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Total No. of Questions : 09] [Total No. of Pages :03

Paper ID [EE303]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 5th)

ELECTROMAGNETIC FIELD THEORY (EE - 303)

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

(10 × 2 = 20)

Q1)

a) State divergence theorem and give its mathematical form.

b) Define and explain the term electric flux density and permittivity of free space.

c) Show that Del. E is zero for the field of a uniform line charge.

d) Give the physical interpretation of the gradient.

e) Find the conduction and displacement current density in a material having conductivity of 10^{-3} S/m and ε_r is 2.5 if $E=5.0 \times 10^{-6} \sin 9.0 \times 10^{9}t$ V/m.

f) Write the Maxwell's Equations in integral form.

g) State Poynting theorem.

h) Are all the four Maxwell's equations independent? Explain.

i) Explain the significance of skin depth.

j) A parallel polarized wave propagates from air into dielectric at Brewster angle of 75° . Calculate the relative dielectric constant of the medium.

Section - B

(4 × 5 = 20)

Q2) State and prove the uniqueness theorem.

Q3) Derive an expression for electric field intensity due to a charge uniformly distributed over an infinite plane with charge density ρ_s.

Q4) Derive the wave equation from Maxwell's equations.

Q5) What is poynting vector? What is the significance of poynting vector? Deduce an expression for instantaneous, average and complex poynting vector.

Q6) What do you understand by vector magnetic potential. Explain its concept show that the vector potential due to moving point charge q at a distance R is

$A_r = \frac{\mu_0 - qV}{4\Pi R}$ where V is the velocity of charge

Such that V<c, c being velocity of light.

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Section - C

(2 × 10 = 20)

Q7) State and explain Ampere law. A solid cylindrical conductor of radius R has a uniform current density. Derive expression for H both inside and outside of the conductor. Plot the variation approximately of H as a function of radial distance from the centre of wire.

Q8) (a) State and explain the electrostatic boundary conditions existing at the boundary between two dielectrics.

(b) Show that the capacitance between a conducting cone with its vertex separated from a conducting plane by an infinitesimal insulating gap and its axis normal to plane is infinite using Laplace's equation in spherical coordinates.

Q9) A uniform plane wave is incident on the interface of two perfect dielectric media with relative permittivities of ε_1 and ε_2. the electric field E parallel to the plane of incidence. Show that reflection coefficient $\Gamma, \frac{E^r}{E^i}$ and transmission coefficient $\tau, \frac{E^t}{E^i}$ are given by

$$\Gamma = \frac{\sqrt{\varepsilon_2}\cos\theta_1 - \sqrt{\varepsilon_1}\cos\theta_2}{\sqrt{\varepsilon_2}\cos\theta_1 + \sqrt{\varepsilon_1}\cos\theta_2}$$

$$\tau = \frac{2\sqrt{\varepsilon_2}\cos\theta_1}{\sqrt{\varepsilon_2}\cos\theta_1 + \sqrt{\varepsilon_1}\cos\theta_2}$$

Where θ_1 and θ_2 are angles of incidence and refraction, respectively.

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