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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E.   Semester: III
Branch: Electrical & Electronics Engineering   Duration: 3 hrs.
Course Code: 22EE3PCFTH   Max Marks: 100
Course: FIELD THEORY

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) Find the Electric field intensity at any given point due to 'n' number of point charges. **04**

b) Point charges of 50 nC each are located at A (1,0,0), B (-1,0,0), C (0,1,0) and D (0, -1,0). Evaluate the total force on the charge at A. **06**

c) Given $\mathbf{D} = 5r \sin^2\theta \cos^2\varphi\ \mathbf{a_r}$ C/m^2. Evaluate both sides of Divergence theorem for the region $r < 2$. **10**

UNIT - II

2 a) Define the following: **06**
   (i) Potential difference (ii).Absolute potential (iii).Equipotential surface.

b) From the law of conservation of charge, it can be said that current is continuous from one side of a reference surface to the other. Considering a suitable reference surface, obtain the current continuity equation. **06**

c) Estimate and analyse the work done in carrying a -2 C charge from $P_1(2\ \ 1\ \ -1)$ to $P_2 (8\ \ 2\ \ -1)$ in the field $\mathbf{E} = y\ \mathbf{a_x} + x\ \mathbf{a_y}$ V/m. i) Along parabola $x=2y^2$ ii) Along the straight line joining P_1 and P_2 **08**

OR

3 a) Analyses and develop an expression for the electric boundary conditions at the interface of conductor and free-space. **08**

b) A potential field in free space is expressed as V = 20/(xyz)V. **07**
   i.   Find the total energy stored within the cube $1 < x, y, z < 2$
   ii. What value would be obtained by assuming a uniform energy density equal to the value at the center of the cube?

c) List out properties of dielectrics **05**

UNIT - III

4 a) Using Laplace equation find the expression for potential distribution in the space between two plates of a parallel plate capacitor also find the capacitance of the system. **10**

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b) Write Laplace equation in cylindrical co-ordinates using this equation find an expression for potential distribution in the angular space between 2 infinite long co-axial cylinder. **10**

UNIT - IV

5 a) State and explain Biot-Savart's law. **05**

b) Develop and analyses an expression for the magnetic field intensity due to straight conductor of finite length. **08**

c) Write an explanatory note on scalar and vector magnetic potentials. **07**

UNIT - V

6 a) State and explain Faraday's Law for time varying field. **05**

b) Develop and expression for conduction current density (J_C) and displacement current density (J_D) of time varying field and also its significance. **08**

c) Derive the wave equations that characterize the propagation of uniform plane wave in free-space. **07**

OR

7 a) List the Maxwell's equations applicable in the case of electromagnetic wave travelling in free-space. **06**

b) Analyze and develop an expression for uniform plane wave in good conductor **08**

c) State and explain Poynting's theorem. **06**

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