Total No. of Questions :10] *[Total No. of Printed Pages :4*

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EX - 401(NGS)

B.E. IV Semester

Examination, December 2012

Electric Magnetic Theory

(Non-Grading System Only)

Time : Three Hours

Maximum Marks : 70/100

Note : *1. Attempt any five questions.*
2. All questions carry equal marks.

Unit - I

1. a) Find electrostatic field intensity if voltage(V) is:

i) $V = V_0 \cdot e^{-x} \cdot \sin\frac{\pi\gamma}{4}$

ii) $V = V_0 \cdot R \cdot \cos\theta$ Notations are as usual.

b) Two point charges of equal mass *m*, charge Q are suspended at a common point by two threads of negligible mass and length L. Show that at equillibrium the inclination angle α of each thread to the vertical is given by:

$$Q^2 = 16 \cdot \pi \cdot \in_0 \cdot mg.l^2 \cdot \sin^2\alpha \cdot \tan\alpha$$

OR

2. a) The finite sheet $0 \le x \le 1, 0 \le y \le 1$ on the $z = 0$ plane has a charge density $P_S = xy\left(x^2 + y^2 + 25\right)^{3/2}\ nc/m^2$. Find the total charge on the sheet & electric c field at (0, 05).

   b) State and explain Gauss's Law.

Unit - II

3. a) Verify that the expression for the potential due to an electric dipole satisfies the laplace equation.

   b) The potential field $v = 2x^2yz - y^3z$ exist in a dielectric medium having $\in = 2 \in_0$. Does V satisfies Laplace's equation, also find total charge within the unit canbe $0 < x, y, z < 1m$.

OR

4. a) What are the boundry conditions that must be satisfied by the electric potential at an interface betwen two perfect dielectrics with dielectric constants $\in_1$ & $\in_2$.

   b) State and explain equation of continuity. Define various terms involved.

Unit - III

5. a) Find the magnetic flux density at a point on the axis of a circular loop of radius r that carries a direct current I.

   b) For a z directed current of I amperes flowing in an infinitely long conductor, verfy that the magnetic vector potential can be written as-

$$\bar{A} = -k\frac{\mu_0 \cdot I}{4\pi} log(x^2 + y^2)$$

Where the symbol have their usual meanings.

OR

5. a) A uniform cylindrical coil, or solenoid of 2000 turns is 50cm long and 5cm in diameter. If the coil carries a current of 5m Amp. Find the flux density at the centre of the coil and on the axis at one end of the coil.

b) State and explain ampere's circuital law.

Unit - IV

7. a) Derive and explain Maxwell's equation in their general differential form & general integral form.

b) A vector magnetic potential

$\bar{A} = x^2 y \cdot \bar{a}x + y^2 x \cdot \bar{a}y - 4xyz\,\bar{a}z$ wb/m. Calculate $\bar{B}$ (magnetic flux donsity) at (–1, 2, 5) and flux through the surface defined by $z = 1, 0 \le x \le 1, -1 \le y \le 4$

OR

a) Prove that the magnetic scalar potential at (0, 0, 2) due to circular loop of radius 'a' is given by

$$V_m = \frac{I}{2}\left[1 - \frac{z}{\left[z^2 + a^2\right]^{1/2}}\right].$$

b) Derive the formula for the inductance of a pair of parallel conductors.

Unit - V

9. a) The magnetic field component of a plane wave in a lossless dielectric is

$$\bar{H} = 30 \cdot sin(2\pi \times 10^8 t - 5 \cdot x)\bar{a}_z \; mA/m$$

i) If $\mu_r = 1$, find ϵ_r.

ii) Calculate wavelength & wave velocity.

iii) Determine the polarization of wave.

iv) Find displacement current density.

OR

10. a) A 500MHz electromagnetic wave is propagating through a perfect non-magnetic dielectric with relative permittivity $\epsilon_r = 6$. Calculate wave length and phase constant.

b) Explain wave polarizatiton.

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