

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 2151002****Date: 23/06/2023****Subject Name: Engineering Electromagnetics****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Explain the curl. 03
 (b) Transform Vector $\mathbf{B} = y \mathbf{a}_x - x \mathbf{a}_y + z \mathbf{a}_z$ into cylindrical coordinates. 04
 (c) Compare Cartesian, Spherical and Cylindrical coordinate Systems with example. 07

- Q.2** (a) Define and differentiate electric field intensity and electric flux density. 03
 (b) Briefly explain streamlines and sketches of fields. 04
 (c) Derive the expression for the electric field $\mathbf{E}$ due to infinitely long line charge distribution. 07

OR

- (c) A 50 cm length of coaxial cable having an inner radius of 1 mm and outer radius of 4 mm. The space between conductors is assumed to be filled with air. The total charge on the inner conductor is 30 nC. Find the charge density on each conductor, $\mathbf{E}$ and $\mathbf{D}$ fields. 07
- Q.3** (a) Define potential and potential difference. 03
 (b) Define and differentiate line charge density and current density. 04
 (c) State and prove Gauss's law. 07

OR

- Q.3** (a) Find $\mathbf{D}$ in the region about a uniform line charge of 8 nC/m lying along the z axis in the free space. 03
 (b) Prove that $\mathbf{E}$ is equal to the negative gradient of scalar V . 04
 (c) The nonuniform field $\mathbf{E} = y \mathbf{a}_x + x \mathbf{a}_y + 2 \mathbf{a}_z$. Determine the work expended in carrying 2C from B (1, 0, 1) to A (0.8, 0.6, 1) along the shorter arc of the circle $x^2 + y^2 = 1, z = 1$ 07
- Q.4** (a) Define current and current density. 03
 (b) Write Maxwell's equations in point and integral form. 04
 (c) Define and discuss Curl with necessary equations & derive point form of Amperes' law as $\nabla \times \mathbf{H} = \mathbf{J}$. 07

OR

- Q.4** (a) State and explain Biot Savart's law 03
 (b) Derive the relationship between $\mathbf{J}$ & $\mathbf{E}$ for a metallic conductor. 04
 (c) State and prove Poynting's theorem. 07
- Q.5** (a) Write Poisson's and Laplace's equations. 03
 (b) Derive the expression of capacitance for parallel-plate capacitor having two dielectrics parallel to the plates. 04
 (c) Evaluate a Poisson's and Laplace's Equations. 07

OR

- Q.5** (a) Briefly explain stokes theorem. 03
 (b) For TEM waves, prove that $\mathbf{E} \cdot \mathbf{H} = 0$. 04
 (c) Derive the expressions for attenuation constant & phase constant for good conductor. Also derive equation for *depth of penetration* & based on it explain the concept of *skin effect*. 07
