T.E. Electrical V - CBSGS   17·5·17
· E M F W

3 Hours   Total Marks: **80**

Instructions:
1. Question No. 1 is compulsory.
2. Answer any **three** from the remaining five questions
3. Figures to the right indicate full marks.

1   Solve any four:-   (5 x 4)

  a)   Justify the statement, 'Divergence of curl of a quantity is zero.'

  b)   What is high dielectric constant material? Describe its advantages.

  c)   State and explain Biot Savart's law and Ampere circuital law.

  d)   Derive point form of continuity equation.

  e)   Enlist five properties of electromagnetic waves.

2   a)   Derive an electric field intensity due to an infinite line having density ρ_l (C/m).   (10)

  b)   Evaluate both sides of the divergence theorem for the electric flux density   (10)
$\overline{D} = 3xy\overline{a_x} + x^2\overline{a_y}$ C/m² and the rectangular parallelepiped formed by the planes x=0 and 2, y=0 and 3, z=0 and 4.

3   a)   Derive boundary condition at the interface of two dielectric materials.   (10)

  b)   Three equal point charges of 2µC are in free space at (0,0,0), (2,0,0) and (0,2,0)   (10)
respectively. Find net force on the fourth charge of 5µC at (2,2,0).

4   a)   Determine $\overline{H}$ on the axis of a circular current loop of radius 'a'. Specialize the result at   (10)
the center of the loop.

  b)   The electric field intensity $\overline{E}$ in time varying field is given by $\overline{E} = E_m \sin(\omega t - \beta z)\overline{a_y}$ in
free space. Determine $\overline{D}, \overline{B}$ and $\overline{H}$.   (10)

5   a)   Derive Maxwell's equations and tabulate them in the time domain and frequency   (10)
domain.

  b)   Formulate inductance of a solenoid and a toroid with circular cross section.   (10)

6   a)   Derive wave equation and explain wave in a dielectric and conducting medium.   (10)

  b)   Find the propagation constant at 400MHz for a medium in which ε_r=16,μ_r=4.5 and   (10)
σ =0.6 S/m. Find the ratio of the velocity v to free-space velocity c.

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