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

Autonomous Institute Affiliated to VTU

October 2022 Semester End Main 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: 19.10.2022**

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

UNIT - I

1 a) Derive the expression for Electric Field Intensity at a point due to an infinite line of charge lying along z – axis using Gauss law. **08**

b) Evaluate both sides of Gauss-divergence theorem for the field, $\overline{D}$ =2xy a_x + x^2 a_y C/m^2, in the region formed by the planes x = 0 and 1, y =0 and 2, z =0 and 3. **08**

c) A uniform line charge of infinite length with charge density 10n C/m is placed in air along the z-axis. Compute the electric field intensity at the point (1, 2, 3). **04**

UNIT - II

2 a) Using Laplace equation find the capacitance per unit length of a co- axial cable of inner radius 'a' m and outer radius 'b' m. Assume V = V_0 at r = a and V = 0 at r = b. **08**

b) A region with z < 0 has ϵ_{r2} = 2 and region z > 0 has ϵ_{r1} = 5. If the flux density in medium 1 is given by $\overline{D_1}$ = $2a_x$ + $5a_y$ -$3a_z$ nC/m^2, determine (i) $\overline{D_{N2}}$ (ii) $\overline{D_{tan2}}$ (iii) $\overline{D_2}$ (iv) angle made by the $\overline{D_2}$ with the normal. **08**

c) A potential field is given by the expression V = x^2-xy^2+2z V. Compute the Electric field intensity at the point P (1,2, 3) **04**

OR

3 a) Derive the relation between Electrical boundary conditions at the boundary between conductor and dielectric of infinite extent. **10**

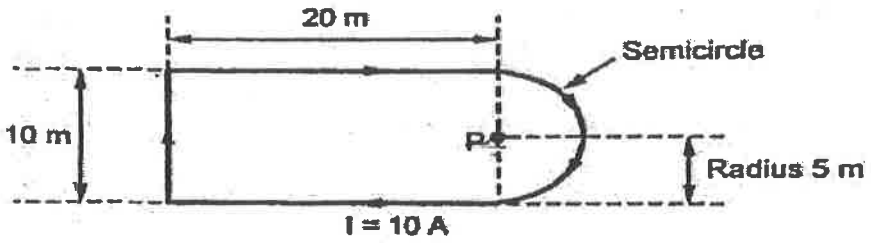
b) A point charge of 6nC is located at the origin in free space. Calculate the potential at point P located at (0.2, -0.4, 0.4), given V = 20V at (-0.5,1,-1). **05**

c) Determine whether the potential field given by V= r cosϕ + z, satisfies the Laplace equation. **05**

UNIT - III

4 a) Derive the expression of Magnetic field intensity $\overline{H}$ due to an infinite long line carrying current placed along the z direction using Ampere's circuital law. **10**

b) Calculate the Magnetic field intensity at the point P for the circuit shown below. **10**



OR

5 a) A current filament carries a current of 10A in the az direction. Find the magnetic field intensity at a point P(1,2,3) due to the filament under the following conditions. (i) Filament extends from z = -□ to □ (ii) Filament extends from z = 0 to 5m **08**

b) Given $\frac{X+2y}{z^2}\, a_y + \frac{2}{z}\, a_z$ A/m. Evaluate current density J and total current passing through surface $z = 4, 1 \leq x \leq 2\ and\ 3 \leq y \leq 5$, in the a_z direction. **08**

c) Explain vector magnetic potential. **04**

UNIT - IV

6 a) Derive the Maxwell's equation for time varying fields in point form and integral form. **10**

b) Describe the relation between Field theory and Circuit theory. **05**

c) A conductor of 10 cm length is parallel to z axis and rotating at r = 30 cm at 1000 rpm. Find the emf if the radial field is given by B = 0.8 T. **05**

UNIT - V

7 a) Explain the terms electromagnetic interference (EMI) and Electromagnetic Compatibility (EMC). **06**

b) Describe the biological effects of electromagnetic radiations. **07**

c) Describe the ways in which electromagnetic interference can be controlled. **07**

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