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80743

B.Tech., IV Semester

ELECTRIC AND MAGNETIC FIELDS (EE 204 C)

Time : 3 Hours] [Max. Marks : 75

Instructions :

(i) It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.

(ii) Answer any four questions from Part-B in detail.

(iii) Different sub-parts of a question are to be attempted adjacent to each other.

PART–A

1. (a) Establish the vector identity $\nabla \times \nabla \phi = 0$. (1.5)

(b) State and explain the Divergence Theorem. (1.5)

(c) What is the difference between scalar and vector magnetic potential. (1.5)

(d) Discuss the boundary relations for magnetic field for any two media. (1.5)

(e) State Maxwell's Equations in integral and point form. (1.5)

(f) Explain the term polarization in the context of electromagnetic wave propagation. (1.5)

(g) What is Brewster angle? Why it is also called the polarizing angle. (1.5)

(h) Define reflection coefficient and voltage standing wave ratio. Also give the relationship between the two. (1.5)

(i) What are standing waves? How and why do they occur inside a transmission line. (1.5)

(j) Explain the significance of Poynting Vector. (1.5)

PART–B

2. (a) Derive the electromagnetic wave equation for a conducting medium. (7)

(b) For a uniform plane wave in fresh lake water $\sigma = 10^{-3}$ mhos/m, $\epsilon_r = 80$, $\mu = \mu_0$. Calculate α, β, η, and λ for two frequencies 100 MHz and 10 kHz. (8)

3. (a) Derive Ampere's circuital law in differential vector form. (8)

(b) Calculate the magnetic flux density at the centre of a current carrying loop when the loop radius is 2 cm, loop current is 1 mA and the loop is placed in air. (7)

4. Derive an expression for resultant electric and magnetic field strength when a plane wave is incident normally at the surface of a perfect conductor. (15)

5. (a) Explain how a finite line terminated in its characteristic impedance behaves as an infinite ideal transmission line. (15)

(b) The constants per km of a certain cable are R = 42.9 ohms, L = 0.7 mH, C = 0.1 μF, G = 24 μ mhos. Calculate the attenuation constant, characteristic impedance and Phase velocity when m = 5000 radians per second. (5)

6. (a) A vector field is given by $A = yz\,i + xz\,j + xy\,k$. Show that it is both irrotational and solenoidal. (8)

(b) What is meant by an electrical image. Describe the method of images for solving electrostatic problem. (7)

7. (a) Prove that the total energy W in an electrostatic field is given by

$$w = \frac{1}{2}\int E.D.\,dr. \qquad (7)$$

Where E is electric field intensity, D is electric flux density and dr is an element of volume.

(b) Derive the mutually perpendicular relationship between E and H for uniform plane waves. (8)