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**80543**

**B.Tech. IVth Semester Examination**

**ELECTROMAGNETIC FIELD THEORY (EC-212C)**

Time : 3 Hours] [Max. Marks : 75

***Instructions :***

*(i) Part-A is compulsory and attempt 4 Questions from Part-B.*

*(ii) Assume relevant data/figure if found missing.*

## PART–A

**1.** (a) Show that vector field given by $\vec{A} = yz\,\vec{a_x} + xz\,\vec{a_y} + xy\,\vec{a_z}$ is both irrotational and solenoidal. (1.5)

(b) What is loss tangent? What should be its value for perfect conductor and perfect dielectric? (1.5)

(c) Justify that net electric field inside a conductor is always zero. (1.5)

(d) What is displacement current? How is this current different from conduction current? Does it exist in free space or not. (1.5)

(e) What is difference between scalar magnetic potential and vector magnetic potential? (1.5)

(f) Differentiate between isotopic and homogeneous medium. What is significance of these mediums? (1.5)

(g) Explain the effect of skin depth. (1.5)

(h) Differentiate between phase velocity and group velocity. Calculate the velocity of electromagnetic wave in a medium whose dielectric constant is 2.56. (1.5)

(i) What are characteristics of infinite length transmission line? (1.5)

(j) Define uniqueness theorem. What you infer from it? (1.5)

## PART–B

**2.** (a) Explain Gauss and Stoke's theorem. Using these theorem convert Maxwell's equation from integral form to differential form. (8)

(b) Derive an expression for electric field intensity due to a charge uniformly distributed over an infinite plane with charge density $\rho$. (7)

**3.** (a) Prove that electromagnetic waves in free space travels with velocity of light. What will be the velocity of electromagnetic waves in all other mediums? Can a good conductor be used for the propagation of electromagnetic waves? Justify your answer. (8)

(b) Define surface impedance and prove that surface impedance of a good conductor is equal to the characteristic impedance of the conductor. (7)

**4.** (a) Show that in a good conductor, $\alpha = \beta = \sqrt{\frac{\mu\sigma\omega}{2}}$ where $\alpha$ is attenuation constant, and $\beta$ is phase shift constant. (8)

(b) Explain continuity equations for static and time varying field. (7)

5. (a) Given two dielectric media medium 1 is free space and medium 2 has $\varepsilon_2 = 4\varepsilon_0$ and $\mu = \mu_0$. Determine reflection coefficient and transmission coefficient for oblique incidence $\theta_i = 30°$ for

(i) perpendicular polarization.

(ii) parallel polarization. (8)

(b) What is poynting vector? What is the significance of poynting vector? Deduce an expression for instantaneous, average and complex poynting vector. (7)

6. (a) If a line is to have neither frequency nor delay distortion, how do you relate attenuation constant and velocity of propagation to frequency? How distortion can be reduced in a transmission line? Explain and derive the conditions. (8)

(b) A 12 $K_m$ line is terminated by its characteristic impedance. At a certain frequency the voltage at 1 $K_m$ from the sending end is 10% below that at the sending end. Find the voltage across the load impedance in terms of percentage of the sending end voltage. (7)

7. (a) Explain Boundary conditions for magnetic and electric field at the surface interface of Dielectric and perfect conductor. (8)

(b) Calculate the skin depth $\delta$, propagation constant $\gamma$ and wave velocity $v$ at a frequency of 1.6 MHz in Aluminium where $\sigma = 38.2$ MS/m, $\mu_r = 1$. (7)