

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER- V (New) EXAMINATION – WINTER 2019****Subject Code: 2151002****Date: 25/11/2019****Subject Name: Engineering Electromagnetics****Time: 10:30 AM TO 01:00 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) Derive relationship between **J** & **E** for a metallic conductor. **03**  
 (b) With the help of necessary formulas, explain conversion among various coordinate systems. **04**  
 (c) Derive the boundary conditions at the interface between two dielectric materials with permittivities  $\epsilon_1$  and  $\epsilon_2$ . **07**

- Q.2** (a) Transform the vector  $\mathbf{A} = y\mathbf{a}_x - x\mathbf{a}_y + z\mathbf{a}_z$  into cylindrical coordinates. **03**  
 (b) Given the potential  $V = (10/r^2)\sin\theta\cos\phi$ . Find **D** at  $P(1,0,\pi/2)$  and  $Q(2, \pi/2, 0)$ . **04**  
 (c) Derive expression for **E** for infinitely long line charge distribution. **07**

**OR**

- (c) Evaluate both sides of divergence theorem for field  $D = 2xy\mathbf{a}_x + x^2\mathbf{a}_y$  C/m<sup>2</sup> and rectangular parallelepiped formed by planes  $x=0$  &  $1, y=0$  &  $2$  &  $z=0$  &  $3$ . **07**
- Q.3** (a) Derive Lorentz force equation. **03**  
 (b) Write a note on permeability. **04**  
 (c) Derive the expression of capacitance for following capacitors: a) parallel plate capacitor b) co-axial capacitor c) spherical capacitor. **07**

**OR**

- Q.3** (a) State and explain Biot Savart's law. **03**  
 (b) Write a note on Magnetization. **04**  
 (c) Three infinite uniform sheets of charges are located in the free space as follows:  $3\text{nC/m}^2$  at  $z=-4$ ,  $6\text{nC/m}^2$  at  $z=1$  &  $-8\text{nC/m}^2$  at  $z=4$ . Determine **E** at point  $P(2,5,-5)$  &  $Q(4,2,-3)$ . **07**
- Q.4** (a) Write a short note on "Skin effect". **03**  
 (b) What is dipole? Derive expression for electric field intensity **E** due to an electric dipole. **04**  
 (c) Define magnetic flux and magnetic field intensity. Also explain magnetic boundary conditions in brief. **07**

**OR**

- Q.4** (a) Write a short note on "The retarded potentials". **03**  
 (b) Explain uniqueness theorem in brief. **04**  
 (c) Define the term curl. Also explain the point form of Ampere's Circuital Law. **07**
- Q.5** (a) Explain the wave motion in free space. **03**  
 (b) For TEM waves, prove that  $\mathbf{E} \cdot \mathbf{H} = 0$  **04**  
 (c) Enlist all four Maxwell's equations in point form and starting from Gauss law derive the Maxwell's equation  $\nabla \cdot \mathbf{D} = \rho_v$ . **07**

**OR**

- Q.5** (a) Explain Stoke's theorem. **03**  
 (b) Explain vector magnetic potential in detail. **04**  
 (c) State and prove Poynting theorem relating to the flow of energy at a point in space in an electromagnetic field. **07**

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