Time: 3 hrs.

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014 Field Theory

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART – A

- State and explain Coulomb's law of force between two point charges. Mention the units. (06 Marks)
 - b. State and prove divergence theorem.

(06 Marks)

Max. Marks:100

- c. Prove that the divergence theorem for the given region $r \le a$ (spherical coordinate system)
- 2

$$\overline{E} = 5e^{-r/4} a_r^{-1} + \frac{10}{r \sin \theta} a_{\phi}^{-1}$$
 (O)

Show that $E = -\nabla V$

(06 Marks)

- c. Derive the boundary conditions at the interface between two dielectrics of different permittivities. (08 Marks)
- State and prove uniqueness theorem 3

(08 Marks)

(06 Marks)

Derive Laplace's equation Verify whether the potential field given below satisfies Laplace's equation. (i) $V = x^2 - y^2 + z^2$ (ii) $V = 2x^2 - 3y^2 + z^2$

(06 Marks)

State and explain Biot-Savart law. a.

(06 Marks)

- Using Biot-Savart law, derive an expression for magnetic field intensity on the axis of a circular ring of radius 'a' carrying current 'I'. (10 Marks)
- Given $\bar{J} = 10^3 \sin \theta \ a_r^{-1}$ A/m² in spherical coordinate system. Find the current crossing the spherical shell of r = 0.02 m, where r = radius of shell. (04 Marks)

PART - B

Derive an expression for the force on a differential current carrying element. (06 Marks)

- Derive an expression for the
 - (i) inductance of Toroid
- (ii) inductance of solenoid.

(10 Marks)

- c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6 cm diameter, length of the tube is 60 cm and the solenoid is in air. (04 Marks)
- Starting from the concept of Faraday's law of electromagnetic induction derive the 6 Maxwell's equation

$$\nabla \times \overline{E} = -\frac{\partial \overline{B}}{\partial t}$$
 (06 Marks)

List Maxwell's equation in differential form and integral form.

(08 Marks)

Derive Maxwell's equation from Ampere's law.

(06 Marks)

- Obtain the solution of wave equation for uniform plane wave in free space. (08 Marks)
 - Derive an expression for uniform plane waves in good conductor. (06 Marks)
 - Calculate intrinsic impedance η . $\sigma = 58$ Ms/m, $\mu_r = 1$, $\epsilon_r = 1$ at frequency of 100 MHz.

High (06 Mart

- Derive an expression for transmission coefficient and reflection coefficient. (10 Marks)
 - With necessary expression, explain standing wave ratio. (10 Marks)

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