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# B.Tech. (Sem. - 5th)

# ELECTROMAGNETIC FIELD THEORY

## SUBJECT CODE : EE - 303

## Paper ID : [A0414]

**[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) Mention the importance of a unit vector.

b) State Faraday's law of electromagnetic induction.

c) Write Laplace's equation in cylindrical coordinates.

d) State normal boundary conditions.

e) What are the conditions for field to be irrotational?

f) Define Poynting vector.

g) State the Stokes' theorem. What do you infer from it?

h) What is meant by homogeneous and isotropic medium?

i) Define propagation constant.

j) State uniqueness theorem.

## Section - B

*(4 x 5 = 20)*

*Q2)* State and prove the Gauss's theorem. Explain why it is called the divergence theorem.

*Q3)* Explain the concept of 'Displacement Current'. How is this current different from conduction current?

*Q4)* Write Maxwell's equation in free space for the time varying fields both in differential and integral form. Why these equations are not completely symmetrical?

*Q5)* Prove that in a travelling plane electromagnetic wave there is a definite ratio between the amplitudes of E and H and find this ratio.

*Q6)* Explain briefly the oblique incidence of wave on conductors.

## Section - C

*(2 x 10 = 20)*

*Q7)* (a) Justify that the net Electric field within a conductor is always zero.

(b) Derive the equation of continuity for time varying fields.

*Q8)* Define uniform plane wave propagation. Discuss its properties. A uniform plane electromagnetic wave propagating in air is given by

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

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

*Q9)* Write short notes on the following:

(a) Magnetic vector potential.

(b) Helmholtz equations.