# B.M.S. College of Engineering, Bengaluru-560019

### Autonomous Institute Affiliated to VTU

## September / October 2023 Supplementary Examinations

**Programme: B.E.**                                           **Semester: IV**
**Branch: Electronics and Instrumentation Engineering**       **Duration: 3 hrs.**
**Course Code: 19EI4PCEMF**                                  **Max Marks: 100**
**Course: Electro Magnetic Field Theory**                      **Date: 15.09.2023**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
                  2. Missing data, if any, may be suitably assumed.

<div style="writing-mode: vertical-rl">**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.</div>

## UNIT - I

1. a) Given point P (-2,6,3) and vector A= y $\mathbf{a_x}$ + (x+z) $\mathbf{a_y}$ in rectangular co-ordinate system, express P and A in cylindrical systems. **04**

   b) Define Electric Field at a point and derive an expression for the same due to infinite line of charge lying on z-axis. **08**

   c) Evaluate both sides of Divergence theorem if $D = 5\frac{r2}{4}a_r$ c/m$^2$ for the volume enclosed by r=4m and $\theta=\frac{\pi}{4}$. **08**

## UNIT - II

2. a) Two-point charges -4µC and 5µC are located at (2, -1,3) and (0,4, -2). Find the potential at (1,0,1) assuming zero potential at infinity. **06**

   b) Derive the boundary conditions at interfaces between conductor and free space. **10**

   c) Establish relation between electric field intensity and gradient of potential. **04**

### OR

3. a) Determine whether the following potentials satisfy Laplace's equation. $V = 2x^2-4y^2+z^2$ **06**

   b) Derive the expression of capacitance by considering composite parallel plate. **06**

   c) Potential field given by $V = 150(x^2-y^2)$. The point P (4,-2,1) lies on the boundary of conductor and free space. At point P obtain magnitudes of V, E, $E_N$, D and $E_{tan}$. **08**

## UNIT - III

4. a) State and Explain Biot Savart's Law **06**

   b) A current Filament Carries a current of 10A in $a_z$ direction on Z axis. Find the magnetic field Intensity H at point P (1,2,3) due to this filament if it extends from z=- ∞ to + ∞ **08**

   c) At a point P(x,y,z), components of the vector magnetic potential A are given as Ax=4x+3y+2z, Ay= 5x+6y+3Z and Az=2x+3y+5z. Determine B at Point P. **06**

**OR**

5  a)  Discuss the boundary conditions at the interface between two media of different permeabilities. **06**

   b)  Calculate Magnetic field intensity and Magnetic flux density at a point P(1,2,3) due to current carrying element of 5A in the $a_z$ direction if i) z=0 to 5m and ii) z=5 to $\infty$. **08**

   c)  A coil has a self-inductance of 1 henry and a resistance of 40 ohms. If it is connected to a 4-volt DC supply, find the energy stored in the magnetic field when the current has attained its steady value. **06**

## UNIT - IV

6  a)  List Maxwell's equation in differential form and integral form for time varying fields. **10**

   b)  Derive the expression for displacement current density and explain its physical significance. **10**

## UNIT - V

7  a)  Explain different sources of EMI. **06**

   b)  Discuss briefly different control methods of EMI. **07**

   c)   Explain health hazards of EMI and EMR. **07**

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