DU – 089

IV Semester B.E. (Electrical and Electronics) Degree Examination, December 2017/January 2018
(2K11 Scheme)
EE-405 : ELECTRO MAGNETIC FIELD THEORY

Time : 3 Hours Max. Marks : 100

***Instruction**: Answer **any five** full questions choosing at least **two** from **each** Part.*

PART – A

1. a) State and explain Coulomb's law in its complete vector form. Derive the expression for electric field intensity on the axis of a charged circular ring. **12**

   b) A point charge $Q_1 = 20\,\mu c$ is located at $P_1(1, 2, 3)$ in free space while $Q_2 = -10\,\mu c$ is at $P_2(1, 2, 10)$. Find the vector force exerted on Q_2 by Q_1. **8**

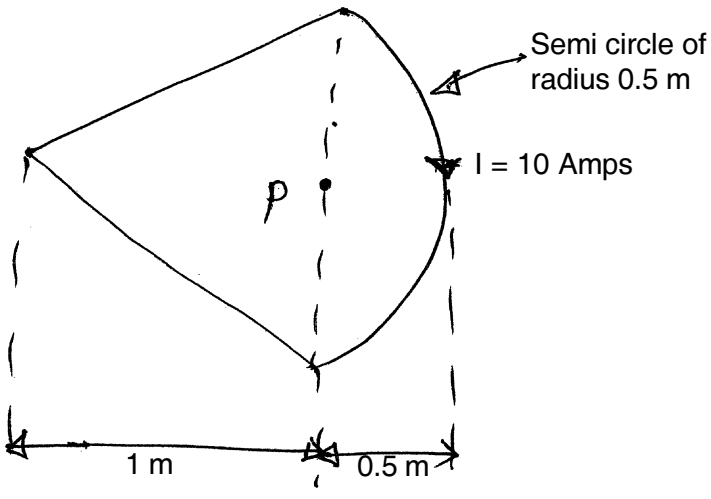
2. a) State Gauss law. Using Gauss law find E at all points in a co-axial cable also sketch the magnitude of E v/s distance. **10**

   b) In a system of two concentric spherical shells a field exists such that when expressed in spherical co-ordinates V = 0 for r = 0.1 m and V = 100 for r = 2.0 m. Solve for
   i) Potential distribution
   ii) Electric field intensity
   iii) Electric flux density.

   For the region bounded between the spheres where free space is assumed to exist. **10**

3. a) State Biot Savart's law. Obtain the expression for magnetic field intensity at any point as the axis of a plane circular loop. **10**

   b) For the Fig. 1 shown, find the value of magnetic flux density at a point P. **10**



P.T.O.

4. a) Obtain an expression for vector magnetic potential at any point in the vicinity of long straight current carrying conductor. **8**

   b) An air cored toroid having a cross sectional area of 6 cm^2 and mean radius 15 cm is wound with 500 turns carrying a current of 4A. Determine the magnetic flux density and inductance of the toroid. **6**

   c) Prove the following relations :

      i) $\nabla \cdot \vec{D} = \rho$

      ii) $\nabla^2 \cdot V = \frac{-\rho}{\varepsilon}$. **6**

PART – B

5. a) Derive Faraday's law in integral and differential forms for time varying fields. **10**

   b) Write Maxwell's equations in free space in point and integral form. **10**

6. a) Derive wave equations in terms of $\vec{E}$ and $\vec{H}$ for conducting medium. **10**

   b) A lossy dielectric is characterized by $\varepsilon_r = 2.5$, $\mu_r = 4$ and $\sigma = 10^{-3}$, $\mho$/m at a frequency 10 MHZ. Find :

      i) attenuation constant

      ii) phase constant

      iii) velocity of propagation

      iv) wavelength

      v) intrinsic impedance. **10**

7. a) Discuss the wave propagation in a conducting medium. Hence explain the term 'skin depth' and 'relaxation time'. **10**

   b) Calculate the skin depth of copper at 60 Hz and 6 GHz. **6**

   c) Define polarization and linear polarization. **4**

8. a) State poynting theorem and derive the expression for power flow in a co-axial cable using poynting vector. **10**

   b) Explain average, instantaneous and complex poynting vector. **10**

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