B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

December, 2015

BIEE-005 : ELECTROMAGNETIC THEORY

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. All the questions are to be answered in English only.*

1. Prove that the electric field strength at any point outside a spherical charge distribution is the same as though the whole charge were concentrated at the centre.   *10*

2. What do you mean by the capacitance of a capacitor ? On what factors does it depend ? Show that the energy density of electric field in the region between the plates of a parallel plate capacitor is given by

$$u = \frac{1}{2} \varepsilon E^2.$$ *2+2+6=10*

3. Define the Green's function with reference to electrostatic potential problems. Prove that this function satisfies the symmetry

$$G(x, x') = G(x', x).$$ *4+6=10*

4. A long horizontal rigidly supported wire carries a current i_a of 100 A. Directly above it and parallel to it is a fine wire that carries a current i_b of 20 A and weighs 0·03 N/m. How far above the lower wire should the second wire be kept, if we wish to support it by magnetic repulsion ?

    Given permeability constant

    $$\mu_0 = 4\pi \times 10^{-7} \text{ Wb/m}.$$ *10*

5. Establish Maxwell's equations for the electromagnetic fields and obtain an expression for Poynting vector. *10*

6. Explain the theory of propagation of electromagnetic waves in a conducting medium and also explain why in high frequency circuits current flows only on surface of conductors. *6+4=10*

7. Give briefly the general methods for the solution of potential problems in electrostatics and compare their merits and limitations. *10*

8. A charge 1 µC is placed at the centre of a hollow cube. Calculate the electric flux diverging *5+5=10*

    (i)   through the centre.

    (ii) through each face.

9. The rails of a railway track are 1·5 m apart and assumed to be insulated from one another. Calculate the emf in volts that exists between the rails, if a train is passing at 100 km/hour. Assume that the horizontal component of Earth's magnetic field is 0·36 oersted and $\tan \theta = 1·036$, where θ is the angle of dip.   *10*

10. Write short notes on any *two* of the following : *2×5=10*

   (a)   Snell's Law of Refraction

   (b)   Transmission Line Parameters

   (c)   Generalized form of Gauss's Theorem

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