

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– V (OLD) EXAMINATION – SUMMER 2019****Subject Code: 151002****Date: 31/05/2019****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.

- Q.1** (a) Define Coulomb's law. Derive the expression for the intensity of electric field due to a line charge along the Z direction with uniform charge density  $\rho_L$  c/m. **07**
- (b) State and prove Uniqueness theorem. **07**
- Q.2** (a) Derive the expression of gradient of scalar field in all the systems and list computational formulas on gradient. **07**
- (b) Given point P(-2,6,3) and vector  $A = y a_x + (x + z) a_y$ , express P in cylindrical and Spherical coordinates. Evaluate A at P in the Cartesian and Cylindrical systems. **07**
- OR**
- (b) Determine the divergence of these vector fields. **07**
- i)  $P = x^2 y z a_x + x z a_z$
  - ii)  $Q = \rho \sin \theta a_\rho + \rho^2 z a_\theta + z \cos \theta a_z$
  - iii)  $T = 1/r^2 \cos \theta a_r + r \sin \theta \cos \theta a_\theta + \cos \theta a_\phi$
- Q.3** (a) Define electric dipole. Derive expression for electric field intensity at point 'P' at distance 'r' from center of dipole at origin along Z axis **07**
- (b) Describe the electric boundary condition between free space and conductor. Explain the importance of boundary condition. **07**
- OR**
- Q.3** (a) Write Maxwell's equation in point and integral form, also explain its significance. **07**
- (b) Derive Poisson's and Laplace's equations and states their applications. **07**
- Q.4** (a) State Ampere's circuit law and derive the expression for curl of magnetic field intensity. **07**
- (b) State and derive Biot- Savart's law **07**
- OR**
- Q.4** (a) Using Ampere's circuit law, derive an expression for H due to infinite sheet of current. **07**
- (b) Explain Faraday's law in detail with neat diagram. **07**
- Q.5** (a) Define lossy dielectric medium. Derive expression for attenuation constant and phase constant for the same. **07**
- (b) A parallel plate capacitor with plate area of  $5 \text{ cm}^2$  and plate separation of 3mm has a voltage of  $50 \sin 10^3 t$  V applied to its plates. Calculate the displacement current assuming  $\epsilon = 2\epsilon_0$ . **07**
- OR**
- Q.5** (a) State and derive Poynting's theorem. **07**
- (b) In a nonmagnetic medium **07**
- $E = 4 \sin(2\pi \times 10^7 t - 0.8x) a_z \text{ V/m}$
- Find
- 1)  $\epsilon_r, \eta$
  - 2) The time average power carried by the wave.
  - 3) The total power crossing  $100 \text{ cm}^2$  of plane  $2x + y = 5$