

Roll No .....

**EC - 402**

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**B.E. IV Semester Examination, December 2014**

**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 questions 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) Explain Coulomb's law?
- b) Define electric dipole and dipole moment?
- c) What is electric field intensity?
- d) State and prove Gauss's law?

OR

A potential field in free space is expressed as  $V = \frac{60 \sin \theta}{r^2}$  volts. Find the electric flux density and hence the volume charge density at the point ( $r = 3\text{m}$ ,  $\theta = 60^\circ$ ,  $\phi = 25^\circ$ ) in spherical co-ordinates.

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**Unit - II**

2. a) Explain uniqueness theorem.
- b) Explain Biot-savart's law?
- c) What is amperes circuital law?
- d) Write a short note on image theory?

OR

Give a mathematical analysis for solution of Laplace's equation in Cartesian co-ordinate system?

**Unit - III**

3. a) Write Maxwell's equations in differential and integral forms for free space and harmonically time varying fields.
- b) Derive continuity equation.
- c) Explain Faraday's law.
- d) State and prove poynting vector theorem.

[2]

OR

Derive wave equations for conducting and non-conducting medium?

**Unit - IV**

4. a) Define linear, circular and elliptic polarization.  
b) Explain Hoss tangent.  
c) Discuss plane wave propagation in a good conductor?  
d) Discuss the concept of skin depth? Find the skin depth  $d$  at a frequency of 1-6 MHz in aluminium where  $\sigma = 38.2 \text{ Ms/m}$  and  $\mu_r = 1$ . Also find the propagation constant and wave velocity.

OR

Discuss surface current density and transmission line analogy.

**Unit - V**

5. a) Define Brewsters angle.  
b) Explain total internal reflection.  
c) Discuss retarded potential.  
d) What is normal and oblique incidence? A perpendicularly polarized wave propagates from a region having  $\epsilon_r = 8.5$ ,  $\mu_r = 1$ ,  $\sigma = 0$  to free space with an angle of incidence of  $15^\circ$ . The incident field is  $1.0 \mu\text{V/m}$ , find the reflected and transmitted electric field incident, reflected and transmitted magnetic field.

OR

Discuss surface impedance of a conductor. Explain magnetic vector potential.

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