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**B. Tech (EE) (Semester – 3rd)
ELECTROMAGNETIC FIELDS**

Subject Code: BELES1306

Paper ID: [18111513]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. Explain the significance of displacement current.
- b. State Amperes law of force.
- c. Determine the value of $(\text{div } A)$ at point $(1, -1, 1)$, if $A = i(x^2 z) - j(2y^3 z^2) + k(xy^2 z)$.
- d. Enlist various applications of Laplace and Poissons equations.
- e. Derive the Ohms law in point form.
- f. Prove that both E and H are perpendicular to each other for a TEM wave.
- g. Define the coefficient of coupling in magnetic circuits.
- h. What is the difference between soft and hard magnetic materials?
- i. Given the two vectors $A = 4i + 10j$ and $B = 2i + 3j$. Find the projection of A on B.
- j. Define attenuation constant and phase constant. Give their units.

Section – B

(5 marks each)

- Q2. Find the skin depth δ at a frequency of 1.6 MHz in aluminium, where $\sigma=38.2 \text{ MS/m}$ and $\mu_r=1$
- Q3. Using Gauss's law, derive the value of electric field intensity for a uniform line charge distribution ρ_L (Coulomb/m) over the line passing through the axis of a cylinder.
- Q4. Explain the physical interpretation of Maxwell's equations. Hence, derive these in differential and integral form.
- Q5. Find the curl of a vector, V where $V = i(x + 2y + az) + j(bx - 3y - z) + k(4x + cy + 2z)$
- Q6. Derive an equation for magnetic vector potential in differential form.

Section – C

(10 marks each)

- Q7. An electric field is represented by $E_y = 10 \cos(6\pi 10^8 t - \beta x)j$, is propagating through a lossless medium having $\mu_r=1$ and $\epsilon_r=78$ at a frequency of 300 MHz. Find i) phase constant, phase velocity, intrinsic impedance and wavelength ii) corresponding value of magnetic field H.
- Q8. Write a short note on
 - a) force on a differential current element
 - b) Laplacian operator

Q9. Derive an equation for capacitance (in F/m) of a cable, which consists of two different dielectric mediums ϵ_{r1} and ϵ_{r2} .