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EX - 302**B.E. III Semester**

Examination, December 2013

Electro-Magnetic Theory**Time : Three Hours**

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Maximum Marks : 70**Note:** Attempt one question from each unit.**Unit - I**

1. a) Transform the vector field $\vec{w} = 10\vec{a}_x - 8\vec{a}_y + 6\vec{a}_z$ to cylindrical co-ordinate system, at point P (10, -8, 6). 6
- b) Explain physical significance of gradient of a scalar, divergence of a vector and curl of a vector. 8

OR

2. a) Using Gauss law find the expression for \vec{D} for uniformly charged sphere. 6
- b) A charged ring of radius 'a' carries a uniform charge distribution. Determine the potential and the electric field intensity at any point on the axis. 8

Unit - II

3. Derive solution of Laplace's equation for the following: 14
 - i) Cartesian solution in one-dimension (field between two parallel plates)
 - ii) Cylindrical coordinates (field between co-axial capacitors)

OR

4. a) If a dielectric material of $\epsilon_r = 4.0$ is kept in an electric field $E = 3a_x + 2a_y + a_z$ V/m, find the polarization. 7
- b) Obtain the expression of energy stored in an electrostatic field. 7

Unit - III

5. a) Derive the expression for displacement current. Explain how it is different than conduction current 7

- b) Calculate the magnetic flux density produced by a current loop of radius 'R' on the loop axis when the loop is carrying a current I and situated in air. 7

OR

6. a) Prove the differential form of Ampere's circuit law. 7
- b) Two long parallel wires separated 2 metres apart carry currents of 50A and 100A respectively in the same direction. Determine the magnitude and direction of the force between them per unit length. 7

Unit - IV

7. a) When the vector magnetic potential is given by:

$$A = \frac{1}{r^3} (2.0 \cos \theta a_r + \sin \theta a_\theta)$$

find the magnetic flux density. 7

- b) Calculate the inductance of a solenoid of 200 turns wound tightly on a cylinder tube of 6cm diameter. The length of the tube is 60cm and the solenoid is in air. 7

OR

8. a) Derive the expression for the energy stored in a magnetic field. 7
- b) State and prove magnetic boundary conditions. 7

Unit - V

9. a) Derive general wave equations in source free medium using Maxwell's equations. 7
- b) Define poynting vector and give its physical interpretation. 7

OR

10. a) If a wave with a frequency of 100MHz propagates in free space, find the propagation constant. 4
- b) The electric field intensity of a uniform plane wave in free space is given by:

$$\vec{E} = 94.25 \cos(\omega t + 6z) \vec{a}_x \text{ V/m}$$
 determine the magnetic field intensity and average power density in the medium. 10
