Total No. of Questions :5] *[Total No. of Printed Pages :4*

Roll No .

EE - 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.

Unit - I

1. a) Define Gaussian surface.

b) Write down the values of the electric field intensity in a case of point, line, sheet and volume charge density.

c) Give physical significance of the term divergence.

d) Show that the integral of normal component of any vector field over a closed surface is equal to the integral of divergence of this vector field throughout the volume enclosed by the closed surface.

OR

Unit - V

5. a) What do you mean by polarization? What are the types of it?

b) Define plane wave and uniform plane wave.

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

d) Prove that $P = E \times H$ where P is Poynting vector in watts/m^3; E and H are electric and magnetic field respectively.

OR

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

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

Unit - II

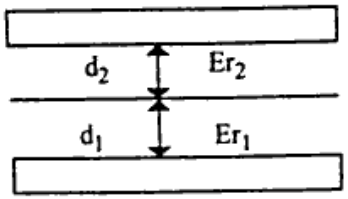
2. a) What is an 'electric dipole' and its 'dipole moment'.
   b) Derive for the Laplace's equation starting from the point form of Gauss's law.
   c) Determine whether or not following potential field satisfies Laplace's equation. Justify your answer.
   $V = 10\,\sigma\,\Phi\, z$ volts.
   d) Show that the energy stored in electric field is given by :

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

OR

Find out a capacitance of parallel plate capacitor as shown in the figure contains two dielectric layer where

$Er_1 = 2$, $d_1 = 5$ mm, and $Er_2 = 5$, $d_2 = 10$ mm



Unit - III

3. a) State Biot-Savart's law.
   b) State ampere circuital law as applied to steady magnetic field.
   c) Define the term $\overline{B}, \overline{H}$, current density J and surface current density K.

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d) A filamentary current of 10 A is directed in from infinity to origin on the +ve x axis and the back to infinity along the +ve y axis. Use Biot-Savart's law to find H at P(0,0,1).

OR

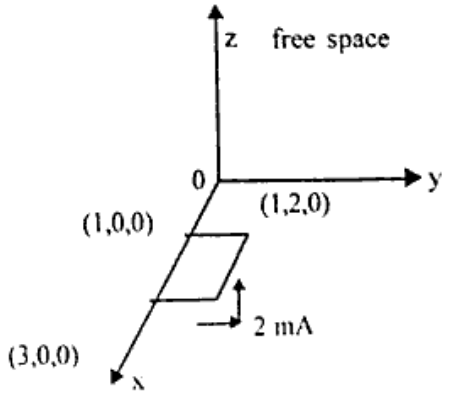
Derive for the field at any point P due to long current carrying straight conductor.

Unit - IV

4. a) Define scalar magnetic potential and explain it simplifies the solution of magnetic fields.
   b) What is Lorentz force equation.
   c) State Maxwell's equation in the differential form for time varying fields.
   d) What is meant by displacement current density? Derive continuity equation for time varying field.

OR

In the wired square loop as shown below carrying 2mA current and loop is in Z = 0 plane. Calculate total force on the loop due to this.



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