Unit - V

5. a) What do you understand by circular polarization?

   b) Derive the wave equation from Maxwell's equations for free space, charge free region.

   c) Show that characteristic impedance free space is $120\pi\Omega$.

   d) What is pointing vector. State pointing theorem? Drive it.

   OR

   The electric field intensity associated with a uniform plane wave travelling in free space is given by $E=10\cos(2\pi\times10^7t-\beta z)a_x$ V/m. Find expression for H field. What is direction of propagation of this wave? What is value of β.

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Roll No .....

EX - 302

B.E. III 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 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) State divergence theorem.

   b) Give physical significance of the term divergence.

   c) Describe the Gauss's law.

   d) Define electrostatic potential and electric field intensity. Hence show that, $E=-\nabla V$.

   OR

   Transform the vector field $F=2r\cos\Phi\ a_r+a_\Phi$ into Cartesian co-ordinates and evaluate it at P(4, –2, 3). Also find a unit vector a_F at P.

Unit - II

2. a) What is an 'electric dipole' and its 'dipole moment'.

   b) What is a conservative field? Give example.

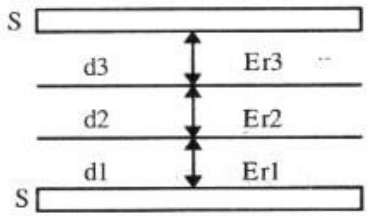
   c) Determine whether or not following potential field satisfies Laplace's equation. Justify your answer. $V = 10\sigma\Phi z$ volts.

   d) Show that the energy stored in electric field is given by

$$W_E = \frac{1}{2}\int_{vol} \rho_v V dv.$$

OR

A parallel plate capacitor as shown in the figure contains three dielectric layer where $Er_1 = 1$, $d_1 = 0.2$ mm, $Er_2 = 2$, $d_2 = 0.3$ mm, $Er_3 = 3$ and $d_3 = 0.4$ mm. Where S = surface area of plane = 20 cm^2. Find the total capacitance.



Unit - III

3. a) Write the point form of Ampere's circuital law.

   b) State Ampere's circuital law as applied to time varying magnetic field.

   c) Starting from current density J obtain the point form of the continuity equation.

   d) Find H at P (2, 3, 5) in cartesian co-ordinates if there is an infinitely long current filament passing through the origin and point C. The current of 50A is directed from origin to C, where the location of C is : (a) C (0, 0, 1); (b) C (0, 1, 0)

OR

Derive for the field at any point P due to long current carrying straight conductor.

Unit - IV

4. a) What is Lorentz force equation?

   b) What is meant by displacement current density?

   c) State Maxwell's equation in the integral form for time varying fields.

   d) Comment on the inductance and the mutual inductance.

OR

A rectangular loop as shown below has dimensions 1m by 2m and lies in the uniform field $F = -6a_y + 8a_z$ T. The loop current is 10mA. Find the vector force on each side of the loop.