

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VI (OLD) EXAMINATION – WINTER 2018****Subject Code:160906****Date: 27/11/2018****Subject Name: Theory of 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. Symbols have their usual meanings

Q.1

- (a) Discuss cylindrical and spherical co-ordinate systems (7)
- (b) Given vectors  $A = 2a_x + 4a_y + 10a_z$  and  $B = -5a_p + 1a_\phi - 3a_z$ , do the following (7)
- (i) Convert B into cartesian system at (5,0,2) and then find A+B
  - (ii) Find the angle between A and B at P
  - (iii) Find the scalar component of A along B at P

Q.2

- (a) Explain Coulomb's law. Using this law find the vector force on 0.7 mC charge at (2,3,6) due to 4.9  $\mu$ C charge located at (0,0,0) (7)
- (b) Derive the expression for electric field intensity due to continuous sheet charge (7)
- OR
- (b) A sheet charge of  $\rho_s = 2 \text{ nC/m}^2$  is present at  $x = 3$  in free space and a line charge  $\rho_L = 20 \text{ nC/m}$  is located at  $x = 1, z = 4$ . Find (i) the magnitude of electric field intensity at the origin (ii) E at (4,5,6) (7)

Q.3

- (a) Derive differential or point form of Gauss' law and hence state divergence theorem (7)
- (b) Discuss how Coulomb's Torsional balance can be used to measure small forces (7)
- OR

Q.3

- (a) Define potential and potential difference. Explain how potential difference between two points can be found out due to infinite line charge (7)
- (b) Derive the expression for electric and potential fields due to electric dipole (7)

Q.4

- (a) Discuss boundary conditions for perfect dielectric materials (7)
- (b) What is capacitance? Explain how capacitance can be found out for parallel plate capacitor? (7)
- OR

Q.4

- (a) Discuss Poisson's and Laplace's equations (7)
- (b) With the help of neat diagram explain the working of electrostatic precipitator (7)

Q.5

- (a) Prove that  $\nabla \times H = J$  for steady magnetic fields (7)
- (b) Explain Maxwell's equations in integral and point form (7)
- OR

Q.5

- (a) Write a short notes on any two from the following (7)
- (i) Watt Hour meter (ii) Magnetic levitation (iii) Induction heating
- (b) What is FDM? List out the steps for solving differential equations using FDM (7)