shells. find \vec{E} and \vec{D} . (10)

5

- a) Derive magnetic field intensity on the axis of a circular loop. (10)
- b) Given $\vec{E} = E_0 z^2 e^{-t} \hat{a}_x$ in free space .Determine if there exists a magnetic field such that both Faraday's law and ampere's circuital law are satisfied simultaneously. (10)

6

- a) Derive the wave equation for electric field and magnetic field in free space (10)
- b) A 10GHz plane wave travelling in free space has an amplitude $E_x=10$ V/m . find v, λ, β, η and amplitude and direction of H. (10)
