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B.Tech. (Sem. - 4th)

ELECTROMAGNETIC FIELD THEORY

SUBJECT CODE : EC - 208

Paper ID : [A0309]

[Note : Please fill subject code and paper ID on OMR]

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

Q1) *(10 x 2 = 20)*

a) What is the physical significance of divergence of a vector field?

b) Under what conditions will the field intensity be solenoidal and irrotational?

c) Write Laplace's equation in cylindrical coordinates.

d) What is the condition for the field to be realizable as static magnetic field?

e) What is Polarization? What are its types?

f) Differentiate between conduction current and displacement current.

g) Define propagation constant.

h) What are uniform plane waves?

i) What is a waveguide? What is its importance and applications?

j) Define clearly dominant and degenerate modes with examples.

Section - B

(4 x 5 = 20)

Q2) State Coulomb's law. Four like charges of 30 μC each are located at the four corners of a square, the diagonal measures 8m. Find the force on a 100 μC located 3m above the center of the square.

Q3) A uniform plane electromagnetic wave propagating in air is given by

$$E = i_x \cos [wt - (2\Pi / \lambda)y]$$

Derive by using the Maxwell's equations, the expression for the vector magnetic field.

Q4) Find the input impedance of the distortionless transmission line at radio frequencies in both open circuited and short circuited cases.

Q5) Describe the mapping of constant resistance and constant reactance circles on the reflection coefficient plane.

Q6) Discuss the propagation of TE and TM waves in circular waveguides.

Section - C

(2 x 10 = 20)

Q7) (a) Starting with Ampere's law, derive Maxwell's equation in integral form. Obtain the corresponding relation by applying the Stoke's theorem.

(b) Differentiate between phase velocity and group velocity.

Q8) Derive the relation between E and H in uniform plane wave propagation. Define intrinsic impedance and give its physical significance.

Q9) (a) Derive the expression for attenuation factor for TEM waves between parallel conducting planes.

(b) Discuss the use of UHF lines as circuit elements.