BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
SECOND YEAR
FIRST SEMESTER
SUPPLEMENTARY EXAM 2023
FIELD THEORY

Time:3 hours   Full Marks:100

(50 marks for each part)

Use separate Answer-script for each part

PART-I

Answer any three questions. Two marks for neatness. All symbols have their usual significance

1. a) Derive the expression for curl of a vector field **C**, written as $\nabla \times \mathbf{C}$ where ∇ is the vector differential operator in Cartesian coordinates. What is the physical significance of the $\nabla \times \mathbf{C}$,curl of a vector field.

b) Establish the Stoke's theorem.

10+6=16

2. a) What is significance of $\nabla \cdot \mathbf{J} = -\partial\rho/\partial t$,where ρ is volume charge density.

b) Establish $\nabla \cdot \mathbf{B} = 0$.

c) Find the curl **H** at the origin, where $\mathbf{H}=(2y)\mathbf{i} -(x^2+z^2)\mathbf{j}+(3y)\mathbf{k}$ A/m also what may be **J** here?   6+6+4=16

3. a) Establish $\nabla \times \mathbf{E} = -\partial\mathbf{B}/\partial t$ **and** show the pictorial view of this relation.

b) Establish $\nabla \times \mathbf{H} = \mathbf{J} + \partial\mathbf{D}/\partial t$ and show the pictorial view of this relation.

What is displacement current?   8+8=16

4. a) Derive electromagnetic wave equations. Using E.M. wave equation in free space, obtain an analytical solution of the wave equation of Electric Field(E) considering it as a plane wave and also draw the wave propagation.

b) What do you mean by electromagnetic fields? Why do E.M.fields travel?   10+6=16

5. Write short notes on any two: 8+8=16

a) Boundary relation for magnetic field when it passes through two different magnetic media having permeabilities μ_1 and μ_2.

b) "Poynting Theorem".

c) $\nabla \times \mathbf{H}=\mathbf{J}$ and its physical significance.