

[4]

OR

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

\*\*\*\*\*

www.rgpvonline.in

www.rgpvonline.in

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**

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  $\Delta H$  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  $75^\circ$ . 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  $\epsilon_r = 2.25$ ,  $\sigma = 10^{-4} \text{ s/m}$ . 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  $E_0$ ,  $\omega$  and  $\beta$  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.