TE | E | ETRX | CBGS | EE | 15/05/18

Sub – Electromagnetic Engg.

Q. P. Code: 37487

(3 Hours) [Total Marks:80]

N. B.: 1) Question No. **1** is **compulsory.**

2) Attempt **any three** questions out of the remaining five questions.

3) Assume suitable data wherever necessary.

1. Answer the following (any four): 20
   a) Let $\epsilon_r = 5, \mu_r = 4$ and $\sigma = 0$. If the displacement current density is $20\cos(1.5 \times 10^8 t - \beta x)\,\overrightarrow{a_y}$ μA/m². Find $\overrightarrow{D}$, and $\vec{E}$.
   b) For a wave propagating in z-direction, prove that $\vec{E} \cdot \vec{H}=0$ and $\vec{E} \times \vec{H}$ gives the direction of propagation.
   c) An electromagnetic wave propagating in a perfect dielectric is normally incident on a perfect dielectric. Derive the reflection and transmission coefficient for the reflected wave.
   d) Explain the concept of retarded potential.
   e) Explain ground wave propagation. State its applications.

2. a) What is polarization? Explain different types of polarization. 10
   b) Derive the reflection coefficient for a wave with oblique incidence having perpendicular polarization, reflected from a perfect dielectric. 10

3. a) State and prove Poynting theorem. Give interpretation of each power term. 10
   b) Explain in detail FDM method and state its advantages and drawbacks. 10

4. a) Derive the expression for the radiated power for a hertzian dipole. 10
   b) Define critical frequency, MUF and OWF. A high frequency radio link has to be established between two points on the earth 2500km away. If the reflection region of the ionosphere is at a height of 200km and has a critical frequency of 12MHz, calculate the MUF of the given path. 5
   c) Find the average and maximum radiation intensity, Uave and Umax respectively and the directivity, D if $U(\theta,\phi)=4\text{cosec}^2\theta$, $\pi/3 < \theta < \pi/2$, $0 < \phi < \pi$. 5

5. a) Derive boundary conditions for electric and magnetic fields at dielectric-dielectric boundary. 10
   b) What is line of sight propagation? Obtain an expression for the range of line of sight for space wave propagation in terms of antenna's transmitting and receiving heights. 5

6. Write short note on:
   a) Folded dipole antenna 5
   b) Poisson's and Laplace's equations 5
   c) Wave equations for time harmonic fields 5
   d) Interpretation of Maxwell's equations in integral form 5

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