

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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E.

ES Cluster (EEE/TCE/ECE/EIE/MD)

Course Code: 19ES3GCFTH

Course: FIELD THEORY

Semester: III

Duration: 3 hrs.

Max Marks: 100

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.

UNIT - I

- 1 a) Develop an expression for $EFI(\bar{E})$ due to various charge distribution **06**
- b) Develop and Analyses an expression for the Electric field intensity due to infinite long Straight Conductor. **06**
- c) Analyses and Evaluate both sides of the divergence theorem precisely for the region:
if the flux density $\bar{D} = x^2\bar{a}_x + y^2\bar{a}_y + z^3\bar{a}_z$; $0 < x < 2m, 0 < y < 2m, 0 < z < 4m$. **08**

UNIT - II

- 2 a) Estimate and analyses the work done in carrying a -2C charge from $P_1(2, 1, -1)$ to $P_2(8, 2, -1)$ in field $E = y\bar{a}_x + x\bar{a}_y$ V/m i). Along parabola $x=2y^2$; 2). along the straight line joining P_1 & P_2 . **06**
- b) Develop an expression for relation between Electric field intensity (E) & Scalar potential(V). **06**
- c) Develop and analyses an expression for boundary conditions between conductor and free space. **08**

OR

- 3 a) Develop an expression for the relation between Current density and volume charge density (**04M**) and continuity equation(**04M**). **08**
- b) List out properties of conductors **04**
- c) Develop and analyses an expression for boundary conditions between conductor and dielectric's space. **08**

UNIT - III

- 4 a) Analyses and develop an expression for Laplace and Poisson's Equations & also Verify whether Laplace equations satisfied or not:
1). $V = x^2 - y^2 + z^2$; 2). $V = r\cos\phi + z$; 3). $r\cos\theta + \phi$ **10**
- b) Write Laplace's equation in spherical co-ordinates. Using this equation evaluate and analyses an expression for potential difference between concentric spherical shells. Also find the capacitance of the same. **10**

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.

UNIT - IV

- 5 a) Develop and Analyses an expression for the magnetic field intensity due to infinite long straight Conductor. **07**
- b) If $\vec{H} = 10 \sin\theta \vec{a}_\theta$ A/m, Analyses and Evaluate both sides of the Stokes' theorem for the surface $r = 3$, $0 \leq \theta \leq 90^\circ$, $0 \leq \phi \leq 90^\circ$. Let the surface have the \vec{a}_r direction. **07**
- c) Analyses and develop an expression for Magnetic boundary conditions between permeability's of two medium. **06**

UNIT - V

- 6 a) State and explain faraday's law and Write Maxwell's equations in point form and integral for time varying field in free space. **10**
- b) Analyze and develop an expression for electromagnetic waves in free space. **10**

OR

- 7 a) Analyze and develop an expression for uniform plane wave in good conductor **10**
- b) State and explain Poynting theorem and Let $\mu = 3 \times 10^{-5}$ H/m, $\epsilon = 1.2 \times 10^{-10}$ F/m, and $\sigma = 0$ everywhere. If $\vec{H} = 2 \cos(10^{10}t - \beta x)\vec{a}_z$ A/m, use Maxwell's equations to obtain expressions for \vec{B} , \vec{D} , \vec{E} , and β **10**
