[4]

OR

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

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**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 Laplaces equation in cylindrical co-ordinate system.

OR

Derive boundary conditions on magnetic field.

## Unit - III



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

4. a) Define polarization of waves?

   b) Define Attenuation constant and phase constant.





   c) For a non-magnetic material, having $\epsilon_r = 2.25$, $\sigma = 10^{-4}$ 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: $E = E_o \frac{\sin\theta\cos\theta}{r}\cos(\omega t - \beta r) IQ$, where $E_o$, $\omega$ 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.