Total No. of Questions :5]

Roll No .....

EC - 402

B.E. IV Semester

Examination, June 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 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.

1. a) Define equipotential surfaces.

b) State Coulomb's law.

c) Prove that Curl of a gradient of a scalar is zero.

d) Give physical significance of curl, divergence and gradient of a vector.

OR

Point charges 1mC and –2mC are located at (3,2,–1) and (–1,–1,4) respectively. Calculate the electric force on a 10nC charge located at (0,3,1).

2. a) Define magnetic flux density.

   b) A charge 'q' is moving with a velocity 'v' in free space. Write an expression for the magnetic field produced at any point by this charge.

   c) What do you mean by magnetic vector potential?

   d) Explain Ampere's circuital law and show that magnetic field is irrotational. Find the magnetic field inside a solenoid.

   OR

   Derive the expression for the magnetic flux density produced by an infinite thin long wire carrying current I at a distance R.

3. a) State Faraday's law of induction.

   b) Write Maxwell's equation in integral form.

   c) Why was it necessary to modify Ampere's law for time varying filed?

   d) Define Poynting vector and give its physical interpretation.

   OR

   State Maxwell's equations in differential form and explain their physical significance.

4. a) Define Skin resistance.

   b) Define complex permittivity.

   c) Show that the intrinsic impedance has the dimensions of resistance.

   d) Determine the polarization of the wave if the electric field in a region is given by

$$\bar{E} = (3\bar{a}_x + j4\bar{a}_y)e^{-0.02z}e^{-j0.5z}\,V/m.$$

   OR

   A lossy dielectric has an intrinsic impedance $200\angle 30°$ ohms at a particular frequency. If at that frequency the plane wave propagating through the dielectric has the magnetic field component

$$\bar{H} = 10e^{-\alpha x}\cos\left(\omega t - \frac{x}{2}\right)\bar{a}_y\,A/m$$ find $\bar{E}$.

5. a) What is meant by a critical angle of reflection?

   b) What is meant by a retarded field?

   c) Explain the difference between phase velocity and group velocity.

   d) Explain the terms : The propagation constant, the attenuation constant, the phase constant, the wavelength, the intrinsic impedance and the skin depth.

   OR

   Explain the Brewster angle. What is the difference between the critical angle and Brewster angle? Why is the Brewster angle also called a polarization angle?

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