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OR

Discuss reflection of uniform plane waves by perfect Dielectric-normal incidence.

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Total No. of Questions :5]

[Total No. of Printed Pages : 4

Roll No

EC - 402

B.E. IV Semester

Examination, December 2015

Electro-Magnetic Theory

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Define electric flux density.
b) Define potential difference.
c) Derive capacitance of 2 concentric spheres (spherical shell capacitor).
d) State and prove Gauss's divergence theorem? Write equation for gradient, divergence and curl for any one co-ordinate system.

OR

Give a mathematical analysis of electrostatic energy and energy density. Write Laplaces and Poisson's equation.

Unit - II

2. a) Define magnetic field intensity and magnetic flux density.
- b) Define self and mutual inductance.
- c) Explain any one application of Biot-Savart's law.
- d) Give a mathematical analysis for solution of Laplace's equation in cylindrical co-ordinate system.

OR

Derive boundary conditions on magnetic field.

Unit - III

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3. a) Define uniform plane waves.
- b) What is complex Poynting vector?
- c) Discuss displacement current concept.
- d) Derive relation for magnetic energy density. A current element $I \Delta l = 2\pi (0.6I_x - 0.8I_y)$ is situated at a point $(4, -2, 3)$. Find the incremental field ΔH at a point $(1, 3, 2)$?

OR

Write a note on magnetic scalar potential. A parallel polarized wave propagates from air into dielectric at Brewster angle of 75° . Calculate the relative dielectric constant of the medium?

Unit - IV

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4. a) Define polarization of waves?
- b) Define Attenuation constant and phase constant.

- c) For a non-magnetic material, having $\epsilon_r = 2.25$, $\sigma = 10^{-4} \text{ s/m}$. Find
 - i) Loss tangent
 - ii) Attenuation constant
 - iii) Phase constant
 - iv) Intrinsic impedance for a wave having a frequency of 2.5 MHz. Assume the material to be a good dielectric.
- d) Discuss wave propagation in a lossy Dielectric medium.

OR

Give a brief mathematical analysis for the following:

- i) Linear polarisation
- ii) Circular (OR) Elliptic polarization

Unit - V

5. a) Define perpendicular polarization.
- b) What is phase velocity and group velocity?
- c) What is frequency dispersive propagation?
- d) The electric field intensity in radiation field of an antenna located at the origin of a spherical co-ordinate system is given by: $E = E_0 \frac{\sin \theta \cos \theta}{r} \cos(\omega t - \beta r) \hat{Q}$, where E_0 , ω and β are constants. Find
 - i) The magnetic field associated with this electric field.
 - ii) The Poynting vector
 - iii) The total power radiated over a spherical surface of radius 'r' centered at the origin.