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10EE44

Fourth Semester B.E. Degree Examination, June/July 2018
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain coulombs' law in vector form. **(06 Marks)**

b. Derive an expression for Gauss law in differential form. **(08 Marks)**

c. A zone point charge in located at P(2, 4, -3). Find : i) E(r) ii) Find the locus of all points at which E(x) = 1V/mt. **(06 Marks)**

2 a. Show that Electric Field Intensity is equal to negative gradient of potential in an electrostatic field. **(10 Marks)**

b. A spherical surface in free space, r = 4cm contains a uniform surface charge density of 20micro coulombs/m^2. Find r_A if the region $0.06 < r < r_A$. Contains 1 milli Joule of Energy. **(10 Marks)**

3 a. State and prove uniqueness theorem. **(08 Marks)**

b. Derive Laplace equation from Maxwell's first equation of electrostatics. **(06 Marks)**

c. Solve Laplace's equation between two conical surfaces. **(06 Marks)**

4 a. Compute the magnetic field at a point on the axis of a square loop of wire carrying a current of 'I' amperes of a side 'a' mts, **(10 Marks)**

b. If $\overline{A} = 10P^{1.5}\overline{a}_z$ wb/mt in free space find i) $\overline{H}$ ii) $\overline{J}$. **(10 Marks)**

PART – B

5 a. Explain phenomena of Magnetization and permeability in magnetic materials and show that $\mu_r = 1 + x_m$. **(10 Marks)**

b. A square loop in z = 0 plane in carrying 2 milli amperes in the field of an infinite filament on the y-axis carrying a current of 15Amps. Determine the total force on the loop. **(06 Marks)**

c. Derive an expression for self inductance of a Torroid. **(04 Marks)**

6 a. Write down the Maxwell's Equation in differential scalar form. **(08 Marks)**

b. Show that in a capacitor, conduction current is equal to displacement current. **(06 Marks)**

c. Explain briefly the concept of related potentials in time varying fields. **(06 Marks)**

7 a. Derive expression for attenuation constant and phase constant of Electromagnetic wave in a conducting medium. **(10 Marks)**

b. State and prove poynting vector theorem. **(10 Marks)**

8 a. Discuss clearly reflection and refraction of electromagnetic waves. **(06 Marks)**

b. Define the terms i) Reflection co-efficient ii) Transmission co-efficient with respect to reflections of electromagnetic waves. **(04 Marks)**

c. Given region 1, $z < 0$, $\epsilon_1 = 20$pF/mt , $\mu_1 = 2$ μH/mt ; region 2, $0 < z < 8$cm, $\epsilon_2 = 50$pF/mt , $\mu_2 = 2.5$μH/mt and region 3, $z > 8$cm, $\epsilon_3 = \epsilon_1$ and $\mu_3 = \mu_1$; let $\sigma = 0$ everywhere i) what is the lowest frequency at which a uniform plane wave incident from region 1 on the boundary at z = 0 will have no reflection? i) If f = 200MHz what will be SWR in region 1? **(10 Marks)**

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